New evidence of the impact of dividend taxation and on the identity of the marginal investor

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ABSTRACT

This paper examines the impact of a major change in dividend taxation introduced in the UK in July 1997. The reform was structured in such a way that the immediate impact fell almost entirely on the largest investor class in the UK, namely pension funds. We analyse the behaviour of share prices around the ex-dividend day both before and after the reform to test clientele effects and the impact of taxation on the valuation of companies. We find strong clientele effects in the UK, which are consistent with the distortions introduced by the tax system (before the reform dividend income was *tax-advantaged* in the UK). We also find significant changes in the valuation of dividend income after the reform, in particular for high-yielding companies. These results provide strong support for the hypothesis that taxation affects the valuation of companies, and that pension funds were the effective marginal investors for high-yielding companies.

It is very rare for governments to design their tax changes in a way that allows clean tests of important hypotheses. However, in July 1997 the incoming Labour government in the UK radically reformed the taxation of dividend income in such a way that the immediate impact fell almost entirely upon one important class of investors, namely pension funds. As is well known, pension funds are the single biggest class of investors in UK equities. In 1997 it was estimated that over one third of UK equities were held by pension funds, and the impact of the tax change was to increase the taxation of dividend income by £5bn per annum. We use this major tax change to examine two questions: is there evidence that pension funds are the "marginal" investors in the UK, and, if so, how do taxes affect the valuation of dividend income?

Given the nature of the tax change we examine, these questions are inevitably linked. We examine the valuation of dividends before and after the tax change, by considering the ex-dividend day behaviour of share prices. If pension funds were not the marginal investors, then we would anticipate no change in valuation, as all other classes of investors were unaffected by the tax change. However, if pension funds have a significant effect at the margin in setting share prices, then we can estimate how, if at all, taxation affects their valuation of dividend income. In practice the marginal investor may differ across companies (for example, depending on the dividend yield) and so we also test for tax-clientele effects. This ability to test both the identity of the marginal investor and the impact of dividend taxation is one of the unusual features of this tax reform.

Despite considerable research effort, the impact of taxation on the valuation of dividends remains the subject of dispute. In many countries, such as the US, profits distributed as dividend payments are taxed more heavily than profits retained within the firm. This should, if dividend taxes affect valuation at the margin, result in strong incentives for firms to reduce dividend distributions to zero. The fact that dividend payments still exist in such countries has led to a large literature on the possible reasons for paying dividends even when such distributions are tax-disadvantaged (see Poterba and Summers (1985) and Zodrow (1991) for a discussion).

However, an interesting feature of UK dividend taxation until July 1997 was that dividends were actually tax-preferred by certain investor classes. Between 1973 and July 1997 the UK operated an imputation tax system, whereby companies paid Advance Corporation Tax (ACT) on dividend distributions, and issued a tax credit to investors in respect of the dividend distribution (we give details of the tax system in the next section). Subject to certain rules, ACT paid could be offset against the Mainstream Corporation Tax liabilities of the company, and investors could use the tax credits to offset their personal tax liabilities. Importantly, in the case of tax-exempt investors, these tax credits could be sent to the tax authorities and a full cash refund obtained. This feature, which is uncommon among countries operating imputation systems, resulted in tax-exempt investors having a strong preference for dividend distributions (with the associated tax credit) over retaining profits within the company (which generated no tax credit). The main effect of the reform introduced in July 1997 was to withdraw the ability of tax-exempt investors to reclaim dividend tax credits, thereby significantly reducing (by 20%) their valuation of dividend income. The overall result of the tax reform was to make tax-exempt investors indifferent, at least in tax terms, between dividends and retained earnings.

This paper analyses the impact of this major tax reform by estimating the extent of any change in the valuation of dividend income before and after the reform. We do this, following Elton and Gruber (1970) and others, by considering the behaviour of share prices observed around ex-dividend days. The argument is that the fall in price on the ex-dividend day should reflect the value of dividends relative to capital gains to the marginal investor clientele. If investors were indifferent between dividends and capital gains, price would drop one-for-one with the dividend that is paid on each share. Depending on the tax treatment, however, investors might not be indifferent between dividends and capital gains. The ratio of the ex-day price drop to the amount of the dividend should then reflect the relative taxation of dividends and capital gains of the clientele holding the particular stock.

This tax interpretation of ex-dividend day price behaviour can be problematic if prices around ex-dividend days are influenced more by the behaviour of short-term traders than the longer-term investors in the company. Kalay (1982) argues that if short-term trading is important price movements on the ex-day may reflect transaction costs of arbitrageurs rather than the relative tax preferences of the investors that matter in the longer term. This view is consistent with the finding of Karpoff and Walking (1988) that ex-day returns in the US are significantly related to transactions costs. Boyd and Jagannathan (1994) provide a model in which transactions costs faced by different classes of traders induce a non-linear relationship between ex-day price movement and dividend yield. They document that US data display this non-linearity. Lakonishok and Vermaelen (1986) confirm the importance of dividend-capture trading in the US market by reporting abnormally high trading volumes around ex-days, which are more pronounced in shares with higher yields.

The argument that dividend-capture trading clouds the interpretation of ex-dividend day evidence involves the implicit assumption of a change in the identity of the marginal investor around the event. In the UK, pension funds were the class of investors that could potentially make the largest profits on dividend capture trading, at least prior to 1997. However, with an ownership share of over one third of UK equities pension funds were also the single biggest class of investors and thus the most likely marginal shareholders in the longer term. If the "trading" clientele corresponded to the "holding" clientele in the UK, the conflict between the short-term trading interpretation and the tax interpretation is less apparent. Moreover, tax-motivated short-term trading activities are seriously constrained by restrictions in the tax code as noted by Poterba and Summers (1984) and Lasfer (1995). The latter specifically investigates the relevance of short-term trading to the UK and concludes that "unlike the US market, ex-day returns in the UK are not affected by short-term trading". This makes evidence from the UK particularly pertinent.

The recent literature suggests that even in the absence of short-term trading ex-day returns may not be driven by tax effects. For example, Frank and Jagannathan (1998) examine ex-day price behaviour in the Hong Kong stock market where short-term trading activities can be ruled out and neither dividends nor capital gains are taxed. Prices on the ex-day are found to drop by less than the amount of the dividend. They are able to account for this theoretically by market microstructure arguments. In their model, the collection and reinvestment of dividends is a nuisance to individual buyers and sellers, but less so for market makers. Most trades therefore tend to occur at the bid price on the last cum-dividend date and at the ask price on the ex-dividend day. This results in stock prices rising on average on ex-dividend days quite independent of the amount of the dividend, with the rise being related to the magnitude of the bid-ask spread. In the context of the US market, therefore, where dividends tend to be tax-discriminated against, ex-day price changes of less than the dividend amount may be mistaken as evidence of tax effects. Green and Rydqvist (1999) examine the ex-day price behaviour in the Swedish lottery bond market where cash distributions are tax-advantaged relative to capital gains. They find that the prices of bonds fall, on average, by substantially more than the coupon over the ex-distribution period. If non-tax frictions were important, they argue, the finding of price drops in excess of the cash distributed would reinforce rather than weaken evidence of tax effects. A similar argument applies in the UK tax environment where tax-exempt investors had a strong tax preference for dividends before 1997. Moreover, our analysis focuses on the change in ex-day returns in response to a major dividend tax reform. This allows us to control for any non-tax frictions that may affect the ex-day price behaviour of UK stocks.

