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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 twenty-five 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 change equilibrium relationships 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.

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Financial economists have long been puzzled by corporate dividend behavior. It would seem that rational personal investors should value a dollar of corporate dividends less highly than a dollar of corporate retentions, because the former gives rise to greater tax liabilities. On the other hand, corporations face equal costs of paying out dividends and retaining earnings. As Miller and Modigliani (1961) demonstrated, in the absence of taxes dividend policy should have no effect on share valuation. It follows that if dividends are tax penalized, the value maximizing strategy for a firm would involve paying no dividends. It is therefore surprising that dividend payments to taxable investors are widespread. In 1981, dividend tax revenues in the United States were estimated to exceed twenty 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 Litzenberger and Ramaswamy (1979, 1982), Auerbach (1983), and Gordon and Bradford (1980), have isolated relationships between stock returns and dividend yields which are consistent with the existence of tax effects. Others, notably Miller and Scholes (1982), have suggested alternative explanations for the relationship. 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 yield - certainly nothing that could be considered a yield-related tax effect of the classic kind [1982, p.1131]."

A full understanding of how dividends affect returns remains difficult to achieve. It appears unlikely that we will ever be able to devise completely satisfactory empirical measures of ex-ante returns on securities. Most studies of dividend effects rely on the standard CAPM, with the aggregate stock market used as a proxy for the market portfolio, in order to model required returns. Substantial theoretical and empirical literatures cast doubt on the validity of this procedure. If ex-ante returns are mis-modelled and yields are correlated with required returns, dividend yield effects will not be estimated consistently. This makes the isolation and attribution of tax effects problematic.

This paper presents the results of our research on dividends and taxes using British data. As Miller and Scholes argue, the identification of tax effects is likely to be impossible using data generated under a single tax regime. British data offer great potential to illuminate the taxes and dividends question because there have been two radical changes and a number of minor changes in British dividend tax policy during the last 30 years. 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 investors' 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 thirty years and discusses the tax reforms which form the basis for our empirical tests. We consider both the tax treatment of individual investors and the rules governing arbitrage 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. Section IV presents our conclusions and describes several directions for future research.

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

The taxation of corporate income in Britain has been substantially reformed twice during the last 20 years. This makes British data especially powerful in testing alternative hypotheses about the impact of taxes on the market valuation of different forms of corporate income. If taxes affect the relevant marginal investor, then the relative valuation of dividends and capital gains should change when the tax law changes. It appears that the major changes in British corporate income taxation can safely be viewed as exogenous. Both occurred following transitions of the political party in power, after elections in which taxes were not an important issue.

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 the relative valuation of dividend income. The second change occurred in 1973, when the Conversative 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 an integrated tax system like that introduced in Britain in 1973 affects investors' relative valuation of dividends and capital gains. To motivate this, assume 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[2] and require an after tax return of $\rho(1-z)$. Asset market equilibrium requires that:

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

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

$$R = g+d = \rho + (\frac{m-z}{1-z})d = \rho + \delta d \quad . \tag{2}$$

The pretax return on higher yield securities is higher than that on low dividend shares. This return just compensates investors for the extra taxes they must pay. Prior to 1965, there was no capital gains tax so $\gamma = m$. 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 $\gamma = (m-z)/(1-z)$.

In April 1973, the tax system was reformed in a way which substantially reduced the tax rate applicable to dividend income. Investors are now permitted to take a partial credit for corporate tax payments in evaluating their dividend tax liability. This tax system 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 kind of withholding mechanism for collecting the dividend tax, where the amount withheld is "imputed" to the shareholder. In this case γ becomes:

$$\gamma = \frac{\frac{m-w}{1-w} - Z}{1-z} \tag{3}$$

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

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 w = .33, implying that corporate tax payments worth thirty three 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 £.50, 25 percent of the dividend received after withholding. For an investor in the 33 percent tax bracket, no further taxes would be due. For shareholders with tax rates <u>below</u> w, the Inland Revenue would provide a refund of (m-w)/(1-w) times the dividend.[3]

