Taxes and Ex–day Returns: Evidence from Germany and the U.K.

Abstract - *I analyze the tax systems and tax reforms in Germany and the U.K. and test the hypothesis that ex–day returns are related to each country's tax differential between dividends and capital gains. The results indicate that in the U.K., where this tax differential is high and short–term trading is regulated, ex–day returns are higher, and the market microstructure and short–term trading impacts are weak. In contrast, in Germany, the tax impact is mitigated by short–term trading and market microstructure effects. The results suggest that despite their dividend tax similarities, the institutional differences between the two countries lead to different determinants of ex–day returns.*

INTRODUCTION

Previous studies show that the risk–adjusted abnormal returns on the ex–dividend dates are positive and significantly related to the dividend yield. However, the interpretation of these findings is controversial (see, e.g., Allen and Michaely (2003), Elton, Gruber, and Blake (2002), and Graham (2006) for a review). The question relates to what category of investors sets ex–day prices and to whether ex–day returns are driven by non–tax–related factors. Elton and Gruber (1970) argue that ex–day share prices are set in such a way that marginal long–term investors are indifferent between buying and/or selling before and after the ex–day. As a consequence, ex–day premium should reflect the differential taxation of dividends and capital gains of these long–term investors, and the magnitude of the drop in ex–day prices relative to dividends will indicate their identity. Other studies suggest that the behavior of share prices on the ex–dividend dates may not be totally related to tax effects. For example, Kalay (1982) shows that, in a world of certainty, investors not subject to the differential taxation of dividends and capital gains, referred to as short–term traders or tax–neutral arbitrageurs, will capture dividends, but since short–term trading is costly, ex–day returns will be related to transaction costs rather than tax differential. Heath and Jarrow (1988) relax the assumption of risk neutrality and argue that since arbitrageurs are risk averse, their long and short positions cannot be unlimited, and, as a result, ex–day returns will reflect a compensation for their

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excess risk taking.[1] Bali and Hite (1998) and Frank and Jagannathan (1998) relate ex–day premium to market microstructure effects and suggest that ex–day premium can deviate from one for some stocks to reflect tick size and bid–ask bounce.

The empirical evidence is mixed. For example, Dai and Rydqvist (2007) use data from Norway where companies pay the imputation tax credit and cash dividends at different dates to find that the costly tax arbitrage is observed only in the case of cash dividend payment. Beggs and Skeels (2005) find that in Australia only the last tax reform affected ex–day returns. Moreover, while Bali and Hite (1998) argue that when stock prices are constrained to discrete multiples of 12.5 cents, ex–day prices should drop by the largest tick multiple less than the dividend, regardless of tax considerations, Graham, Michaely, and Roberts (2003), Jakob and Ma (2004) and Cloyd, Li and Weaver (2006) cast doubt on this model by showing that ex–day effects persist even after discreteness constraints were removed by the "decimalization" of U.S. stock markets in 2001.

The purpose of this paper is to contribute to this contending literature by examining the ex–day share price behavior across two countries with different tax and institutional frameworks. The analysis centers on Germany and the United Kingdom (U.K.), where the differences in ownership, trading practices, short–term trading rules and income and capital gains systems allow for a deeper exploration of the conflicting determinants of ex–day returns. First, unlike Germany, ex–day returns in the U.K., where short–term trading is not allowed, are more likely to be driven by the differential taxation of dividends and capital gains or market microstructure factors. Second, although, both countries adopted during the sample period an imputation system whereby dividends carry tax credits and are taxed at lower rates than capital gains for basic taxpayers and tax–exempt investors, their underlying systems differ significantly. These differences are highlighted by modeling the tax systems in each country and by relating the tax differential between dividends and capital gains to ex–day prices. These theoretical models suggest that in the U.K., where the tax differential between dividends and capital gains is high, ex–day returns should be high, and the reforms that affected each country's respective tax differential between dividends and capital gains altered ex–day returns. During the sample period, three major tax changes in each country are identified, and the hypothesis that tax reforms that resulted in dividends to be taxed more heavily than capital gains will lead to an increase in ex–day returns is tested. These tax reforms offer a unique controlled experiment to test for the impact of taxation on the behavior of share prices on the ex–dividend days. Finally, the impact of the market microstructure effects is tested by analyzing the bid–ask spread around the ex–dividend dates and the magnitude of dividends relative to the tick size. These hypotheses are tested using 10,085 events in the London Stock Exchange and 2,910 in the Frankfurt Borse from 1988 to 2002.

Unlike previous single–country studies, the combination of the comparative analysis of ex–day returns across the two countries and the tax reforms, together with the direct analysis of short–term trading and microstructure effects, highlighted strong differences between the two countries, despite their tax system similarities. In particular, while the results show that the average ex–day returns are positive in both countries, they indicate

[1] Koski and Michaely (2000) show that the risk can be eliminated by negotiating a purchase and a sale simultaneously, when the settlement dates are before and after the ex–dividend dates. In this case the dividend–related volume will increase significantly.

that in the U.K., where the differential taxation between dividends and capital gains is relatively high, the average ex–day returns over the sample period of 0.75 percent are statistically higher than the 0.57 percent observed in Germany. In addition, ex–day returns are affected by the tax reforms, as, in the U.K., they increased monotonically from 0.38 percent (t = 1.75) to 1.17 percent (t = 5.57) in the post–1999 period when taxes on dividend increased following the elimination of the tax credit, and in Germany, they increased from 0.15 percent to 0.74 percent. The results based on the drop–off ratio and alternative event study methodologies are similar. Overall, these results provide support for the tax hypothesis.

Further analysis shows contrasting differences between the two countries. In particular, while in the U.K., ex–day returns are not affected by short–term trading, in Germany, this activity mitigates the tax impact. For example, unlike previous U.S. evidence, (e.g., Eades, Hess and Kim (1984)), the pre– and post–ex–day abnormal returns in the U.K. are not significant and the relationship between ex–day returns and the various measures of risk and transaction cost effects documented in previous studies is weak, as, unlike Naranjo, Nimalendran, and Ryngaert (2000), the relationship between ex–day returns and dividend yield, firm size and $1/P_{cum}$, used as a measure of transaction costs, is strongly positive (not negative). These results are even stronger for high–yield stocks, which are likely to be subject to short–term trading (e.g., Naranjo et al. (2000)), implying that the ex–day returns are not subject to dividend capture and suggesting that the U.K. laws against dividend capture are effective and/or the high transaction charges involved in trading in the UK market, particularly the stamp duty, limit arbitrage transactions. In contrast, in Germany, ex–day returns are insignificant when the zero ex–day price change events (i.e., stale prices) are excluded, the pre– (post–) ex–day abnormal returns are positive (negative), the abnormal trading volume is positive (negative) for high– (low–)yield stock, and, while the ex–day returns are not related to dividend yield, they are negatively related to the abnormal volume, suggesting that, in line with McDonald (2001), ex–day returns, of particularly high yield and low transaction cost stocks, are affected by short–term trading.