Previous studies of UK tax changes have generally found taxes to be an important determinant of equity returns. Poterba and Summers (1984) study two reforms: the introduction of capital gains tax in 1965, and the move to the imputation tax system in 1973. One aspect of the latter reform was the introduction of the dividend subsidy for tax-exempt investors, the removal of which we study in this paper. They conclude that the valuation of dividends changes significantly across tax regimes. Lasfer (1995) considers the impact of the 1988 tax changes, which reduced the higher rates of income tax, harmonised income and capital gains taxes, and reduced the tax credit associated with dividend payments. This was a complicated reform whose effects differed across investors. However, Lasfer finds a significant change in the valuation of dividends after the reform, in particular for those companies with high dividend yields.[1]

The results we find in respect of the 1997 tax reform are consistent with these previous studies. We find a significant reduction in the valuation of dividend income after 1997, in particular for high-yielding companies. The effects of the reform on lower-yielding companies are much less pronounced, a result that is consistent with tax-exempt investors not being the marginal investors in such companies. This, of course, would be consistent with the tax-clientele hypothesis as tax-exempt investors should, prior to the reform, have had a strict preference for dividend distributions over retained profits.

The remainder of the paper is organised as follows. In section I we describe the taxation of dividend income in the UK, and the effects of the July 1997 reform. We also explain the hypotheses to be tested. In section II we describe the data and methods we use to test these hypotheses. Section III presents the empirical results. Section IV contains the conclusions and a discussion of the wider implications of the results.

I. The 1997 UK tax reform

A. The UK imputation tax system before Finance Act 1997

Under the UK imputation system, resident companies were liable to account to the Inland Revenue for Advance Corporation Tax (ACT) upon dividend distributions to shareholders. The ACT was treated as a payment on account of the Mainstream Corporation Tax for the accounting period in which the dividends were paid.[2] The rate of ACT was 20% of the tax-inclusive dividend. Thus, on a dividend payment of 100, a company had to pay 25 in ACT.

Shareholders were issued with an imputation tax credit equal to the rate of ACT, which could be offset against income tax liabilities. The final dividend tax burden depended on the status of the recipient shareholders. We summarise the position prior to Finance Act 1997 (FA97) in Table I below. It shows the after-tax receipts resulting from a dividend payment of 100 made by a UK resident company.

Table I: The after-tax value of a dividend of 100 before Finance Act 1997

	Pre-FA 1997
Higher rate individuals	75
Lower and basic rate individuals	100
Corporate shareholders	100
Pension funds	***125***
PEPs	125
Charitable institutions	125
Non-UK investors (no special treaty)	100
Non-UK portfolio/direct investors (treaty)	106/107

Notes: The tax rates for individual investors were: higher rate, 40%; lower rate, 20%; and basic rate, 25% in 1994/5 falling to 24% in 1996. The category of pension funds includes insurance companies in respect of their pensions business.

The tax credit discharged the tax liability of individual investors subject to the lower and basic rates of income tax. Individuals subject to the higher income tax rate had to pay further tax equal to the higher rate on the grossed-up dividend less the tax credit. UK resident companies did not count dividends as income and there was no liability to corporation tax. Rather, dividends were treated as investment income, and the attached tax credit eliminated companies' ACT liability when the dividends were paid on to the ultimate shareholders.

The peculiar feature that distinguished the UK from other imputation tax systems was that the *tax credit was fully refundable to tax-exempt shareholders*. The tax-exempt shareholder community predominantly consists of pension funds and insurance companies with respect to their pension business, but also of charitable bodies and individuals holding shares through Personal Equity Plans (PEPs). Although not shown in Table I, the credit repayment extended to non-tax paying individuals with incomes below their annual allowance as well as to companies that used franked investment income to offset trading losses.

A partial refund was also granted to non-resident investors qualifying for special tax treaty provisions. Non-treaty qualifying investors received no refund but were not subject to further UK tax on the dividends. For all non-residents, the total dividend tax burden depended on how the dividends were taxed when declared in their country of residence.

The relative importance of these various shareholder groups, at least in terms of their ownership of UK listed companies, can be seen in Table II. As is well known, institutional share ownership has gone much further in the UK than in many other countries. In contrast to the US, where individuals still own more than half of quoted equity, more than 56% of UK equity in 1997 was directly owned by financial institutions, including pension funds, insurance companies, and unit and investment trusts. Of particular importance for this paper is the size of equity holdings within pension schemes, which enjoyed tax-exempt status. In addition to direct contributions to pension funds, the Association of British Insurers (1998) estimate that 50-55% of company insurance premium income represents contributions to pension schemes. Thus, tax-exempt pension fund investors, for whom Finance Act 1997 was of major impact, held over one third of the equity in UK listed companies.

Table II: UK ownership structures (31 Dec 1997)

	Total Equity Owned (%)
Pension funds	**22.1**
Insurance companies	**23.5**
Individuals	16.5
Unit trusts	6.7
Investment trusts	1.9
Other financial institutions	2.0
Charities	1.9
Private non-financial corporations	1.2
Banks	0.1
Public Sector	0.1
Rest of the World	24.0

Source: Central Statistical Office (1997).

B. Finance Act 1997

On 2 July 1997 the incoming Labour government radically reformed the taxation of dividend income in the UK. The resolutions taken in Finance Act 1997 marked the beginning of the end of the imputation system that had been in existence in the UK since 1973.

The main effect of FA97 was to abolish the right of pension funds to be repaid the imputation tax credit on dividends paid on or after the day the Act was passed. Thus, UK pension funds saw an immediate 20% drop in the value of their net dividend income on UK equities. FA97 contained dividend tax reforms that affected other investors, but these either had a significantly smaller, or a delayed, impact.[3] FA97 had no immediate dividend tax implications for other investor groups. There were no changes to the rates of imputation credit or income tax and thus no changes to the dividend tax burden of individual shareholders. Similarly, tax-exempt charities, tax-favoured PEPs, non-tax paying individuals, and treaty-protected investors continued to enjoy the pre-Budget regime of refundable tax credits.

Although not immediately effective, FA97 provided for two future changes to the taxation of dividend income. As of 6 April 1999, the rate of imputation credit was to be cut from 20% on the tax-inclusive dividend to 10%. This however did not affect the dividend tax burden of individual investors because of a simultaneous cut in tax rates applicable to dividend income. Shareholder relief, in the form of lower dividend tax rates, therefore offset the reduction in dividend imputation.

Whilst having no effect on shareholders subject to tax in the UK, the reduction in the rate of imputation effectively eliminated any credit repayments to non-resident investors benefiting from special tax treaty provisions. For such investors, the value of dividends after UK tax fell by 6%. However, the total effect depended on how the UK dividends were subsequently taxed when (and if) declared in the residence country.[4]

The second change that became effective as of April 1999 was that the remaining credit repayments to tax-exempt investors would cease. However, charitable bodies were granted compensatory payments, which in 1999/2000 prevented the value of UK dividends from falling by more than 3%. Similarly, shareholders in PEPs were offered the opportunity to switch into a new tax-privileged savings vehicle, the Individual Savings Account (ISA).[5]

In summary, although FA97 had wide-ranging implications for UK dividend taxation, the immediate and largest impact fell entirely on tax-exempt pension funds. As of Budget day, pension funds saw a drop in the value of their UK net dividend income of 20%. FA97 did not change the dividend tax burden of individual or corporate shareholders.[6] It affected some other investor groups such as charities, investors in tax-exempt savings accounts, and certain non-residents, but only with a time lag of 21 months and in no case was the dividend tax increase anywhere near as sharp as that for pension funds on 2 July 1997. The remainder of this paper is concerned with estimating the effect of this major change on the valuation of dividend income.