It is sometimes suggested that the relevant marginal investor for the valuation of dividends is either a tax free institution or a broker-dealer who engages in trading around the ex-day. Some discussion of the regulations affecting dividend arbitrage is therefore needed. Prior to 1970, "dividend stripping" by trading around ex-days was apparently widespread. Major changes in the tax rules relating to dividend trading occurred in 1970.[4] For an individual, after 1970, if trading around ex-days such as selling shares before the ex-day and repurchasing them later reduced his tax liability by more than 10 percent in any year, his transactions could be declared void. He could be assessed for the tax to which he would have been liable if he did not pursue this strategy. The second major class of investors is tax-exempt institutions. After 1970, their trading around ex-days could be declared void if they bought and sold the share within one month of the ex-day. In this situation, the institution could be required to pay a partial tax. For traders in securities, the third major class of investors, both dividends and realized capital gains are taxed at the personal income tax rate (for partnership dealers) or the corporate rate (for incorporated dealers). Since 1970, when a dealer trades in securities around ex-days and holds the shares for less than a month, a substantial fraction of his capital loss on the transaction can be disallowed for tax purposes. As the holding period declines, the fraction disallowed rises and can reach 100 percent.

While the interactions among these tax provisions are difficult to describe, two facts stand out. First, the opportunities for avoiding taxes by trading around ex-days were substantially reduced for all investors in 1970. To the extent that trading around ex-days is important in determining ex-dividend price movements, we would expect to observe noticable changes around 1970. Second, the average tax burden on dividend income, relative to capital gains, declined in 1965 and fell substantially in 1973. To provide some indicator of these changes, Table 1 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 determining the marginal tax rates applicable to different classes of shareholders assuming they did nothing to avoid taxes, and then averaging these rates across investor classes with weights proportional to the shareholders' total equity holdings. A detailed description of the procedures

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 (γ)
1955	.518	0.0	.518
1956	.516	0.0	.516
1957	.515	0.0	.515
1958	.498	0.0	.498
1959	.484	0.0	.484
1960	.486	0.0	.486
1961	.485	0.0	.485
1962	.483	0.0	.483
1963	.483	0.0	.483
1964	.518	0.0	.518
1965*	.533	0.0/.184	.533/.427
1966	.489	.174	.381
1967	.488	.172	.382
1968	.481	.169	.375
1969	.469	.157	.370
1970	.452	.152	.353
1971	.441	.149	.346
1972	.420	.148	.319
1973*	.402/.049	.143	.302/-.109
1974	.107	.134	-.031
1975	.049	.130	-.093
1976	-.015	.132	-.169
1977	-.045	.134	-.207
1978	-.050	.135	-.214
1979	-.069	.136	-.237
1980	-.129	.134	-.304
1981	-.121	.133	-.293
Average Values:			
Regime I (1955-1965)	.4997	0.0	.4997
Regime II (1965-1973)	.4662	0.162	.3639
Regime III (1973 -)	-.0277	0.134	-.187

Source: King (1977), King, Naldrett, and Poterba (1984), and authors' calculations. The data for 1965 and 1973 refer to the months before and after the April tax reforms.

used in deriving these tax rates can be found in King (1977) and King, Naldrett and Poterba (1984).

The table shows both discrete changes in average marginal tax rates caused by the two tax reforms, and continuing movements which result from trends in the pattern of share ownership. In 1955, more than two-thirds of all equity was held by persons, who are the most heavily taxed class of investors. By 1981, this fraction had declined to less than forty percent.[5] The marked decline in personal holdings coincided with the rapid rise in the value of institutional holdings, particularly untaxed pension funds. These trends have reduced the marginal tax rates on both dividends and capital gains. We should emphasize that the weighted average tax rates are only designed to indicate 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.

The third column of Table I presents a summary measure for the tax system's treatment of dividends and capital gains. Since our study is directed at estimating γ from market data, it is informative to calculate the values which would obtain if market returns reflected the average marginal tax rates on all shareholders for the different tax regimes. The data clearly reflect substantial variation. Prior to 1965, in what we refer to as Regime I, γ averages .50. This reflects a substantial tax burden on dividends and the absence of capital gains taxes. Between 1965 and 1973, γ averages .36, lower than in Regime I largely because of the capital gains tax. Finally, since 1973, γ has actually been negative in many years. The average value of

γ during Regime III is -.187.

With these benchmark values of the tax parameters in mind, we examine share prices to see if the tax changes have left a trace in the measured pretax returns of different securities. In the succeeding two sections we report estimates using daily and monthly data of the market's relative valuation of dividends and capital gains under different tax regimes.