Finally, while in the U.K. the market microstructure effects documented in previous studies (e.g., Bali and Hite (1998)) do not influence strongly ex–day returns, their impact in Germany is significant. In the U.K., although there is some evidence of a positive effect of the abnormal trading volume on ex–day prices, this trading did not lead to an increase in the bid–ask spread; thus, it is not fully consistent with the proposition of Frank and Jagannathan (1998) that some investors dislike dividends and buy stocks on the ex–days and inflate ex–day prices. These results are consistent with the more recent U.S. evidence (e.g., Elton, Gruber, and Blake (2002), Jakob and Ma (2004) and Graham, Michaely, and Roberts (2003)). However, in Germany, the bid–ask spread increases significantly for the highest–yield groups and particularly in the last sub–period, suggesting that short–term traders mitigate the tax effects on ex–day pricing.

The results contribute to the literature of the impact of taxation on dividends in several different ways. First, following the Graham (2006) argument that it would be helpful if there were more research that exploits the rich variation in tax codes around the world, I provide a comparative analysis of the tax systems in Germany and the U.K., and expand prior country–specific studies by modeling the impact of recent tax changes. In Germany, while the overall results are consistent with McDonald (2001), I also show, using a relatively larger sample and more recent data, that

the tax effects prevail after the 1997 period, but the results are not too strong as this impact is mitigated by the activities of short–term traders and do not apply when stock prices that did not change on the ex–day are excluded. In the U.K., a number of studies provide some mixed evidence on the impact of taxes on ex–day prices: Poterba and Summers (1984), Lasfer (1995) and Bell and Jenkinson (2002) show that the various tax reforms affected ex–day returns, while Asimakopoulos and Hodgkinson (2001) find that ex–day returns of large companies in the U.K. in 1988–97 are driven by market microstructure factors and not taxation, and Armitage, Hodgkinson, and Partington (2006) and Bond, Devereux, and Klemm (2007) show that the 1997 tax reform did not affect the ex–day drop–off. I provide further evidence of the tax effect, particularly in the post–1998 period. Moreover, I show that the tax reform impact is not limited to high dividend yield firms, suggesting that, in line with Bond et al. (2007), the results of Bell and Jenkinson (2002) that pension funds hold high–yield stock and ex–day share prices of these high–yield stocks were affected by the 1997 elimination of the tax credit is not likely to apply.

The rest of the paper is organized as follows. The next section presents the institutional framework and the hypotheses to be tested. The third section discusses the data and the methodology. The fourth section discusses the empirical results. The conclusion is in the fifth section.

INSTITUTIONAL FRAMEWORK

This section builds on previous studies (e.g., Elton and Gruber (1970), Kalay (1982), and Lasfer (1995)) and relates ex–day returns to the tax differential of dividends and capital gains in Germany and the U.K. I provide details of the two tax systems and show that investors across these two countries face relatively different tax discrimination between dividends and capital gains. I model these effects and set up the hypotheses.

Taxes and Ex–day Returns

Elton and Gruber (1970) show that in a risk–neutral world with preferential treatment of capital gains and no restrictions on short–sales, shareholders are indifferent between buying or selling shares before the ex–day at P_{cum} or after the ex–day at P_{ex} if these two days' after–tax returns are equal, i.e.,

$$[1] \quad P_{cum} - (P_{cum} - P_0)z = P_{ex} - (P_{ex} - P_0)z + D(1-m),$$

where P_0 is the original purchase price, m is the marginal tax rate on dividend income, z is the effective capital gains tax rate and D is the cash dividend received. This indifference condition can be arranged to yield ex–day return, R_{ex}, as

$$[2] \quad R_{ex} = \frac{P_{ex} + D - P_{cum}}{P_{cum}} = \left(1 - \frac{1-m}{1-z}\right)\frac{D}{P_{cum}}$$

and the ex–day premium or drop–off ratio, DOR_{ex}, as

$$[3] \quad DOR_{ex} = \frac{P_{cum} - P_{ex}}{D} = \frac{1-m}{1-z}.$$

Following Elton et al. (2002), the left–hand side of equation [2] is reduced by the expected return, r, and P_{cum} is multiplied by $(1 + r)$ in equation [3]. The term on the right–hand side of equation [3] reflects the tax differential between dividends and capital gains and will be referred to as the tax discrimination variable, TD. Under the tax hypothesis, ex–day returns are positively associated with dividend yield and the income tax rate on dividends, m, but negatively related to the capital gains tax rate, z. If m is higher than z, then the drop–off ratio will be less than one, resulting in an ex–day tax premium.

Equations [1] to [3] describe the classical system in operation in, say, the U.S. In some other countries, dividends received, d, carry a tax credit equal to $sd/(1 - s)$, where s is the imputation/tax credit rate. Thus, in equations [1] to [3], gross dividend is $D = d/(1 - s)$, which is taxed at the income tax rate m, but the tax credit can be claimed. If the imputation rate s is equal to the corporation tax rate, then a full imputation system is in operation, i.e., dividends are not taxed at the firm level as all shareholders will be able to claim the full corporation tax paid on dividends. If, on the other hand, the imputation rate is lower than the corporation tax rate, then a partial imputation system is in operation whereby only a fraction of the corporation tax on dividends is claimed. In both systems, ex–day returns are positive if the capital gains tax, z, is lower than the tax on dividends, $(m - s)/(1 - s)$.

In the U.K. a partial imputation tax system was adopted in 1973, under which dividends received by shareholders from their company are net of the tax credit. Companies pay tax credit at a rate s but deduct it from their corporation tax liability. Shareholders set it against their income tax demand, resulting in the following TD:

$$[4] \quad TD = \frac{1-m}{(1-s)(1-z)}.$$

Table 1, Panel A summarizes the main features of the system, and Table 2, Panel A illustrates the magnitude of TD for three major types of investors—high taxpayers, basic taxpayers, and tax exempt investors—and across various tax reforms summarized in the last column of Table 1. The statutory capital gains tax rate, z, is equal to the income tax rate, m, after the 1988 Income and Corporation Taxes Act. In the pre–1994 period, the imputation rate was 25 percent; TD was $1/(1 - s) = 1/(1 - 0.25) = 1.33$ if capital gains are taxed at the statutory rate. This rate became 20 percent in 1994 and lowered TD to 1.25. Since July 1997 TD is one for tax–exempt investors, as they cannot claim the tax credit, and for high taxpayers dividends are taxed at 32.5 percent, leaving TD at 1.25. Capital gains are not taxed at the statutory rate because of allowances (currently about $20,000 per year), indexation and exemption if the stock is held for more than three years, making the effective rate close to zero.[2] The respective TD for high taxpayers decreases from 0.80 to 0.75. For basic taxpayers, TD decreases from one to 0.675. Thus, ex–day premiums should be positive and increase through the three tax reforms for high taxpayers and positive for tax exempt investors, such as pension funds.