C. Tax hypotheses

We examine the valuation of dividends before and after FA97 by considering the ex-dividend day behaviour of share prices. Following Elton and Gruber (1970), market prices in equilibrium will be such that the marginal investor is indifferent between selling a share on the cum-dividend day at the price P_c or on the ex-dividend day at the price P_e. If the dividend per share is D, the price-drop-to-dividend ratio (DOR) is expected to equal the relative tax differential between dividends and capital gains, where t_d and t_g are the investor's effective tax rates on dividend income and on capital gains respectively:

$$DOR = \frac{P_c - P_e}{D} = \frac{1 - t_d}{1 - t_g}. \qquad (1)$$

Alternatively, the rate of return on the ex-dividend day (R_e) is expected to be:

$$R_e = \frac{P_e + D - P_c}{P_c} = (1 - DOR)\frac{D}{P_c} = \left(\frac{t_d - t_g}{1 - t_g}\right)\frac{D}{P_c}. \qquad (2)$$

In many countries, such as the US, profits distributed as dividend payments are tax-disadvantaged relative to capital gains for many investors ($t_d > t_g$). Dividends are taxed at ordinary rates without tax credits, whereas effective capital gains taxes are low. Under dividend tax discrimination, drop-off ratios are expected to be less than one or, alternatively, ex-day returns must be positive in order to compensate investors for the tax penalty.

The tax environment in the UK is very different. As explained above, under the UK imputation system, the total tax burden on dividend income (t_d) depends not only on the ordinary income tax rate (t_m) but also on the rate of imputation credit (s) such that:

$$DOR = \frac{(1-t_m)}{(1-s)(1-t_g)}, \text{ and} \tag{3}$$

$$R_e = \left(\frac{t_m - s - t_g(1-s)}{1-t_g} \right) \frac{D}{P_c}. \tag{4}$$

The peculiar feature of UK dividend taxation before FA97 was that dividends were tax-preferred by many investor classes. In particular, tax-exempt investors such as pension funds were not liable to either income tax or capital gains tax ($t_m = t_g = 0$) but were allowed the repayment of the imputation credit (s = 0.20). As shown in Table III, if ex-day share price movements were solely driven by the tax preferences of tax-exempt investors we would expect the DOR to be equal to 1.25.

Taxable UK resident investors are in general liable to capital gains taxes at the ordinary (corporate or personal) income tax rates. However, effective capital gains tax rates are significantly lower than statutory rates because of deferral, generous allowances, and inflation indexation. Under the assumption of an effective capital gains tax rate equal to zero, Table III shows that basic- and lower-rate individuals as well as corporate shareholders were tax-indifferent between dividends and capital gains both before and after FA97. For them, we would expect a drop-off ratio equal to one. Indeed, the only investor class for which the expected drop-off ratio might be less than one is individual shareholders subject to income tax at the higher rate, but able to shelter capital gains.

Table III also shows the upper bound for expected drop-off ratios, which would obtain if capital gains were effectively taxed at the statutory rates. In this extreme case, most investor classes, whether tax-exempt or not, had a strong tax preference for cash distributions over capital gains. Thus, if ex-dividend behaviour of stock prices was driven by the taxation of dividends relative to capital gains, we would expect the behaviour of UK equities to be the reverse of that in the US. The price should fall by more than the distribution when a stock reaches the ex-dividend day, rather than by less than the distribution.

Table III demonstrates why an analysis of the level of drop-off ratios prior to FA97 is problematic as regards inferences on relative dividend valuation and the identity of the marginal investor. First, uncertainty about effective capital gains tax rates means that we cannot directly relate the ex-day price drop-off to the differential taxation of dividends and capital gains in order to determine the identity of the marginal investor.[7] Second, even if we were able to rule out high effective capital gains tax rates, the finding of drop-off ratios equal to 1.25 would not allow us to discriminate between different classes of tax-exempt investors. As Table III shows, prior to FA97 at least two investor classes other than pension funds had a marked tax preference for dividends. Finally, other non-tax factors might influence share price movements on the ex-day. For example, Frank and Jagannathan (1998) study ex-day price behaviour in Hong Kong where neither capital gains nor dividends are taxed. Prices are found to drop on average by less than the dividend due to market microstructure effects and transaction costs. Thus, in the UK tax environment a drop-off ratio of less than 1.25 could be wrongly interpreted as evidence against tax-exempt pension funds setting share prices.

Table III: Expected drop-off ratios before and after FA97

This table calculates expected drop-off ratios for different classes of investors. The drop-off ratio is defined as $DOR = \frac{(1-t_m)}{(1-s)(1-t_g)}$ and is calculated under two assumptions regarding the effective capital gains tax rate, t_g. The reforms introduced in FA97 had their main effect immediately, although the effect of some provisions was delayed until April 1999. Personal Equity Plans (PEPs) were withdrawn with effect from April 1999 and replaced by Individual Savings Accounts (ISAs), although the returns on existing sums invested within PEPs continued to be free of income and capital gains taxes.

	Effective capital gains tax = 0			**Effective capital gains tax = statutory rate**		
	Before FA97	After FA97	After April 1999	Before FA97	After FA97	After April 1999
Pension funds	**1.25**	**1.00**	**1.00**	**1.25**	**1.00**	**1.00**
Higher-rate individuals	0.75	0.75	0.75	1.25	1.25	1.25
Basic-rate individuals	1.00	1.00	1.00	1.30	1.30	1.30
Lower-rate individuals	1.00	1.00	1.00	1.25	1.25	1.11
PEP (ISA) holders	1.25	1.25	(1.11)	1.25	1.25	(1.11)
Unit/investment trusts	1.00	1.00	1.00	1.00	1.00	1.00
Corporations	1.00	1.00	1.00	1.49	1.45	1.43
Charities	1.25	1.25	1.21	1.25	1.25	1.21
Non-UK (no treaty)	1.00	1.00	1.00	1.00	1.00	1.00
Non-UK (treaty)	1.06/1.07	1.06/1.07	1.00/1.00	1.06/1.07	1.06/1.07	1.00/1.00

We overcome these ambiguities by analysing the *change* in ex-day price behaviour in response to FA97. As described above, FA97 was designed in a way that the immediate and only significant dividend tax impact fell entirely upon tax-exempt pension funds. The main effect of the reform was to withdraw the ability of pension funds to reclaim tax credits, thereby reducing their valuation of UK dividend income by 20%. Therefore, if DORs after FA97 were significantly lower than before we would argue in favour of the joint hypothesis that pension funds had a significant effect at the margin on UK equity prices and that taxes affected the valuation of dividend income. If taxes were fully reflected in the valuation of dividends, we would expect the drop-off ratio to fall by 20%.

The finding of a significant change in ex-day price behaviour around FA97 is not consistent with other types of investors being those that mattered at the margin. Since no changes were made to the taxation of capital gains[8] and dividends, taxable individual and corporate investors would not alter their relative valuation of dividend income. For other tax-exempt investors and certain non-residents the dividend tax resolutions would become effective only after 6 April 1999 and had a much smaller impact.

Clearly, the finding of no significant change around the Budget day is consistent with a number of hypotheses. In particular, if pension funds were intra-marginal investors we would anticipate no significant impact of the reforms. However, equally, a finding that the reforms had no impact would not imply that taxes were in general irrelevant for the valuation of dividends. The nature of the tax change examined would not allow us to discriminate between the alternatives. These arguments lead to our first hypothesis:

Hypothesis 1: Pension funds were the marginal investors in UK equities and dividend taxes affected equity values. As a result, drop-off ratios declined significantly after the day FA97 was passed.