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 (1970), Black and Scholes (1973), Green (1980), Kalay (1982), Eades, Hess and Kim (1982), Auerbach (1983), Hess (1983), 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, this tax-based explanation has been subject to some criticism. Hess (1982, 1983) showed that the restrictions implied by the after-tax CAPM are violated in daily and monthly returns. However, since his tests are joint tests of both the tax effects hypothesis and a particular model of ex-ante security returns, it is difficult to decide whether the tax hypothesis is at fault.

Black and Scholes (1973), Green (1980) and Kalay (1982) raised a second objection, suggesting 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 income and on short term capital gains (m=z), this short term arbitrage should lead share prices to decline by the full value of their dividends.[6]

As we noted above, there were changes in the rules concerning ex-day trading during our sample period. This is particularly evident in the 1970 Finance Act. 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. As we shall see below, 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 sixteen large U.K. firms.[7] A listing of these firms and the periods covered by our data may be found in the appendix. Using information on ex-dividend dates for these firms 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

$$R_{it} = \beta_0 + \sum_{i=1}^{16} \beta_i R_{mt} + \sum_{j=1}^{3} \alpha_j d_{itj} + \nu_{it} \tag{4}$$

where R_{mt} is the market return and β_i is a company-specific coefficient which should resemble the security's beta. The dividend yield on each day is d_{itj}, where j denotes the tax regime (I, II, or III) in which the dividend falls. The α_j coefficients reflect the excess pretax return on ex-dividend days, an estimate of γ 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 took a more agnostic approach to modelling ex-ante returns, and introduced firm-specific intercept terms:

$$R_{it} = \sum_{i=1}^{16} \delta_i + \sum_{i=1}^{16} \beta_i R_{mt} + \sum_{j=1}^{3} \alpha_j d_{itj} + \nu_{it} \quad . \qquad (5)$$

These equations were estimated by a generalized least squares procedure which allowed for heteroscedasticity across different firms.[8] 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) and (5) for ex-dividend days alone. There is clear evidence that the α_j coefficients have changed over time, with values between .3 and .4 in Regimes I and II and much smaller values, between -.15 and -.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 .443, which is somewhat smaller than the difference of .551 between the average values of γ 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 his shares for the ex-day and the following day. When we repeated our regressions on the 2-day returns, the coefficients changed, although not markedly, and the basic conclusion that the 1973 tax reform had

Table II

Ex-Dividend Day Return Regressions

Equation	Data Set	Firm Specific Intercepts	Implicit Tax Rate Regime I	Regime II	Regime III	Number of Observations	R^2
1.	Ex-Days Only	No	.319 (.062)	.302 (.070)	-.055 (.065)	633	.384
2.	Ex-Days Only	Yes	.440 (.081)	.413 (.086)	-.061 (.080)	633	.482
3.	2-Day Returns	No	.345 (.084)	.322 (.103)	-.062 (.096)	584	.443
4.	2-Day Returns	Yes	.429 (.100)	.421 (.113)	.042 (.109)	584	.533
5.	All Days	No	.414 (.033)	.413 (.037)	-.052 (.034)	1217	.416
6.	All Days	Yes	.442 (.058)	.416 (.061)	-.057 (.057)	1217	.483

Notes: All equations correspond to the model

$$g_{it} + d_{it} = \sum_{i=1}^{N} \delta_i + \sum_{i=1}^{N} \beta_i \cdot R_{mt} + \alpha_1 d_{it1} + \alpha_2 d_{it2} + \alpha_3 d_{it3} + \varepsilon_{it} .$$

The δ_i coefficients are firm-specific intercept terms, β_i are company β's, and α_1, α_2, and α_3 are the implicit tax effects corresponding to each tax regime. Standard errors are shown in parenthesis.

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 .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 III.[10]

We adopted another approach to testing the "tax-effects" hypothesis, exploiting both the within-regime and the across-regime variation in tax rates, by comparing our estimate of $\hat{\alpha}$ for <u>each year</u> with γ in Table I. The hypothesis that $\hat{\alpha} = \gamma$ was rejected at standard significance levels. However, tests using $\hat{\alpha} = (m-w)/(1-w)_t$, imposing $z_t = 0$, 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.