In Germany, the dividend taxation system adopted in 1977 combines features of split rate and imputation system. At firm level, profits distributed as dividends are subject to a lower corporation tax rate than retained earnings. Since the introduction of unification tax or solidarity surcharge in 1995 of 7.5 percent, the corporation tax rate increased, to reach 0.45 (1.075) = 48.375 percent in 1997.[3] Shareholders are entitled to a tax credit on dividends equal to the full amount of corporation tax. Tax–exempt shareholders, who account for a smaller holding than in the U.K., are not entitled to the tax credit and are liable to no further tax liability on dividends received, while foreign investors are not entitled to any tax credit. McDonald (2001)

[2] Data to compute the effective tax rates for each company and for each investor category are not available. However, setting this rate equal to zero is not unrealistic as Stiglitz (1983) showed that capital gains taxes can be avoided all together in a perfect capital market where transactions are costless by borrowing, hedging, accelerating losses and deferring gains. For simplicity, only three types of investors are considered. In practice, firms and financial institutions may be subject to different rates than the high–income taxpayers. Foreign investors cannot claim the tax credit.

[3] See McDonald (2001) for details.

TABLE 1
SUMMARY OF TAX SYSTEMS IN EUROPE
SUMMARY OF TAX LEGISLATION AND MAJOR TAX REFORMS IN GERMANY AND THE U.K. OVER THE PERIOD 1988–2002

Dividends	Capital Gains	Losses	Dividend Withholding Tax: Final	Dividend Withholding Tax: Not Final	Foreign Source Income	Major Taxation Reforms
			United Kingdom			
Imputation: Dividends carry a tax credit usually equal to the basic rate of income tax.	Taxed as income after indexation allowance	C/fd[1] No limit C/bk 3 years C/fd[2] No limit C/bk 2 years	There is no withholding tax in the U.K.; however companies must prepay the tax credit.		Tax credit given for withholding tax and underlying overseas taxes paid.	1994: Tax credit decreased from 25% to 20%. 1997: Abolished the right of pension funds to be repaid the imputation tax credit. 1999: Tax credit rate decreased to 10% and can be claimed only by high taxpayers and dividends are taxed at 32.5%.
			Germany			
Imputation: Retained and distributed profits taxed at different rates and dividends carry a tax credit equal to the distributed profits corporation rate.	Taxed at normal corporate tax rates. Tax may be deferred though re–investment of proceeds.	C/fd No limit C/bk 2 years	N/A	25% + surcharges	Tax credit available up to the amount of the German Taxes payable on the foreign source income. Tax treaties often provide further exemptions to investments in subsidiaries located in the European Union.	1991: Solidarity charge for 1 year of 3.75% is introduced. 1994: Corporate tax rates reduced but reintroduced solidarity charge. 1998: Solidarity charge decreased to 5.5 % and corporate tax rates reduced. Introduction of local taxes and increase of the holding period for tax–free capital gains on sales of shares and securities from six months to one year.

Source: Own research and European Parliament (1998).

[1]C/fd: Carried Forward.
[2]C/bk: Carried Back.

TABLE 2
THE TAX DISCRIMINATION VARIABLE

Periods	Dates	Higher Tax Payer		Basic Tax Payer		Tax–Exempt
		z = Standard	z = 0	z = Standard	z = 0	
		Panel A: The U.K. system				
1	6 Apr 88–31 Mar 94	1.333	0.800	1.333	1.000	1.333
2	1 Apr 94–1 Jul 97	1.250	0.750	1.250	1.000	1.250
3	2 Jul 97–5 Apr 99	1.250	0.750	1.250	1.000	1.000
4	6 Apr 99–31 Dec 02	1.250	0.750	1.000	0.675	1.000
		Panel B: German system				
1	1 Jan 88–31 Dec 90	2.273	1.000	2.273	1.770	2.273
2	1 Jan 91–31 Dec 93	2.000	0.940	2.000	1.620	2.000
3	1 Jan 94–1 Oct 98	1.818	0.891	1.818	1.473	1.818
4	1 Nov 98–31 Dec 02	1.667	0.817	1.667	1.350	1.667

Note: The tax discrimination variable is the ratio of the after–income tax on dividends over the after–tax capital gains assuming that 1 unit of retained earnings generates 1 unit of capital gains. The analysis is based on the standard rate of capital gains, z = Standard. Since this rate is likely to be lower than the effective rate, I compute TD assuming a capital gains tax rate of zero, $z = 0$.

shows that foreign investors sell before the ex–day and buy back the stock on or after the ex–day to avoid taxes on dividends. For corporations, capital gains are taxed as ordinary income. Individuals are not liable to capital gains tax if the holding exceeds six (12 after 1999) months.[4]

At the firm level retained earnings are taxed at $t_{c,re}$ and the firm's after–tax profit is equal to $(1 - t_{c,re})$. Investors' after–tax capital gains are $(1 - t_{c,re})z$, resulting in total tax burden on capital gains of $(1 - t_{c,re}) - (1 - t_{c,re})z$, which is equal to $(1 - z)(1 - t_{c,re})$. Dividends are taxed at $t_{c,d}$ and the firm's after–tax profit is $(1 - t_{c,d})$. Shareholders' income tax liability is $(1 - t_{c,d})m/(1 - t_{c,d}) = m$, making dividends escape corporation tax. Therefore, the net after–tax dividend is $(1 - m)$, resulting in the following TD:

$$[6] \quad TD = \frac{(1-m)}{(1-z)(1-t_{c,re})}.$$

Table 1, Panel B provides a summary of the tax system in Germany and Table 2, Panel B reports a numerical simulation of TD for each tax–bracket investor and tax regime. The results show that, for tax–exempt investors, TD is above one in 1988–1990 but decreases to 1.667 in 1998–2002. If capital gains are not taxed, as a result of, for example, holding the shares for more than one year, TD is equal to $[(1 - m)/(1 - t_{c,re})]$. For basic taxpayers TD decreases from 1.77 to 1.35 over these periods. If, on the other hand, capital gains are taxed as income, then TD is the inverse of the after–tax retained earnings, i.e., $1/(1 - t_{c,re})$ and decreases from 2.273 to 1.667 as the tax on retained earnings decreases from 56 percent to 40 percent. For high taxpayers, if capital gains are not taxed, TD is one in the first period and decreases monotonically to 0.82 in 1998–2002. These arguments suggest that share prices will decrease by the full amount of the dividends in 1988–1990 and become positive and increase thereafter. If capital gains are taxed, TD decreases from 2.273 to 1.667 and ex–day returns will be negative.[5]

[4] Short–term capital gains are taxed at the individuals' income tax rate.