In practice marginal investors may differ across companies. Prior to FA97 pension funds had a strong tax preference for dividend income. On the other hand, individual investors with high incomes and unexhausted capital gains allowances preferred companies to retain earnings for investment. Following Elton and Gruber (1970), we thus test for tax-clientele effects:

Hypothesis 2: Prior to FA 1997, pension funds predominantly invested in high-yielding stocks and shareholders subject to high relative dividend taxes in low-yielding stocks. As a result, drop-off ratios were increasing in dividend yield.

The existence of tax clienteles in the UK would imply low effective capital gains tax rates. At rates close to statutory rates, all investors would value dividends in a way similar to that of pension funds and no obvious clienteles could emerge. Tax clienteles would also imply that the impact of FA97 differed across companies depending on their dividend policy. We would expect the strongest effect on ex-day price behaviour for those stocks most likely to be held by pension funds. This leads to our third hypothesis:

Hypothesis 3: Prior to 2 July 1997, pension funds predominantly held stocks with high dividend yields. As a result, the decline in drop-off ratios in response to FA97 was strongest for highest-yielding stocks and weakest for lowest-yielding stocks.

The overall result of FA97 was to make pension funds indifferent, at least in tax terms, between dividends and profit retentions. Assuming that pension funds had a disproportionately high stake in high-yielding stocks purely to take advantage of the tax credit subsidy, we should observe, over time, a shift in their shareholdings away from high-yielding stocks towards other stocks. We therefore test:

Hypothesis 4: FA97 made pension funds indifferent between dividends and capital gains. As a result, any tax clientele effects and associated spreads in drop-off ratios across companies disappeared after 2 July 1997.

Apart from the pension fund hypotheses, we also test for the impact of those tax measures that were enacted in FA97 but only took effect after 6 April 1999. If the tax preferences of PEP holders, charities, non-tax paying individuals, or non-residents mattered, we should observe a decline in drop-off ratios after that date.

II. Data and methodology

A. Data

The change we study became effective on 2 July 1997; we set our sample period to be 30 months before and after this date (1 January 1995 to 31 December 1999). Initially we included all companies quoted on the London Stock Exchange that paid at least one dividend during our sample period and for whom data was available on Datastream (all data in this paper was derived from Datastream). Foreign corporations and investment trusts were then eliminated. For the remaining 1,785 companies we gathered information on all dividend payments over the sample period. This produced an initial sample of 12,343 dividend events. We excluded foreign income dividends (440 observations), special dividends (68 observations) and screened the remaining observations for missing or contradictory data entries (463 observations).[9] Minimum data requirements on historical prices, which we needed to estimate the risk characteristics of each stock, forced us to delete a further 1699 ex-day events.[10]

The resulting sample contained 9,673 ex-dividend day events for 1,478 companies. As is well known, a feature of the UK equity market is the low level of liquidity amongst small companies. One manifestation of this in our sample is that on 836 (8.6%) of the occasions when stocks went ex-dividend, there was no share price movement, on the day, at all due to non-trading. This is not to say, of course, that the price did not change when the share was next traded. However, since we study the behaviour of share prices on the ex-day we exclude zero-price change observations of stocks that did not trade on the ex-day. The resulting sample contains 8,837 observations for

1,434 stocks.[11] We take our concerns about thin-trading one step further. Since liquidity problems are most severe for small companies we generate our own synthetic *Largest 250* sample by ranking the market capitalisations of each stock at the start of each calendar year. Ex-day events of the largest 250 stocks in that year are included. This sample contains 2,348 ex-day events for 383 different companies. Panel A of Table IV gives descriptive statistics for the two samples.

B. Methodology

A number of different approaches have been employed to document the behaviour of ex-day share prices. Elton and Gruber (1970) base their analysis on the average drop-off ratio:

$$D\hat{O}R = \frac{1}{N}\sum_{i}^{N}\left(\frac{P_c - P_e}{D}\right)_i , \tag{5}$$

where N is the number of ex-day observations. The Elton and Gruber statistic can be estimated as the intercept of the regression:

$$DOR_i = \overline{DOR} + \varepsilon_i^* , \tag{6}$$

where ε_i* is an error term with an assumed mean of zero. Although an analysis of (unweighted) average ex-day drop-off ratios is intuitively appealing, there are several reasons that discourage the use of this particular statistic. First, the empirical distribution of drop-off ratios is far from being normally distributed. The second reason is that the error term ε_i* is heteroskedastic: drop-off ratios are scaled by dividends that vary widely for different firms. As Lakonishok and Vermaelen (1983) and Michaely (1991) point out, this would exacerbate the ex-day price change of small dividends relative to large dividends.

Assume that ex-dividend day returns R_e, as defined in (2), are generated by the following process:

$$R_{e\,i} = \left(\frac{P_e - P_c + D}{P_c}\right)_i = (1 - \overline{DOR})\left(\frac{D}{P_c}\right)_i + \varepsilon_i , \tag{7}$$

where ε_i is an error term with $E(\varepsilon_i) = 0$ and $Var(\varepsilon_i) = (\sigma^2)$.

Thus, applying OLS to (6) would result in a residual variance that is decreasing in the dividend yield:

$$DOR_i = \overline{DOR} - \varepsilon_i \left(\frac{P_c}{D} \right)_i , \tag{6*}$$

so the OLS estimate is not efficient. Given the problems with the Elton and Gruber statistic, our interpretation is largely based on an alternative estimate of the drop-off ratio, which gives less weight to lower-yielding stocks with higher ex-day price variability.[12] Rearrange (7) to give:

$$\left(\frac{P_c - P_e}{P_c} \right)_i = \overline{DOR} \left(\frac{D}{P_c} \right)_i - \varepsilon_i , \tag{8}$$

and we can estimate the drop-off ratio as the slope coefficient in the OLS regression:[13]

$$\left(\frac{P_c - P_e}{P_c} \right)_i = \beta \left(\frac{D}{P_c} \right)_i + \varepsilon_i . \tag{9}$$

We thus relate the ex-day price change scaled by the cum-dividend price to the dividend amount, also scaled by the cum-dividend price. Further corrections for heteroskedasticity should lead to only minor improvements in efficiency in large samples, but we nevertheless base our inferences on robust standard errors using White's (1980) procedure.

Although there is nothing in the tax argument to suggest a non-zero intercept, Boyd and Jagannathan (1994) and Frank and Jagannathan (1998) develop microstructure models of ex-day trading behaviour which imply a negative intercept in regression (9). If such microstructure effects were important, forcing the intercept through zero would produce biased estimates of the slope coefficients. We therefore allow for a non-zero intercept and, in addition to regression (9), estimate:

$$\left(\frac{P_c - P_e}{P_c} \right)_i = \alpha + \beta \left(\frac{D}{P_c} \right)_i + \varepsilon_i . \tag{10}$$

We estimate all models on both an unadjusted and market-adjusted basis. In the latter case we adjust the ex-day closing price in the following way:

$$P_e^* = P_e - P_c \beta R_e^m , \tag{11}$$

where P_e^* denotes the adjusted price on the ex-day, R_e^m is the return on the market (as measured by the *FT-Actuaries All Shares Index*) on the ex-day. To obtain a stock's beta we estimate the market model based on monthly return data and observations (-60, -1) relative to the ex-dividend month.[14] The reasons why we depart from other researchers and use monthly returns over a much longer time period are essentially twofold:[15] First, monthly data allows us to reduce thin-trading problems, which would likely bias our beta-estimates downward. Second, we expect to obtain more reliable estimates of a stock's risk characteristics over a three to five year estimation period. Panel A of Table IV reports descriptive statistics of our beta estimates. The average beta of 0.76 in the whole sample is low and reflects the thin-trading problems of many stocks in the sample. For the more liquid companies in the Largest 250 sample beta averages 1.01.