Previous research, such as that of Gordon and Bradford (1980), has documented the existence of large fluctuations in estimated tax effects even over periods when the tax law was stable. To measure time series variation, we re-estimated equation (2a) from Table II allowing separate α_j coefficients for each year. When the tax regime changed <u>during</u> the year,

Table III

Time Series Movements in Dividend Valuation

Year	Estimated α	
1956	.149	(.177)
1957	.439	(.165)
1958	.393	(.151)
1959	.637	(.182)
1960	.361	(.201)
1961	-.142	(.207)
1962	.378	(.194)
1963	.276	(.205)
1964	.050	(.174)
1965	.304(.186)/.546(.240)	
1966	.272	(.150)
1967	.259	(.148)
1968	.254	(.190)
1969	.460	(.180)
1970	.459	(.151)
1971	.298	(.145)
1972	.455	(.180)
1973	.365(.305)/-.044(.297)	
1974	-.146	(.160)
1975	-.600	(.185)
1976	-.031	(.164)
1977	-.109	(.174)
1978	-.115	(.168)
1979	-.056	(.137)
1980	-.093	(.139)
1981	-.064	(.145)

Notes: The coefficients were estimated from the equation:

$$R_{it} = \delta_0 + \sum_{i=1}^{N} \beta_i \cdot R_{mt} + \sum_{j=1956}^{1981} \alpha_j \cdot d_{it} + \nu_{it}.$$

The data set including only ex-days was used.

we estimated separate coefficients for the two regimes. These resulting estimates are shown in Table III. 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 return 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 Brennan (1970), Auerbach (1983), and Gordon and Bradford (1980). The tax modified capital market line requires that for each security i,

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

where $(1-m)r_{ft}$ is the after-tax risk-free rate of return, $\hat{m} = \frac{m-w}{1-w}$, g_{mt} and

and d_{mt} are the capital gains and dividends on the market portfolio, β_i = $Cov(\tilde{R}_{it}, \tilde{R}_{mt})/Var(\tilde{R}_{mt})$, and m is the marginal tax rate on interest income. We use ~ above a return to show that it is measured after tax. Dividing through expression (6) by (1-z) and manipulating terms yields

$$R_{it} = g_{it} + d_{it} = \frac{(1-\beta_i)}{(1-z)} (1-m)r_{ft} + \beta_i [g_{mt} + (1-\gamma)d_{mt}] + \gamma d_{it} + \nu_{it}. \quad (7)$$

In daily data, the variation over time in the risk free rate and the market dividend yield is small, so we could approximate (7) by

$$R_{it} = \delta + \beta_i g_{mt} + \alpha d_{it} + \nu_{it} \quad . \quad (8)$$

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 (6):

$$R_{it} - (1-m)r_{ft} - \beta_i(R_{mt}-(1-m)r_{ft}) = \alpha_1 d_{it1} + \alpha_2 d_{it2} + \alpha_3 d_{it3} + u_{it}. \quad (9)$$

where R_{mt} is the total return on the market and u_{it} is an error which assumed to be uncorrelated across firms and time.[11]

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 which began by defining R_{mt} = $d_{mt} + g_{mt}$, estimating $\hat{\beta}_{it}$, and estimating $\hat{\alpha}$ for each regime. We than 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 $\hat{\hat{\beta}}_i$'s. The new $\hat{\hat{\beta}}_i$ were then used to form the left hand side variable in (9). Our results were insensitive to these experiments; the findings reported below correspond to β_i's estimated from unadjusted R_{mt} and R_{it}.

Estimating α_j's from (9) may be subject to serious biases if the assumptions underlying the CAPM are not valid, or if β's cannot be accurately estimated. 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, and there is little evidence that firm β's are stable over long time periods. These problems are probably substantial. 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 upwards biased estimates of the tax effects on the valuation of dividends. To control for this possibility we follow Miller and Scholes (1982), and add a variable $\overline{P}_i/P_{it}$ 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 (9).