[5] As of 2002, the German full imputation tax system is replaced by the "half–income" system whereby only half of the distributed profits of a corporation is included as part of the shareholder's taxable income. In return, it is no longer necessary to credit the corporate tax paid by the company against the shareholder's income tax. Dividends received by corporations are tax exempt. However, this change in the system has been implemented through a series of transitional provisions and firms with non–calendar year–ends follow the new rules for year–ends of 2002. This system did not affect all companies in the sample and for 2002 I select only firms with non–calendar year–ends.

These arguments motivate the following first hypothesis:

H1: Ex–day returns will be positive and significant in both countries if the long–term investor is a high taxpayer with a zero effective capital gains tax rate.

Comparative Analysis across Countries

Table 2 shows that, when capital gains are not taxed, TD is lower than one in both countries. However, the magnitude of the tax discrimination variable appears to be higher in the U.K. compared to Germany. If the marginal investors are the basic taxpayers with zero capital gains tax, ex–day returns will decrease by less than dividends in the last sub–period in the U.K, but, in Germany, ex–day returns will be negative as TD is always higher than one. I, thus, set the following second hypothesis:

H2: Ex–day returns will be higher in the U.K. compared to Germany.

Impact of Tax Reforms on Ex–day Pricing

An examination of the price behavior on ex–days is unlikely to discriminate between the tax and the alternative hypotheses because shareholders are taxed at effective rates that are likely to be lower than the statutory rates. However, since the actual effective capital gains tax and income tax rates are not known, a drop in ex–day prices in a particular period cannot be related directly to the differential taxation of dividends and capital gains. To overcome this problem, I analyze the behavior of ex–day prices that resulted from changes in the legislation that affected the tax discrimination variable but not the trading system.[6] The last column of Table 1 summarizes the three major tax reforms in each country and in Table 2 the potential impact of such reforms on ex–day prices through changes in the tax discrimination variable is computed. These various tax reforms are expected to have significant impact on ex–day pricing in both countries. The analysis of these tax reforms results in the following third hypothesis:

H3: Ex–day returns will not be homogeneously distributed across the tax regimes.

DATA AND METHODOLOGY

Data on dividend distributions, ex–dividend dates, share prices and market index to cover the sample period 1988–2002 are drawn from *Datastream*, an online database. I also use *Perfect Information*, another online database, to collect the amounts of annual, semi–annual or quarterly dividends as Datastream only provides annual dividend per share. To avoid potential confounding effects of other announcements, firms are excluded if they have any specific announcement such as earnings, stock splits or rights issues within a period of five days on either side of their own ex–day. Firms with missing dividends and/or share prices over the event period and those with less than 20 share–price observations over the estimation period are also excluded. The final sample contains 10,084 observations for the U.K. and 2,909 for Germany.

[6] Similar approach was adopted in some previous studies. For example, Michaely (1991) analyzes the impact of the 1986 Tax Reform Act, Poterba and Summers (1984), Lasfer (1995) and Bell and Jenkinson (2002) investigate the effects of major changes in the British tax system and the introduction of the legislation against dividend capture, Graham et al. (2003) analyze ex–day stock returns before and after the conversion of prices to different decimals and the 1997 cut in capital gains tax rates, and Dhaliwal and Li (2003) explore ex–day trading volume across various U.S. tax reforms.

The standard event study methodology (Brown and Warner, 1985) is used to test the above hypotheses where the event is the ex–dividend date. I use the market model to compute the abnormal returns over the event window [–40, +40] relative to the ex–day. The market model coefficients are obtained from the regression of the security returns against the corresponding market index in each country over the period [–290, –41] trading days relative to the ex–dividend date. The respective market indices, *CDAX* in Germany and *Financial Times All Shares Index* in the U.K., combine small as well as large firms in each country. A minimum of 40 non–missing observations is required for the market model. The results are checked for robustness by using the Dimson (1979) and Scholes and Williams (1977) specifications to account for non–synchronimous trading, the adjusted market model (beta = 1), and, to overcome any potential problems that might arise from the market model and the event study methodology, I use the mean adjusted returns, the drop–off ratio and the raw returns. Finally, I test for the equality of the abnormal returns across tax periods by defining the χ^2–statistics as:

$$\chi^2(4) = \sum_{TP=1}^{4} \left[\frac{\overline{AR_{TP}} - \overline{AR}}{S_{TP}} \right],$$

where $\overline{AR_{TP}}$ is the mean ex–day abnormal returns for tax period TP, $\overline{AR}$ is the mean abnormal returns for the whole sample and S_{TP} is the standard error or the mean abnormal returns in tax period TP.

EMPIRICAL RESULTS

Ex–day Returns across Countries

Table 3, Panel A reports the abnormal returns based on the market model. On day zero the abnormal returns are all positive and significant, suggesting that, in both countries, ex–day prices decrease by less than the amount of the dividend and that, based on the analysis in the *Institutional Framework* section above, these results suggest that ex–day returns are set by high–tax–paying investors with zero capital gains tax. As expected, ex–day returns are higher in the U.K. (0.75 percent, $t = 3.56$) compared to Germany (0.57 percent, $t = 2.57$). The respective medians (not reported) are 0.70 percent and 0.68 percent. The differences in means and medians are significant (Panel B). Similar results are obtained using alternative methodologies (Panel C). For example, the average (median) drop–off ratio in the U.K. of 0.701 (0.639) suggests that, on average, ex–day share prices decrease by 70 percent of the dividend amount. Similarly, in Germany, the mean (median) drop–off ratio is 0.795 (0.739). These means and medians are all statistically different from one and across the two countries, and provide an early indication that the differential taxation between dividends and capital gains affects ex–day returns and that in the U.K., where dividends are taxed at higher rates than capital gains, ex–day returns are high.