To test the first tax hypothesis, we compare estimated drop-off ratios before and after FA97. We pick up the tax-induced change by including an interactive zero-one dummy (PostFA97) for whether or not the observation falls in the post-reform period:[16]

$$\left(\frac{P_c - P_e}{P_c} \right)_i = \alpha + \beta \left(\frac{D}{P_c} \right)_i + \beta_{FA} \left(PostFA97 \frac{D}{P_c} \right)_i + \varepsilon_i \, . \tag{12}$$

Support for our tax hypothesis of a significant decline in drop-off ratios would require the rejection of the null H_0: $(\beta_{FA}) = 0$ in favour of the alternative H_A: $(\beta_{FA}) < 0$. To control for frictions in ex-day returns, we also test whether the intercept was significantly different from zero in one or both tax periods.

Tests for tax clientele effects relate drop-off ratios to dividend yield. There are various ways to measure the dividend yield and hence various ways to categorise stocks into clientele groups. One approach that has been used in a number of papers (for example, Lakonishok and Vermaelen (1983) and Lasfer (1995)) is to compute the instantaneous dividend yield (D/P_c). This approach will, therefore, classify according to dividend events and is likely to result in different dividend payments by the same company being classified into different groups.[17] An alternative approach is to use a smoothed measure of the dividend yield for each company by averaging the total dividend payments over a year. Such a measure could either be historical or prospective (using dividend forecasts). In principle, the latter is to be preferred, as clienteles should be based upon anticipated dividend yields.

Measuring the (smoothed) dividend yield of the company paying the dividend, rather than the instantaneous yield of a particular dividend event, is, we would argue, more in line with the spirit of the tax-clientele hypothesis, and is also more realistic given the far higher transaction costs that would be incurred in continuously changing portfolio composition in response to particular dividend events. We therefore focus our analysis on a smoothed measure of the dividend yield.

For each period, we categorize ex-day observations into five equally-sized clientele groups on the basis of the annualised dividend yield (forecast) for the stock at the time of the dividend payment, derived from Datastream. This allows us to test for clientele effects by comparing estimated drop-off ratios for each yield quintile before and after 2 July 1997. Using our regression approach (10), we first test whether drop-off ratios were increasing in dividend yield by comparing the slope coefficients (β) across different yield quintiles. We also use this framework to test whether clientele effects were less prominent following FA97. Using (12), we then test whether higher-yielding quintiles experienced a sharper drop in response to FA97.

C. Clustering

A final methodological issue that has to be addressed when dividend data is used is the clustering of dividend events on particular days. This is certainly a major feature of our sample: the 8,837 ex-day observations occurred on only 274 different calendar dates with the majority of payments being made on Mondays. This raises the possibility that the innovations might be correlated and OLS standard errors would then be biased. However, there is no reason to suspect the error terms to be correlated when the corresponding ex-days occur on different dates. Neither are there reasons to suspect that the dividend yield (D/P_c) is correlated with the error term. For estimation purposes, we first ignore the possibility of contemporaneous correlation due to multiple observations on the same ex-dividend day. Following Boyd and Jagannathan (1994) and Green and Rydqvist (1999), we then check for the robustness of our results by forming portfolios across all stocks going ex-dividend on the same calendar date.

III. Empirical results

We start by considering the evidence regarding the first hypothesis: that pension funds were the effective marginal UK investor group, and that dividend taxation affected their valuation of dividends. In Panel B of Table IV we present evidence on the average drop-off ratios and ex-day returns for our two samples. Before the 1997 reform the mean unadjusted DOR was 0.84 for the whole sample and 0.89 in the sample of the 250 largest companies. Market-adjusting results in a slight increase in these mean DORs (to 0.87 and 0.95 respectively), and in each case the median DOR lies somewhat above the mean DOR. As noted in section I, the expected DORs prior to the 1997 reform were in the range 0.75 to 1.49 depending on who was the marginal investor and on the effective capital gains tax rate. Hence our results are consistent with this theoretical range, although are, on average, somewhat lower than might be expected if UK pension funds were the marginal shareholder group for *all* companies. However, given the tax incentives that existed before FA97, pension funds had a strong preference for high-yielding companies, and so we would expect their effect on price formation of low-yielding shares to be relatively limited. We investigate the impact of possible dividend yield clientele effects in detail below.

After the 1997 reforms we observe falls in the average DORs. All median DORs are significantly lower after FA97 than before. The observed impact is greatest in the case of the large company sample, where the median DOR falls by around 0.12, and the number of companies with DORs above unity falls by five or six percentage points. The mean DORs are also lower, although the differences are not generally statistically significant. This greater impact in the large company sample is likely to be explained in part by pension funds' preference for taking a stake in large and liquid stocks. Panel B also reports the returns on the ex-dividend day, and in all cases there is a significant increase in the observed returns after FA97.

As noted in the previous section, the use of average DORs raises concerns regarding the reliability of statistical inference (given the non-normality and heteroskedasticity of the errors). Hence, in Panel A of Table V we report regression estimates of drop-off ratios (that weight the observations by dividend yield) and consistent estimates of standard errors. The results are based on market-adjusted ex-day prices. The findings based on unadjusted prices were similar and are not reported here. Before FA97, the estimated DORs averaged 0.89 for the whole sample and 1.03 for the largest 250 companies. After FA97, the estimated DORs fall to 0.78 for the whole sample and 0.82 for the large company sample. The falls are statistically significant. To control for possible non-tax frictions in ex-day price movements, as in Boyd and Jagannathan (1994) and Frank and Jagannathan (1998), we also report the results of regressions that allow for a free intercept. However, in both samples the intercepts are economically and statistically insignificant suggesting that any micro-structure effects are likely to be small.

As mentioned in section II.C, there is heavy clustering of dividend payments onto particular days of the week (especially Mondays), which introduces the possibility that the innovations in our models are correlated. In order to investigate this issue we repeat the analysis reported in Panel A but instead of treating each dividend event as a separate observation we construct a portfolio for each day upon which a dividend event occurs. The number of dividend events within these portfolios varies between 1 and 77. We then calculate the weighted average price drop and weighted average yield for each portfolio (where the portfolio weights are determined by the yield) and perform a weighted least squares regression, where the weights reflect the number of dividend events in each portfolio. The results are presented in Panel B. It seems that event clustering does not affect the estimates unduly. As before, we estimate declines in the slope coefficients after FA97 that are significant in both samples. The intercepts are significantly negative but small in absolute terms. In the largest 250 sample, inclusion of the intercept results in slope coefficients that are not significantly different from the predicted values if pension funds are the marginal investors: 1.16 before FA97 and 0.94 after the reform. However, it hardly affects the magnitude and significance of the decline in drop-off ratios in response to the reform. In the zero-intercept regression, we estimate a decline of about 21%. This is only slightly larger than the 19% decline estimated in the free-intercept regression. These nearly match the predicted 20% decline in the valuation of dividends if pension funds are the marginal investor class.

There is, therefore, strong initial evidence in favour of the hypothesis that pension funds are the marginal investor class, and that taxation affects the valuation of dividends. However, as noted above, given the tax treatment of dividends and capital gains for pension funds, we would expect such investors to have a strong preference, *ceteris paribus*, for high-yielding companies before FA97. The measures reported in Table V take sample averages, and do not allow for these possible clientele effects. If different yields attract different clienteles, we expect the relation between ex-day percentage price drop and yield to be non-linear.