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

$$R_{it} - (1-m)r_{ft} = u_i + \delta_t + \alpha_1 d_{it1} + \alpha_2 d_{it2} + \alpha_3 d_{it3} + \varepsilon_{it} \ . \tag{10}$$

Equation (10) 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 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. In principle equation (10) 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 (1977), is to subtract the means for each firm and for each month from each variable in (10). We considered some models with only firm effects and others with both firm effects and time effects. These were estimated as:

$$R_{it}-R_{i.} - (1-m)(r_{ft}-r_{f.}) = \alpha_1(d_{it1}-d_{i\cdot 1}) + \alpha_2(d_{it2}-d_{i\cdot 2}) + \alpha_3(d_{it3}-d_{i\cdot 3}) + \nu_{it} \tag{11}$$

for firm effects, and

$$R_{it}-R_{i.}-R_{.t} = \alpha_1(d_{it1}-d_{i.1}-d_{.t1}) + \alpha_2(d_{it2}-d_{1.2}-d_{.t2}) + \alpha_3(d_{it3}-d_{i.3}-d_{.t3}) + \nu_{it} \tag{12}$$

for firm and time effects. The term $R_{i.}$ is the average value of R_{it} for firm i, $d_{i.j}$ is the time average of d_{itj} for firm i, and $R_{.t}$ is the average return at time t across all firms. This procedure is numerically equivalent to doing a regression with firm and time dummies, but it is much less computationally burdensome. In estimating (11) and (12), we also allowed for unmeasured changes in required returns by adding the inverse price level and the average dividend yield variables, appropriately de-meaned, to our equations.

Before presenting our monthly regression results, there is one remaing methodological issue to discuss. This is the question of 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 (1982) 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 (1982). We included in the sample only observations for which i) positive dividends were paid but 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 semi-annual basis. Restricting the sample to these observations should eliminate most 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 (1976) in the context of rational expectations macro models. 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:

$$x_t = x_t^e + \theta_t \tag{13}$$

where θ_t is orthogonal to any element of the information set Ω_t. Equation (13) 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 $d_{it}^* = \frac{1}{3}(d_{it-11} + d_{it-12} + d_{it-13})$, which is the previous year's dividend yield in this month with a minor correction to allow for possible timing differences in two consecutive years.[12] When

$d_{it} = 0$ our instrumental variable was also set equal to zero. This may leave some small residual bias but it should be common to all firms, and reasonably constant over time.

Our instrumental variable procedure differs from the iterated least squares procedure used by Litzenberger and Ramaswamy (1979, 1982), Gordon and Bradford (1980), and many other authors. These authors use a first stage regression to create an expected dividend yield variable which they then include in estimating an equation like (12). However, as Hausman (1983) explains, this procedure is flawed in two respects. First, unless all the variables included on the right hand side of (12) or any other second stage equation are included in the first stage, the second stage estimates will be inconsistent. Second, even if all the appropriate variables are included, the standard errors will be overstated if a two stage procedure is used. Our results are therefore the first which both correct for information effects and also present consistent standard errors.[13]

It is important to recognize that the biases in estimated tax effects due to information effects and mismeasurement of risk which have been extensively discussed in the literature should infect 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, provided by Mr. Jeremy Smithers of the LBS. This data set includes monthly observations on prices, dividend payments, and market indices for 3,500 U.K. firms during a twenty-six 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 non-trading.

To avoid infrequent trading problems and other difficulties associated with data inconsistencies, we constructed a data subset for our analysis. First, since the LBS tape provides monthly information on each month's final recorded transactions price, the date of this transaction, and the monthly high and low price, we were able to select 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 non-trading 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 <u>before</u> the ex-date. Note that for these firms, the measured price decline due to the dividend payment would be zero.

We also deleted i) any firms for which we had less than twelve admissable observations, on the grounds that the estimated β_i'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 non-cash dividends or special rights issues. Finally, we examined only observations on large firms, measured by market value at the end of 1981. Our results are based on all firms in the first third of the value distribution although the findings are not particularly sensitive to choosing alternative cut-off points. This firm size criterion reduced our sample size from about 135,000 to 44,000 company-months.[14]

B. Results

Estimates of equations (11) and (12) using the restricted data sample of firms without announcement or information biases are presented in Table IV. The results confirm the daily findings and provide strong support for 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 Regime I and II is more difficult to interpret; there are movements in both directions in the various equations, and the hypothesis of equal coefficients ($\alpha_1 = \alpha_2$) can never be rejected.