The levels of the drop–off ratios could be driven by companies for which prices on the ex–dividend day did not change from the previous day. McDonald (2001) argues that these cases will lead to stale prices because of non–trading. This possibility could also be related to the impact of microstructure effects, namely the case where the tick size is equal to the amount of the dividend. Unfortunately, data on the tick size is not available. Instead, I check indirectly for this possibility by computing the drop–off ratios of companies with non–zero change in ex–day price, $DOR_{Pcum \neq Pex}$. The results reported in the last row of Panel C show that for the U.K., if I exclude 17 percent of such cases, the average (median) drop–off ratio increases to 0.909 (0.81). Although the drop–off ratio increased substantially, both the mean and median values are

TABLE 3
PRICE BEHAVIOR AROUND THE EX–DIVIDEND DATES IN THE U.K. AND GERMANY

	United Kingdom		Germany	
Days	%	t–stat	%	t–stat
Panel A: Abnormal returns around ex–dividend dates using market model				
–20, –6	0.231	0.421	0.894	1.330
–5	0.102	0.488	0.085	0.386
–4	0.001	0.005	0.116	0.527
–3	–0.015	–0.073	0.045	0.205
–2	0.050	0.239	0.095	0.432
–1	0.026	0.123	0.074	0.337
0	0.749***	3.563	0.566***	2.572
1	–0.063	–0.302	–0.289	–1.316
2	–0.007	–0.032	–0.351	–1.594
3	–0.006	–0.028	–0.094	–0.428
4	0.036	0.172	–0.160	–0.725
5	–0.031	–0.145	–0.015	–0.069
+6, +20	–0.473	–0.579	–0.888	–1.027
Panel B: t–statistics of differences in means Abnormal returns using market model across the two countries				
U.K.			2.27***	
Panel C: Ex–day abnormal returns and drop–off ratios (DOR) using alternative models				
RAW	0.798***	3.795	0.555***	2.523
ARB1	0.823***	3.915	0.558***	2.538
MAR	0.753***	3.585	0.552***	2.511
AR SCHOLLS	0.704***	3.353	0.522***	2.376
AR DIMSON	0.685***	3.261	0.524***	2.383
DOR	0.701***	–4.980	0.795***	–4.92
$DOR_{PCUM \neq PEX}$	0.909*	–1.74	0.978	–0.250

Note: In Panel A, the Average Abnormal Returns (ARs) are calculated using the Market Model over an event window from day –40 to day +40, with the ex–dividend day being day 0. Market Model coefficients are calculated by regressing the security returns against the main index of the country, such as the Financial Times All Share Index in the U.K., using –290 to –41 trading days relative to the ex–day. In Panel B, I test for robustness by calculating the abnormal returns using alternative event studies methodologies. *RAW* is the raw returns, *ARB1* is the Market Adjusted Returns with Beta equal to 1, *MAR* is the Mean Adjusted Returns, *AR SCHOLLS* is the Scholls and Williams method, *AR DIMSON* is the Dimson method, *DOR* is the drop–off ratio. $DOR_{PCUM \neq PEX}$ exclude zero ex–day price change. t–Stat is for the t–statistics. For the drop–off ratio, the null hypothesis is equal to one. ***, **, * Significant at 0.01, 0.05 and 0.1 levels, respectively.

statistically lower than one, suggesting that the zero ex–day price change is not likely to affect the results. In contrast, for Germany, the incidence of zero ex–day price changes amounts to 29 percent of the total number of observations and the drop–off ratio excluding these cases increases to 0.978 (t = –0.25) and the median is 1.00 (p = 0.144), suggesting that ex–day prices decrease by the full amount of the dividend. Therefore, unlike in the U.K., in Germany the impact of taxation on ex–day prices is not too strong.[7]

Impact of Major Tax Changes on Ex–day Returns

Table 6 reports the distribution of the abnormal returns by tax regimes. In the U.K., as shown in Table 2, ex–day returns are expected to increase through time as the tax credit was cut from 25 percent to 20 percent in 1994, then eliminated to pension funds in July 1997, and reduced to ten percent for tax–paying investors in 1999. Consistent with this trend, the mean ex–day abnormal returns increased monotonically from 0.37 percent in the

[7] I also compute ex–day returns excluding cases where ex–day prices did not change. I find ex–day returns of 0.658 (t = 3.13) in the U.K., and 0.266 (t = 1.21) in Germany.

first period (1988 to March 1994), to 0.70 percent in the second period (April 1994 to July 1997), and to 0.95 percent and 1.17 percent in the last two sub–periods. Similarly, the median abnormal returns are negative in the first period and they increase monotonically to 0.91 percent in the last period. The third column reports the distribution of the drop–off ratio. Unlike Bond et al. (2007), throughout the sample period, the average drop–off ratio decreased from 0.84 in the first period to 0.64 in the post–1999 period. In Panel B, I report the p–values of the differences in means and medians between the first and last tax regime and the χ^2–statistics to test for the equality of the abnormal returns across the tax regimes. Both these statistics indicate that ex–day returns as well as the drop–off ratio have shifted significantly in the U.K. It is interesting to note that some tax reforms, such as the 1997 abolition of the tax credit for tax exempt investors, did not alter significantly ex–day returns. Table 4 shows that, between the tax periods 2 and 3, ex–day returns in the U.K. increased from 0.702 percent to 0.849 percent, but the difference in means is not statistically significant (p = 0.10). In the other regimes, the difference is significant, suggesting that ex–day prices respond only to major tax reforms.

The next three columns of Table 4 report the results for Germany. The analysis of Table 2 above indicates that in the pre–1990 period, ex–day returns should be insignificant, and they should increase through time as dividends become taxed at a higher rate than capital gains. The results, reported in Table 4, are consistent with these predictions. The ex–day abnormal returns are not significant in the first period, but increase monotonically in the last sub–period. The distribution of the drop–off ratios confirms that share prices decrease by the full amount of the dividend in the first period but by less than the amount of dividend thereafter.

TABLE 4
EX–DIVIDEND DAY ARs AND DOR BEFORE AND AFTER MAJOR TAXATION REFORMS IN THE U.K. AND GERMANY

	United Kingdom			Germany		
Taxation Periods	Mean ARs	Median ARs	DOR	Mean ARs	Median ARs	DOR
Panel A: Abnormal Returns (ARs) and Drop–Off Ratio (DOR)						
1	0.367	–0.22	0.841	0.154	0.08	1.32
	(0.09)	(0.00)	(0.00)	(0.70)	(0.09)	(0.15)
2	0.702	0.48	0.814	0.539	0.59	0.73
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)
3	0.849	0.66	0.710	0.551	0.84	0.675
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
4	1.169	0.91	0.640	0.740	0.86	0.491
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Panel B: T–Statistics and Mann Whitney P–Values of Differences in Means and Medians						
P1–P4	0.000	0.000	0.017	0.001	0.000	0.002
$\chi^2(4)$	39.38		8.07	13.26		10.16

Note: The abnormal returns are based on the Market Model with the coefficients calculated by regressing the security returns against the main index of in each country using –290 to –41 trading days relative to the ex–day. The drop–off ratio (DOR) is the ratio of price cum–dividend less price on the ex–dividend date adjusted for expected returns over dividends. Taxation periods reflect the periods before and after major taxation changes; In the U.K., Period 1: April 1988 to March 1994 (N= 3,540), Period 2: 1 April 1994 to 6 July 1997 (N= 2,321), Period 3: 7 July 1997 to 5 April 1999 (N = 1,448), and Period 4: 6 April 1999 to August 2002 (N = 2,776); In Germany, Period 1: January 1988 to December 1990 (N = 351), Period 2: January 1991 to December 1993 (N = 592), Period 3: January 1994 to October 1998 (N = 964), and Period 4: November 1998 to August 2002 (N = 1,002). p–values are in the parenthesis. For the median I report the p–value of the sign test and the Mann–Whitney for differences in medians.