Hence, in Table VI we repeat the analysis reported in Table V, but split each sample into yield quintiles.[18] Note, as discussed above, that we measure the dividend yield of each dividend event by the *annualised* dividend yield for that company.[19] We only report the results of the regressions in which same-day dividend events of companies in the same yield quintile are grouped into portfolios. The results based on individual ex-day events were very similar.

Considering first the results for the whole sample of companies in Panel A, although the slopes are not monotonically increasing according to yield quintile, there is nonetheless evidence that higher-yielding companies had higher DORs before FA97, and that the fall in DORs has been greatest for higher-yielding companies. The intercept turns out to be significant in three of the quintile-specific regressions. This would suggest that non-tax frictions were important for some stocks in the whole sample and that ex-day prices changed quite independently of the dividend amount. However, in contrast to the predictions in the literature, two of the intercepts are positive rather than negative.[20] The negative intercept is observed for the top-yielding quintile, but its inclusion does not affect our conclusions. Indeed, the intercept reinforces our findings of a particularly strong FA97 effect in quintile 5, where again we find that we cannot reject the null hypothesis that the pre-FA97 slope is 1.25 and the post-FA97 slope is 1. In the zero-intercept regression, we estimate a decline in the DOR of 13% which is lower than the 18% decline estimated in the free-intercept regression. We also allowed the intercepts to vary between the two tax periods but found no significant changes in the results.

Intercepts are generally insignificant in the quintile-specific regressions for the largest 250 sample (Panel B), but otherwise the results are qualitatively similar.[21] In the zero-intercept regressions, the slope coefficients are monotonically increasing before FA97 and well exceed one in the highest-yielding quintile. Moreover, the decline in DORs after FA97 has been greatest for companies with the highest yields. The average DOR was 1.1 before FA97 and declined to 0.8 after FA97. This corresponds to a decline of 28%, with a standard error of about 6%. When including the (insignificant) intercept, we estimate the decline in the slope coefficients to be slightly lower at 26%. Recall that the expected fall in the DOR after July 1997, if pension funds are the marginal investor class, is 20%.

We also tested for a change in the valuation of dividends in response to the FA97 reforms that took effect as of April 1999. We included (in equations 10 and 12) a new interactive term obtained by pre-multiplying the dividend yield with a one/zero indicator for whether or not the event occurred after 6 April 1999. The coefficient on the interactive term turned out to be insignificant in all regressions, and its inclusion did not change any of the other coefficients. This suggests that dividends paid in the 9 months after 6 April 1999 were not differently valued from those paid in the 21 months since the day FA97 was passed. It also implies that non-resident investors, charitable bodies, or individuals investing through tax-privileged savings accounts had, in contrast to pension funds, no noticeable impact on the ex-day pricing of UK equities.

To summarize the results, there is strong evidence of clientele effects in the UK. We find drop-off ratios that are consistent with theoretical predictions and which increase, on average, with the observed dividend yield before FA97. We have also found reductions in DORs after FA97, with the greatest, and most significant, reductions being observed for those high-yielding companies likely (given the tax discrimination in favour of dividends) to have been particularly attractive to pension funds. These results suggest that pension funds were, for some companies, the effective marginal investor class, and that taxation significantly affects the valuation of dividend income.

IV. Conclusions

Major changes to the tax system are relatively rare and offer an excellent opportunity to test important hypotheses. The changes introduced in the UK system of dividend taxation in July 1997 were both wide-ranging and focused, initially at least, on the largest single shareholder group in the UK, namely pension funds. We have used an analysis of the valuation of dividends to investigate (i) the importance of pension funds in setting prices (as the "marginal" investor), (ii) clientele effects more generally, and (iii) the impact of taxation on the valuation of dividend income. The UK is a particularly good market to conduct such an analysis as problems associated with short-term trading, which potentially undermine research that considers returns around the ex-day, have been found to be minimal.

Before the FA97 reforms, the UK tax system was relatively unusual in discriminating in *favour* of dividend distributions compared with retention of profit within the company. Before FA97 we find share price movements around the ex-day that are consistent with the range of estimates (depending on the effective marginal investor) implied by theory. In particular we observe average DORs in the range 0.84 to 1.16 depending on the sample and measurement method. We also find strong clientele effects, with DORs being positively related to dividend yields. This finding is consistent with effective rates of capital gains tax being considerably below statutory rates for many investors, and also with pension funds being the effective marginal investors for high-yielding companies.

We test this latter hypothesis by considering the impact of FA97 on the valuation of dividend income. As the immediate impact of the tax reform fell almost entirely on pension funds, we analyse the behaviour of ex-day prices before and after the reform. We find significant changes in DORs, especially for high-yielding companies. Given the strong preference of pension funds for dividend income, prior to FA97, this provides strong evidence that pension funds were the effective marginal investors for high-yielding companies, and that taxation influences the valuation of companies. The reduction in DORs that we observe is also consistent with the range implied by theory. FA97 reduced the valuation of dividend income of pension funds by 20%; for the companies in the top quintile, as measured by dividend yield, we find reductions in the average DORs of 13% to 28% depending on company size.

We turn finally to possible implications of these findings. The changes introduced in FA97 should result in significant changes in pension funds' asset allocation. In particular, the removal of tax credits on dividend payments should, *ceteris paribus*, reduce the attractiveness of high-yielding companies relative to lower-yielding companies. The impact of such a reallocation should be observed in the relative valuation of high-yielding versus low-yielding companies. The impact of FA97 should also show in the dividend decisions of firms. Most theories of dividend behaviour predict that the removal of tax discrimination in favour of dividend distributions should reduce dividend payout ratios. Also, the main justification offered by the government for the policy change was that, by reducing pressure for high dividend payouts, financial constraints that might limit investment in some companies would be relaxed. The impact of FA97 on dividend policy, capital structure and on investment, is clearly an interesting area for future research.

Table IV: Descriptive statistics

Panel A provides sample descriptives of the dividend paid in pence (D), the cum-dividend price in pence (P_c), the instantaneous yield in percent (D/P_c), the annualised yield in percent (D^Y), market value on the ex-day measured in £ million (MV), and beta used for market adjustment (β). "Obs Pre/Post" shows the number of ex-days before and after FA97. In panel B we report for each period mean and median drop-off ratios (DOR) and rates of return (R) on the ex-day. Use of market-adjusted ex-day prices is denoted by an asterisk. "N>1 (< 0)" measures the percentage of observations for which DOR (R) is greater than 1 (less than 0). We test the significance of the fall in DORs (rise in returns) and employ a one-sided t-test for the difference in means (we report the standard error) and the Mann-Whitney rank-sum test for the difference in medians (we report the z-statistic). ** (*) denotes significance at 5% (10%).