The lower rows of Table IV presents the results of estimating our fixed-effects models for the same restricted data sample. Again the findings

Table IV

Monthly Return Regressions, Restricted Sample, 1965-1977

Equation	Constant ($x10^{-3}$)	Implicit Tax Price: Regime I	Implicit Tax Price: Regime II	Implicit Tax Price: Regime III	$(\overline{D}/P)$	$\overline{P}_i/P_{it}$	R^2
4a CAPM	-3.619 (1.243)	.900 (.361)	.741 (.118)	.453 (.126)	-	-	.529
4b CAPM	-1.570 (.322)	.697 (.303)	.731 (.178)	.406 (.125)	.277 (.718)	.010 (.002)	.532
4c Firm Effects	-	.788 (.434)	1.057 (.169)	.261 (.178)	-	-	.0389
4d Firm Effects	-	.861 (.439)	1.235 (.171)	.324 (.178)	8.129 (.254)	.0035 (.002)	.0514
4e Firm and Time Effects	-	.945 (.385)	.730 (.140)	.557 (.153)	-	-	.501
4f Firm and Time Effects	-	.895 (.386)	.757 (.142)	.576 (.153)	2.41 (1.04)	.0123 (.0026)	.505

Notes: These equations 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 1 and 2 were estimated by weighted least squares as in Table II; subsequent models by ordinary least squares. Standard errors are shown in parentheses. The CAPM equations assumed β_i constant for six-year intervals.

suggest the importance of tax changes, although in the firm-effect models many of the inter-regime coefficient changes are larger than the "predicted" changes based on Table I. These large values reflect in part the failure of the fixed effects estimator without time dummies to capture the variation due to systematic forces at each moment of time. When the time dummies are added, in equations 4e and 4f, 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. In the CAPM models, addition of variables designed to capture these biases, such as the inverse price, reduce the absolute size of the coefficients slightly. The changes are not enough to resolve the mystery, however. While our coefficients are implausibly large, other authors using non-American data have found similar values. Lakonishok and Vermaelen (1983) discovered that Canadian share prices often fall on ex-days by only one third of the dividend value, suggesting γ of roughly two thirds. These incredible values for price drop-offs should be a source of further study.

Table V presents estimates of the returns model for the entire 1955-1981 period using our instrumental variable procedure for handling the information effect problem. 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 .25 and .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

Table V

Monthly Return Regressions, 1955-1981

Equation	Constant ($x10^{-3}$)	Implicit Tax Price Regime I	Implicit Tax Price Regime II	Implicit Tax Price Regime III	$(\hat{D}/P)$	$\overline{P}_i/P_{it}$	R^2
5a CAPM	-5.609 (3.835)	.813 (.088)	.714 (.088)	.449 (.089)	-	-	.0042
5b CAPM	-6.803 (.739)	.731 (.089)	.745 (.088)	.472 (.089)	.488 (.073)	.0032 (.0003)	.0089
5c Firm Effects	-	.891 (.119)	.783 (.118)	.094 (.129)	-	-	.0025
5d Firm Effects	-	.794 (.120)	.905 (.118)	.151 (.120)	4.186 (.337)	.0041 (.0004)	.0112
5e Firm and Time Effects	-	.786 (.094)	.747 (.093)	.519 (.095)	-	-	.0042
5f Firm and Time Effects	-	.791 (.094)	.749 (.093)	.517 (.094)	.998 (.265)	.004 (.0003)	.0079

Notes: All equations estimated on monthly LBS returns data, 1955-1981, using a weighted least squares correction for heteroscedasticity. See text for data description. Dividends yeilds were estimated by instrumental variables because of information effects; the instrumental variables were twelve-month lagged values of the dividend yield. Standard errors are shown in parentheses.

did not lead to changes in security returns for only a few days around the ex-day. Rather, these results suggest a more persistent effect which can be traced in monthly returns. This encouraging evidence is partially offset by the comparison between the estimates of γ for Regime I and Regime II. There are few dramatic changes, in spite of the fact that the introduction of a capital gains tax should have reduced γ. The hypothesis that $\alpha_1 = \alpha_2$ can be rejected in only one of the six 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. While the $\overline{P}_i/P_{it}$ variable always enters with a statistically significant coefficient (the t-statistics are often greater than ten), 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.[15] This suggests that a higher average dividend yield <u>raises</u> 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 are often implausibly large. The question of how dividend policy affects required returns in non-dividend months should be a subject of further study.