Panel B indicates that the differences in means of abnormal returns and drop–off ratios between the first and the last tax periods are statistically significant. The significant χ^2–statistics suggest that the abnormal returns and drop–off ratios across the four tax periods are not equal. The results suggest that tax reforms in Germany have, on average, increased ex–day returns. However, when stale prices are excluded, ex–day returns across tax reforms are insignificant.[8]

Is Taxation the Sole Determinant of Ex–day Returns?

I investigate below the extent to which ex–day returns are affected by short–term trading and market micro–structure effects.

Do Short–Term Traders Capture Dividends?

Kalay (1982) argues that, when ex–day returns include the tax premium, investors taxed at the same rate on dividends and capital gains will capture the dividend, making ex–day prices fall by nearly the full amount of the dividend. While this activity is widely documented in the U.S. (e.g., Dhaliwal and Li, 2006), in the U.K., it is subject to institutional regulation and could incur tax penalties, which depend on the identity and motives of the trader.[9] In contrast, in Germany, dividend stripping is not restricted. Corporate and individual non–resident investors can transfer their shares to German residents who are entitled to the dividend and tax credits. The potential benefits on dividend capture, given the above positive ex–day returns, warrant a test of the short–term trading hypothesis in both countries.

I use various methodologies to test this potential effect. First, Table 3, Panel A indicates that, unlike the U.S. evidence, none of the pre– and post–ex–day abnormal returns is statistically significant in the U.K.[10] In contrast, in Germany, ex–day returns are positive (negative) and significant in the pre–event (post–event) periods. These results provide further evidence that ex–day returns in Germany may be affected by short–term trading. Second, I test the hypothesis that short–term traders are likely to target high–yield stocks, and as a result the ex–day abnormal returns of these stocks will be lower than those of low–yield stocks. I find, but do not report, that with the exception of Germany, ex–day returns of high–yield stocks in the U.K. are substantially higher than those of low–yield stocks. I also test the hypothesis that ex–day returns of firms with high yield and low transaction costs, as measured by bid–ask spread,[11] should be lower than other stocks and reflect the level of transaction costs (Kalay, 1982). The results show that in the U.K. high–yield, low–bid–ask spread stocks generate higher returns than other stocks.

[8] The full results are not reported for space considerations.

[9] If an individual investor sells shares before the ex–day and repurchases them later to reduce his tax liability by more than ten percent, then the U.K. tax authority can void the tax savings from these transactions. On the other hand, a tax–exempt investor who buys a share before its ex–dividend date and sells it just after will become liable to tax. Thus, despite their tax–exempt status, they will not be able to claim all the tax credit, $ds/(1-s)$, on dividend received, d, but only $n/30$ of that tax, where s is the rate of tax credit and n is the number of days for which the share is held. Security dealers or corporate investors who trade in a security around its ex–day and hold the share for less than a month, will not be able to deduct the full capital loss from their taxable income. A fraction of this loss, varying inversely with the holding period, is disallowed for tax purposes. In practice, market–makers can trade around ex–dates without paying tax because they can net off their long and short positions and dividends received are set against those paid.

[10] Eades et al. (1984), find abnormal returns of 0.188 (t = 15.64) on day –1, 0.142 (t = 11.74) on day 0 and –0.053 (t = –4.35) on day +1, relative to the ex–dividend dates.

[11] If trading activity increases around the ex–day, posted bid and ask prices may not reflect the effective transaction costs. However, effective prices are not available.

Finally, I analyze the behavior of the abnormal trading volume (AV_{it}) around the ex–dividend dates. Michaely and Vila (1996) argue that investors with different preferences for dividends or capital gains will trade with each other around the ex–dividend dates, leading to an increase in the trading volume around the ex–dividend dates, particularly for high–yield stocks. I obtain from DataStream the trading volume (V_i) from day –80 to day +5 and compute the abnormal volume as the difference between the trading volume over the event period –5 to +5 relative to the ex–dividend date and the mean volume over the estimation period. The data availability has reduced the sample to 5,630 in the U.K. and to 829 in Germany.

Table 5 Panel A shows that, consistent with the U.S. evidence (e.g., Dhaliwal and Li, 2006), in the U.K., the abnormal trading volume is positive and significant in each event period [–5 to +3], but the magnitude of the abnormal volume of 8.9 percent is about half the 20 percent found in the U.S. In Panel B, I test whether the high payoff stocks as proxied by dividend yield are subject to more trading volume than the low–yield stocks. The results indicate that the difference in abnormal trading volume between the two samples is not significant (p = 0.189) while the χ^2 indicates that

TABLE 5
DISTRIBUTION OF EVENT PERIOD ABNORMAL VOLUME IN THE U.K. AND GERMANY

	U.K.		Germany	
	Mean	p–value	Mean	p–value
Panel A: Abnormal Volume				
–5	0.156***	0.000	–0.163***	0.004
–4	0.381***	0.000	–0.083	0.226
–3	0.332***	0.000	0.021	0.710
–2	0.247***	0.000	0.061	0.230
–1	0.188***	0.000	0.367***	0.000
0	0.089***	0.003	0.044	0.424
1	0.146***	0.000	–0.062	0.219
2	0.199***	0.000	–0.181***	0.000
3	0.099***	0.002	–0.152***	0.001
4	–0.005	0.866	–0.208***	0.000
5	–0.057*	0.052	–0.154***	0.010
Panel B: Ex–day Abnormal Volume by dividend yield quintiles				
Low	0.163**	0.020	–0.074	0.609
2	0.158**	0.040	–0.355***	0.000
3	0.100	0.100	–0.245***	0.007
4	0.274***	0.000	0.123	0.334
High	0.314***	0.000	0.507***	0.000
t low–high	–1.320	0.189	–3.030***	0.003
$\chi^2(5)$	12.91**	0.025	55.61***	0.000
Panel C: Ex–day Abnormal Volume by tax periods				
P1	0.053	0.294	—	—
P2	0.060	0.303	–0.012	0.968
P3	0.323***	0.002	–0.011	0.965
P4	0.303***	0.000	0.037	0.518
t P1–P4	–3.18***	0.001	–0.160	0.876
$\chi^2(4)$	18.43***	0.00	0.098	>0.10

Note: The Abnormal Volume (AV) is based on the ratio of the volume in the event period over the average volume over –80, –6 prior to the ex–day less one. In Panel B, events are sorted into equal dividend yield quintiles. The dividend yield is the ratio of dividend for the year over the price cum–dividend. The sample includes 5,630 U.K. observations, and 829 for Germany.