Panel A: Sample Descriptives: Dividend, price, yield, market value and beta

	Obs Pre/Post		D	P_c	D/P_c	D^Y	MV	β
Whole Sample	4,541/4,296	Mean	8.26	493	1.85	4.44	1016	0.76
		(St.dev.)	(245.16)	(12486)	(1.33)	(2.57)	(4534)	(0.51)
		Median	3.00	201	1.57	4.03	94	0.74
Largest 250	1,210/1,138	Mean	7.23	522	1.55	3.85	3590	1.01
		(St.dev.)	(6.32)	(405)	(1.02)	(1.99)	(8268)	(0.38)
		Median	5.50	432	1.36	3.61	1143	1.01

Panel B: Descriptive Statistics: Unadjusted and market-adjusted drop-off ratios and ex-day returns

		Pre-FA97			Post-FA97			Difference	
		Mean (s.e.)	Median	N>1(<0)	Mean (s.e.)	Median	N>1(<0)	Mean (s.e.)	Median (z-stat)
Whole sample	DOR	0.841	0.941	42%	0.732	0.833	36%	-0.108*	-0.108**
		(0.03)			(0.05)			(0.06)	(-7.51)
	DOR*	0.865	0.967	47%	0.866	0.898	44%	-0.001	-0.069**
		(0.03)			(0.06)			(0.06)	(-3.25)
	R	0.269	0.087	42%	0.539	0.282	36%	0.270**	0.195**
		(0.03)			(0.04)			(0.05)	(8.91)
	R*	0.237	0.053	47%	0.401	0.203	44%	0.164**	0.15**
		(0.03)			(0.04)			(0.05)	(4.85)
Largest 250	DOR	0.885	0.955	45%	0.684	0.83	39%	-0.201	-0.125**
		(0.03)			(0.15)			(0.15)	(-4.23)
	DOR*	0.948	1.026	52%	0.906	0.915	47%	-0.042	-0.111**
		(0.03)			(0.16)			(0.16)	(-2.14)
	R	0.105	0.061	45%	0.419	0.254	39%	0.314**	0.193**
		(0.04)			(0.06)			(0.07)	(4.87)
	R*	0.028	-0.048	52%	0.24	0.114	47%	0.212**	0.162**
		(0.03)			(0.06)			(0.07)	(3.13)

Table V: Regression estimates of drop-off ratios

In panels A and B we estimate drop-off ratios as the slope coefficients in the regression $(P_c - P_e)/P_c = \alpha + \beta_{Pre\text{-}FA}\ (PreFA97*D/P_c) + \beta_{Post\text{-}FA}\ (PostFA97*D/P_c) + \varepsilon$. PreFA97 (PostFA97) is a 0/1 indicator for whether or not the observation falls into the pre-FA97 (post-FA97) period, such that $\beta_{Pre\text{-}FA}$ ($\beta_{Post\text{-}FA}$) measures the drop-off ratio before (after) FA97. "Diff." measures the difference in the slope coefficients between the two periods and is estimated using equation 12. The first model restricts the intercept α to zero, the second allows a free intercept. Ex-day prices are market-adjusted. In panel A we treat each ex-day event as an individual observation. The regression is OLS. In panel B we group same-day events into portfolios. Portfolio weights are positively related to the dividend yield. For each portfolio we calculate weighted average price drop $(P_c - P_e)/P_c$ and weighted average dividend yield (D/P_c). The regression is a weighted least squares regression with the weights given by the number of ex-day events per portfolio. The number of observations per sample and period is shown in "Obs Pre/Post". ** (*) denotes a 5% (10%) significant reform effect. Robust standard errors are reported in brackets. R^2 values are only reported for those regressions that include an intercept.

Panel A: Individual observations

	Whole Sample						Largest 250 Companies					
	Obs Pre/Post	α	$\beta_{Pre\text{-}FA}$	$\beta_{Post\text{-}FA}$	R^2	Diff.	Obs Pre/Post	α	$\beta_{Pre\text{-}FA}$	$\beta_{Post\text{-}FA}$	R^2	Diff.
No intercept	4,541/4,296	-	0.890	0.784	-	-0.106**	1,210/1,138	-	1.028	0824	-	-0.204**
			(0.018)	(0.023)		(0.029)			(0.027)	(0.032)		(0.041)
Intercept		-0.000	0.905	0.795	0.17	-0.109**		-0.001	1.069	0.867	0.28	-0.202**
		(0.001)	(0.033)	(0.035)		(0.042)		(0.001)	(0.046)	(0.046)		(0.040)

Panel B: Same-day dividend portfolios

	Whole Sample						Largest 250 Companies					
	Obs Pre/Post	α	$\beta_{Pre\text{-}FA}$	$\beta_{Post\text{-}FA}$	R^2	Diff.	Obs Pre/Post	α	$\beta_{Pre\text{-}FA}$	$\beta_{Post\text{-}FA}$	R^2	Diff.
No intercept	140/134	-	0.910	0.806	-	-0.104**	134/129	-	1.042	0.818	-	-0.223**
			(0.027)	(0.033)		(0.042)			(0.034)	(0.042)		(0.054)
Intercept		-0.004	1.058	0.905	0.49	-0.154**		-0.003	1.160	0.944	0.64	-0.215**
		(0.001)	(0.064)	(0.048)		(0.042)		(0.001)	(0.052)	(0.062)		(0.047)

Table VI: Clientele effects – regression estimates of drop-off ratios by yield quintiles

In panels A and B we estimate drop-off ratios as the slope coefficients in the regression $(P_c - P_e)/P_c = \alpha + \beta_{Pre\text{-}FA}$ (PreFA97*D/P_c) + $\beta_{Post\text{-}FA}$ (PostFA97*D/P_c) + ε. PreFA97 (PostFA97) is a 0/1 indicator for whether or not the observation falls into the pre-FA97 (post-FA97) period, such that $\beta_{Pre\text{-}FA}$ ($\beta_{Post\text{-}FA}$) measures the drop-off ratio before (after) FA97. "Diff." measures the difference in the slope coefficients between the two periods and is estimated using equation 12. The first model restricts the intercept α to zero, the second allows a free intercept. Ex-day prices are market-adjusted. For each sample and tax period, we first group ex-day events into equally-sized yield quintiles and then split each quintile into same-day dividend portfolios. Portfolio weights are positively related to the dividend yield. For each portfolio we calculate weighted average price drop $(P_c - P_e)/P_c$ and weighted average dividend yield (D/P_c). The regression is a weighted least squares regression with the weights given by the number of ex-day events per portfolio. The number of portfolios (calendar dates) per sample and period is shown in "Obs Pre/Post". ** (*) denotes a 5% (10%) significant reform effect. Robust standard errors are reported in brackets. R^2 values are only reported for those regressions that include an intercept.

Panel A: Whole Sample

		No intercept			Intercept				
Quintile	Obs Pre/Post	$\beta_{Pre\text{-}FA}$	$\beta_{Post\text{-}FA}$	Diff.	α	$\beta_{Pre\text{-}FA}$	$\beta_{Post\text{-}FA}$	R^2	Diff.
1	134/130	0.574	0.745	0.171	0.003	0.243	0.456	0.01	0.213
		(0.104)	(0.104)	(0.147)	(0.003)	(0.286)	(0.231)		(0.158)
2	132/127	0.772	0.643	-0.129	0.010	0.077	-0.033	0.01	-0.110
		(0.068)	(0.074)	(0.101)	(0.004)	(0.275)	(0.278)		(0.099)
3	128/130	0.920	0.713	-0.207*	-0.002	0.928	0.721	0.35	-0.207**
		(0.049)	(0.096)	(0.108)	(0.003)	(0.163)	(0.212)		(0.105)
4	133/129	0.841	0.727	-0.114*	0.009	0.444	0.411	0.02	-0.033
		(0.046)	(0.046)	(0.065)	(0.004)	(0.204)	(0.146)		(0.085)
5	130/128	0.986	0.860	-0.126**	-0.006	1.138	0.952	0.75	-0.187**
		(0.035)	(0.038)	(0.051)	(0.002)	(0.070)	(0.048)		(0.049)