In our attempt to learn why the absolute sizes of α_j were larger than expected, we tried several alternative approaches to estimating the basic equations. First, we added d_{it}^2 and β_i as explanatory variables in our estimating equations. These had almost no effect. We experimented with more restrictive data sets, focusing only on the very largest companies. This also had no effect. These results, however, underscore the possible biases in the level of estimated dividend valuation coefficients and further emphasize the need for tests which rely upon genuine variation in the tax system in studying dividends and taxes.

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 tax effects account for a significant part of the positive relationship between yields and stock market returns.

Our conclusions thus support inferences drawn by Litzenberger and Ramaswamy (1979, 1982) and Gordon and Bradford (1980), and cast doubt on those obtained by Miller and Scholes (1982) and Kalay (1982) from American data. Of course, it is possible that our results cannot be extrapolated to American securities markets. Certain tax rules, such as the investment interest limitation stressed by Miller and Scholes (1978), differ between Britain and the U.S. However, the significance of tax details for market valuation of dividends has never been documented. Feenberg (1981) provides evidence suggesting that dividends are taxable for more than 99 percent of American investors.

It would be valuable to extend this work in several directions.

First, some other countries, notably Canada, have significantly reformed dividend taxation in recent years. Their experiences provide similar controlled experiments for assessing tax effects. Second, our research has not examined clientele effects, though changing tax rules offer the potential for further exploration of this important issue. A natural project would consider whether differences in $\hat{\alpha}$ across firms have become less pronounced since the reductions in dividend tax rates on most investors. Finally, an alternative method of examining the market's valuation of dividends is suggested by Amoako-Adu's (1983) study of how the announcement of Canadian tax reform affected different securities. It would be useful to apply his approach to British data, although there are serious problems in dating the moment when expectations of tax reform change.

Perhaps the most important item on the agenda for future research 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 is presented in Poterba and Summers (1984).

Footnotes

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 (1983) calculated effective dividend tax rates for years prior to 1980. Their marginal tax rate on dividends for 1979 was .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.

2. 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 focusses 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 (1983) addresses some of these questions.

3. 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.

4. Kaplanis (1983) discusses these trading rules in greater detail.

5. Data on share ownership proportions for the U.K. may be found in King, Naldrett, and Poterba (1984).

6. There have been several recent papers concerned with questions of tax trading around ex-dividend days. These include Kalay (1982), Elton, Gruber, and Rentzler (1983a) and Kalay (1983), all of which discuss the magnitude of transactions costs for trading around the ex-day. Lakonishok and Vermaelen (1983) have reported tests of the short-term trading hypothesis for Canada, and concluded that it may explain ex-day price movements there. The source of these differences might be traced to institutional details or other factors and clearly warrants further investigation.

7. We began with a sample of twenty large, non-nationalized industrial firms selected from Fortune's 1981 listing of the world's largest 500 industrial corporations. For four firms, substantial evidence of non-trading, especially early in the sample period, or other difficulties in finding comparable price series through time, led to exclusion from the sample.

8. We estimated the returns model by ordinary least squares, computed $\hat{\sigma}_i^2 = \frac{1}{T} \sum_{t=1}^{T} \hat{\varepsilon}_{it}^2$, for each i firm, and then weighted observations for the i^{th} firm by $1/\sqrt{\hat{\sigma}_i^2}$. The differences between the OLS and the GLS results were typically minor.

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 (1973) suggested could explain U.S. ex-dividend behavior.

10. We attempted to estimate clientele effects for each tax regime by adding squared dividend yields to our returns model. While there were some weak evidence of clientele effects, in the form of a negative coefficient on the quadratic term, neither the size of this coefficient nor its differences could be estimated with any precision given our small sample.

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 (1982) and Hess (1982, 1983). Because our monthly sample of firms is so large, these procedures were computationally impractical.

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

13. 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. Since it is a powerful tool for analyzing models which involve rational expectations, it should find numerous applications in financial economics.

14. Other variables in the monthly regressions were measured as follows. We calculated the after-tax risk-free return as $(1-m)r_{ft}$ where τ is a time series on the weighted average marginal tax rate on interest income calculated by Ohrnial and Foldes (1975) and Ohrnial (1979), recently extended by King, Naldrett, and Poterba (1984). 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 on the FT-Actuaries 500 Share Industrial Index.

15. Rosenberg and Marathe (1979) and Elton, Gruber, and Rentzler (1983a) experiment with a variety of similar modifications to the basic CAPM equation, adding average dividend yield variables .

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