The abnormal volume for Germany in P1 is not computed because there are only 4 observations. The t–statistics of the differences in means and the χ^2 relate to P2–P4.

the overall distribution of the abnormal trading volume across the yield quintiles is not homogeneous. The positive excess returns together with this excess volume suggest that there are more buyers on the ex–dividend dates than sellers. Who are the buyers? One possibility could be foreign investors who are not entitled to the tax credit and local shareholders who do not pay capital gains tax, making dividends taxed more heavily than capital gains. However, Panel C indicates that this excess trading volume is confined mainly to the post–1997 period when pension funds cannot claim the tax credit. In the first two periods (P1 and P2), the abnormal trading volume is not statistically significant. However, since the 1997 tax reform made them indifferent between dividends and capital gains, they forgo the ex–day excess returns if they buy on the ex–dividend date rather than on cum dates. Overall, these results are not consistent with dividend capture hypothesis.

In contrast, in Germany, the results are consistent with short–term trading effects. Although, in the pre–event period the excess trading volume is significant only in day –1, in the post–ex–dividend date period, it is predominantly significant. Panel B indicates that, for high–yield stocks, the ex–day abnormal trading volume is positive and significant, but for low–yield stocks (quintiles one to three), it is negative and mostly significant, independently of be tax period (Panel C). These results are consistent with the Michaely and Vila (1996) findings for high–yield stocks. They are also consistent with Frank and Jagannathan (1998), who find that the abnormal trading volume is mainly negative and insignificant during the 11–day period around the ex–dividend dates in Hong Kong where neither dividends nor capital gains are taxed.

Impact of Market Microstructure Factors on Ex–Dividend Dates

A number of other studies suggest that the market microstructure factors explain ex–day returns as the ex–day bid–ask spread is expected to increase because ex–day the opening bid is reduced by an amount greater than or equal to the dividend but the opening ask remains at its cum–dividend level. As a result, ex–day spread is larger by one tick than the dividend and, in turn, it becomes positively related to ex–day returns.[12] Bali and Hite (1998) provide an alternative explanation for the ex–day price behavior based on discreet price intervals. They argue that the trading patterns of the long–term investors and short–term traders will result in ex–day price drop to be less than and within one tick of the dividend. Bali (2003) argues that the trading by investors who do not want dividends will result in the last transaction price to be at bid on the cum dates and at ask on the ex–dividend date. In contrast, the dividend capture activity will result in price cum to be at ask and ex price to be at bid, resulting in price drop to exceed dividend. However, this model implies that if traders who value less dividends sell on the cum day, then the probability that cum prices are equal to bid prices rises. These two models assume a tax–induced capital gains and a dividend price that falls to the tick blow the dividend. Frank and Jagannathan (1998) find that ex–day prices decrease by less than the dividends in Hong Kong where dividends and capital gains are not taxed. They propose another model based

[12] For example, Dubofsky (1992) attributes the ex–day returns to NYSE Rule 118, which requires market specialists to reduce all open buy orders by the amount of the dividends to the next lower price tick, thus reducing ex–day prices by an amount greater than the dividend. Ex–day prices of stocks that pay dividends equal to an even multiple of the tick size decrease by the full amount of the dividend. In the post–decimalization period, stocks with dividend containing a fraction of a cent are reduced by an amount higher than the dividend and there is no reduction in open sell orders.

on investor dividend aversion where sellers trade cum dividend and market makers buy ex–dividend. The cum–dividend price will tend to be at bid while the ex–dividend price will be at ask and the price fall will be from bid to ask which is less than the amount of the dividend. The positive ex–day returns will reflect the small investors' payment to market makers to collect the dividend rather than the tax differential between dividends and capital gains.

The empirical evidence on the impact of these factors on ex–day returns is mixed. Jakob and Ma (2004) compare the Bali and Hite (1998) model to that of Dubofsky (1992) to find that these two models cannot explain fully the behavior of ex–day prices over the different tick size regimes in the U.S. Jakob and Ma (2003) extend the Bali and Hite (1998) model to analyse the buy and sell order imbalances on cum and ex–dividend days, but find no abnormal order flows on the cum dates. Graham et al. (2003) find no significant change in the abnormal returns before and after the conversion of prices from $1/8^{th}$ and $1/16^{th}$, but the 1997 decrease in capital gains tax rates significantly altered ex–day prices. Cloyd et al. (2006) test for the effect of changing price discreteness in early 2001 while holding tax rates constant, and the effects of changing tax rates in 2003 while holding price discreteness constant. They argue that the strong relationship between ex–day returns and dividend yield across the regimes provide support for the tax hypothesis.

I test for the market microstructure effects by analyzing the behavior of the bid–ask spread around the ex–dividend dates as data on the tick size and number of orders is not available for all of the sample. The above models imply that the bid–ask spread will be higher on the ex–dividend dates to reflect the trading of the buyers on the ask prices. I compute the abnormal bid–ask spread ($ABAS_{it}$), in the same way as the abnormal trading volume above, as the ratio of the bid–ask spread on the each event [–5 to +5] over the average bid–ask spread over the estimating period [–80 to –6]. Events with fewer than 20 observations over the estimation period are excluded. In Germany, the data is only available after 1996. The final sample includes 8,932 in the U.K. and 855 in Germany.

The results in Table 6 show that in the U.K. the abnormal bid–ask spread is only significant in days two, three and five. There is no difference in the distribution of the bid–ask spread across dividend yield quintiles (Panel B) and tax periods (Panel C), suggesting that ex–day returns are not likely to be affected by the market microstructure factors. However, in Germany, there are significant abnormal bid–ask spreads in the pre– and post–ex–dividend dates. Panel B shows that the ex–day abnormal bid–ask spread is also significantly larger for the high–yield groups, while for low–yield groups, it is negative and not significant, suggesting that, in line with Frank and Jagannathan (1998), investors, such as overseas shareholders who dislike dividends, sell before and buy on the ex–dividend dates. Panel C indicates that ex–day abnormal bid–ask spread is mainly significant in the last tax period, but the difference between the two tax periods with available data is not significant ($\chi^2(2) = 0.914$).