Panel B: Largest 250 Companies

		No intercept			Intercept				
Quintile	Obs Pre/Post	β_{PreFA}	β_{PostFA}	Diff.	α	β_{PreFA}	β_{PostFA}	R^2	Diff.
1	104/97	0.750	0.884	0.134	-0.001	0.839	0.993	0.04	0.154
		(0.071)	(0.225)	(0.236)	(0.003)	(0.353)	(0.518)		(0.262)
2	109/102	0.934	0.708	-0.227*	-0.005	1.289	1.131	0.18	-0.158
		(0.048)	(0.122)	(0.131)	(0.003)	(0.218)	(0.302)		(0.144)
3	95/102	0.939	0.846	-0.093	0.003	0.757	0.642	0.09	-0.115
		(0.063)	(0.079)	(0.101)	(0.003)	(0.185)	(0.192)		(0.099)
4	100/98	0.992	0.877	-0.115	0.002	0.920	0.801	0.15	-0.119
		(0.050)	(0.072)	(0.088)	(0.003)	(0.168)	(0.183)		(0.088)
5	102/95	1.114	0.804	-0.310**	-0.002	1.177	0.876	0.63	-0.301**
		(0.036)	(0.050)	(0.062)	(0.002)	(0.049)	(0.060)		(0.056)

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Notes

[1] Tax effects on UK equity values are also reported in Kaplanis (1986), Ang et al (1991), Chui et al (1992) and Menyah (1993).

[2] The corporate tax rate was 33% until Finance Act 1997 and then cut to 31%. ACT offset against the Mainstream Corporation Tax was subject to the overriding limit that the dividend and the ACT could not exceed current taxable profits. ACT in excess of the amount was known as "surplus ACT" which could be carried backward or forward. For more details on UK corporate taxation, see Gammie (1997).

[3] The one other change that took immediate effect was that UK companies were no longer able to offset any trading losses against investment income and claim repayment of the tax credit. In particular, for investment funds this meant that they could no longer offset their expenses against UK dividend income and obtain relief at the tax credit rate. For example, a UK equity fund with an annual management charge of 1.5% would see a drop in its income by 0.3% (i.e. 20% of 1.5%). However, this only affected companies with insufficient taxable income from non-UK-equity sources. Similarly, companies had been able to obtain immediate relief for trading losses at the 20% ACT rate, whereas relief at the full corporate tax rate would only have been obtained once the company had moved into profits. FA97 therefore removed a temporary cash flow benefit for some companies. In Tables I and III we assume that corporate shareholders have sufficient income from non-UK-equity sources.

[4] It is difficult to assess the importance of this effect in the absence of a by-country breakdown of the 24% foreign ownership share reported in Table II. Of the more than one hundred double taxation agreements concluded by the UK, about half allowed for the partial refund of the imputation credit. For example, US and Japanese residents qualified for the special provision, whereas Germans did not. Even within the European Union, the UK treaty network was not harmonised.

[5] Dividends received through ISAs qualified for the credit refund for the first 5 years of the scheme. During this period, a dividend of 100 had an ISA value of 111 under the new 10% rate of imputation credit.

[6] Except in the case of UK companies with insufficient income sources other than UK equities to offset their trading losses or expenses. See footnote 3.

[7] For example, the finding of a drop-off ratio equal to 1.25 prior to 1997 is consistent with a tax-exempt ($m = t_g = 0 \leq s = 0.20$) and a higher-rate individual ($m = t_g = 0.40 \geq s = 0.20$) marginal investor.

[8] The 1997 resolutions and those taken in the following two Budgets contained no changes to the way in which corporate capital gains were computed. Corporate taxes were cut from 33% to 31% to 30%, which marginally changed the capital gains tax burden of corporate shareholders (see Table III). UK individuals benefited from a small increase in the annual tax-exempt amount as well as from a 1998 change to the indexation of capital gains. However, these changes were marginal. In April 1999, the lower rate of income tax was cut to 10% on all incomes, which explains the change in drop-off ratios in the case of statutory-rate capital gains taxes for lower-rate individuals (Table III).

[9] 30 observations had missing price data on either ex-day or cum-day. We also compared ex-day share price changes with changes in Datastream's total return index for the stock and deleted 63 observations where the implicit dividend was negative and 370 observations where the implicit dividend deviated substantially from the actual dividend paid. Foreign income dividends were excluded as they are a separate class of dividends subject to a different tax treatment.

[10] The risk adjustment is explained in the next section. We ran the tests on unadjusted ex-day closing prices leaving in shares with insufficient observations to make the market-adjustment, which made for a larger sample but had no effect on the interpretation of the results.

[11] The sample contains 455 observations (5.1%) where the stock experienced no price change but, according to Datastream, was traded on the ex-day.

[12] An alternative approach could have been to use total ex-day returns rather than the percentage price drop as the dependent variable (e.g. Lasfer, 1995) and apply OLS to (7). However, the use of returns on the left-hand side may be inappropriate because dividends are a component of return, and also including the dividend yield on the right-hand side of the model may yield regression estimates with unpredictable behaviour. We present some summary statistics on ex-day returns but do not use them in our regressions.

[13] This is the method used in Boyd and Jagannathan (1994) and others. Michaely (1991) applies GLS regressions to (6*) with the weights being determined by the dividend yield, which produces identical results. A different approach is used in Lakonishok and Vermaelen (1983), who calculate the drop-off ratio as the average percentage price drop divided by the average dividend yield and adjust the variance by making some simplifying assumptions. Their statistic implies a portfolio investment strategy in which each stock is weighted equally. Our reported OLS estimates imply portfolios in which higher-yielding stocks receive higher weights. In this sense, our weighting approach is at the opposite extreme to the Elton and Gruber statistic, which gives a higher portfolio weight to low-dividend stocks. We tested all three approaches, but the results were qualitatively the same. This is to be expected since the variability in dividend yields, D/P_c, is relatively low.

[14] The minimum requirement was 36 months of return data. Ex-day events with insufficient data were excluded.

[15] Most other papers rely on the event study methodology of Brown and Warner (1985). Michaely (1991) estimates the market model parameters using daily returns over the period (–25, –2) and (+2, + 25) relative to the ex-day. Lasfer (1995) uses returns on days (–200, –41). However, Poterba and Summers (1984) is the one paper that also obtains beta-estimates using monthly data over a longer time period (5 years).

[16] Pooling generates unbiased standard errors if the disturbance variances across the two periods are equal. Our standard errors are heteroskedasticity-robust.

[17] For instance, some companies pay low interim dividends and a high final dividend. The instantaneous dividend yield approach would classify the interim dividend events in a lower yield category than the final dividend events.

[18] Prior to splitting the sample into yield quintiles, we interacted quintile dummy variables with yield to estimate, for each tax period separately, a continuous piecewise-linear regression with slope changes at the yield quintiles. Consistent with the clientele hypothesis, we were able to reject slope constancy across quintiles before FA97 but not thereafter.

[19] Similar, if somewhat weaker, results are obtained if the dividend yield is measured as the *instantaneous* yield obtaining for a particular dividend event.

[20] As noted above, Boyd and Jagannathan (1994) and Frank and Jagannathan (1998) show theoretically and empirically that the intercept is negative. However, positive intercepts are also reported in Green and Rydqvist (1999).

[21] The results in Panel A and B are not strictly comparable since the quintile assignment of stocks in the sample of the largest 250 companies is independent of the whole sample assignment. Carrying over the yield-grouping from the whole sample resulted in somewhat less balanced quintiles for the largest 250 sample (for example, the highest-yielding large companies are not necessarily the highest-yielding in the whole sample) but otherwise produced similar results.