Regression Results

I test the joint impact of the aforementioned hypotheses by running a set of regressions. I use ex–day abnormal returns based on the market model as the dependent variable. The results using the alternative abnormal returns and drop–off ratios are qualitatively similar. I test for the tax hypothesis by including dividend yield and tax period dummies as explanatory variables. I expect ex–day returns to be positively related to dividend yield if taxation is the main driver of ex–day

TABLE 6
DISTRIBUTION OF EVENT DATE ABNORMAL BID–ASK SPREAD IN THE U.K. AND GERMANY

	U.K.		Germany	
	Mean	p–value	Mean	p–value
Panel A: Abnormal Bid–Ask Spread				
–5	–0.012	0.303	–0.027	0.488
–4	–0.006	0.350	–0.082***	0.000
–3	0.000	0.940	–0.020	0.488
–2	–0.006	0.122	–0.021	0.476
–1	0.009	0.380	0.014	0.591
0	0.007	0.121	0.094***	0.001
1	0.003	0.564	0.046*	0.072
2	0.009*	0.059	0.084**	0.029
3	0.006	0.186	0.063**	0.040
4	0.009*	0.054	0.054*	0.051
5	0.012*	0.073	0.075***	0.005
Panel B: Ex–day Abnormal Bid–Ask Spread by dividend yield quintiles				
Low	0.015	0.204	–0.055	0.268
2	0.017	0.114	–0.007	0.918
3	0.000	0.985	0.197**	0.012
4	0.011	0.246	0.132**	0.044
High	–0.008	0.380	0.177***	0.003
t low–high	1.540	0.123	–3.04***	0.003
$\chi^2(5)$	4.838	>0.10	15.54***	0.00
Panel C: Ex–day Abnormal Bid–Ask Spread by tax periods				
P1	0.004	0.448	—	—
P2	0.011	0.121	—	—
P3	0.028**	0.036	0.047	0.400
P4	–0.003	0.779	0.108***	0.001
t P1–P4	0.620	0.537	–0.950	0.341
$\chi^2(4)$	3.895	>0.10	0.914	>0.10

Note: The Abnormal Bid–Ask Spread (ABAS) is based on the ratio of the bid–ask spread in the event period over the average bid–ask spread over –80, –6 prior to the ex–day, minus one. The bid–ask spread is the difference between the price ask and the price bid over the sum of price bid plus price ask dividend by 2. In Panel B, events are sorted into equal dividend yield quintiles. The dividend yield is the ratio of dividend for the year over the price cum–dividend. The sample includes 8,932 U.K. observations, and 855 for Germany.

The data on bid–ask spread for Germany in P1 is not available. The t–statistics of the differences in means and the χ^2 relate to P3–P4.

prices. The tax period dummies are also expected to be significant if ex–day returns are affected by the various tax reforms. Following Naranjo et al. (2000), I use the log of the market value of equity, *ln(ME)*, defined as P_{cum} times number of shares outstanding, and the inverse of the Price cum, $1/P_{cum}$, as measures of transaction costs. I expect a negative relationship between ex–day abnormal returns and firm size and $1/P_{cum}$ if short–term traders capture dividends because larger companies are more liquid and firms with higher $1/P_{cum}$ are likely to have higher brokerage costs and bid–ask spreads. I include the ex–day abnormal volume and abnormal bid–ask spread as computed in the two previous sections to test further for the dividend capture hypothesis and the market microstructure effects. I expect ex–day returns to be negatively related to the abnormal trading volume but positively related to the abnormal bid–ask spread if traders buy on the ex–dividend dates at the ask prices. Finally, I use the standard deviation of abnormal returns over the estimation period [–200 to –41] to proxy for the risk exposure of short–term traders. I expect ex–day returns to be positively related to this

risk measure if short–term traders capture dividend.[13]

Table 7 reports the results.[14] The dependent variable in Equations [1] to [4] is the ex–day abnormal returns for the full sample. For the U.K. market (Panel A), the results indicate that ex–day returns are positively related to dividend yield, firm size (*ln(ME)),* abnormal trading volume (AV_0), the tax period dummy variables and the transaction costs measure $1/P_{cum}$. The relationship between ex–day returns and yield and the tax period dummies is consistent with the tax hypothesis.[15] The positive coefficient of size is not consistent with the short–term trading hypothesis as, given that larger firms have lower transaction costs and are also less risky, they should be preferred by short–term traders. Equation [5] reports the results using the high dividend yield quintile to compare my results to Naranjo et al. (2000). The results mimic those of the full sample with the exception of the non–significance of firm size and the negative and significant coefficient of the risk measure, *Risk*. These results do not provide support to Naranjo et al. (2000), who show that, consistent with the dividend capture hypothesis, ex–day returns of high–yield stocks in the U.S. are negatively related to dividend yield, firm size, (*ln(ME)),* and $1/P_{cum}$ and positively related to risk measure. Equation [6] reports results based on the sample of event where ex–day prices are different from the cum prices. I assume that when $P_{cum} = P_{ex}$, dividend is equal to the tick size. The results did not change, suggesting that ex–day returns in the U.K. are not likely to be affected by the tick size.

Panel B reports the results for Germany. Consistent with the tax hypothesis, the tax–period variables are significant. However, the relationship between ex–day returns and dividend yield is weak. Equation [4] shows that ex–day returns are negatively related to the abnormal bid–ask spread and positively related to *Risk*. These results are consistent with the short–term trading hypothesis and suggest that short–term traders target low–risk companies. Equation [5] reports that for the high–yield stocks, ex–day returns are not affected by the transaction costs variables. Niranjo et al. (2000) find in the U.S. that the ex–day returns are negatively related to firm size. They argue that large companies are much more likely to be liquid and have low transaction costs. Thus, they attract short–term traders and, as a result, have low ex–day returns. The positive coefficient of firm size in Equation [5] appears to indicate that, in Germany, size cannot be used as a proxy for short–term trading. The results reported in Equation [6] appear also to indicate that the coefficient of the second proxy variable for transaction costs, $1/P_{cum}$, is positive and significant, while it is expected to be negative. Overall, although there is some evidence of short–term trading, the proxy variables used in previous studies provide mixed results.

Robustness Checks

I check for robustness by first using the drop–off ratio as the dependent variable. The results are similar to Table 7, suggesting that the overall reported findings are

[13] I also include dummy variables for months and the day of the week because I find that in some countries most of the ex–dividend dates in the U.K. are on Mondays. I do not report the coefficients of these dummy variables for space considerations.

[14] The t–statistics are based on standard errors that are heteroskedastic–consistent (White, 1980). I check for multicollinearity by running separate regressions on each individual explanatory variable. The coefficients and the t–statistics did not change.

[15] Following Cloyd et al. (2006), I also test for the non–linearity relationship between ex–day returns and yield. The coefficients of the yield groups are not significant for both U.K. and Germany. The results are not reported for space considerations.

TABLE 7
REGRESSIONS

Dependent variable	AR_{ex0} (1)	AR_{ex0} (2)	AR_{ex0} (3)	AR_{ex0} (4)	$AR_{ex0,\ High\ Yield}$ (5)	$AR_{ex0,\ Pex \neq Pcum}$ (6)
			Panel A: U.K.			
Constant	–0.023***	0.001	0.004***	–0.028***	–0.06***	–0.03***
	(0.00)	(0.96)	(0.00)	(0.00)	(0.00)	(0.00)
Yield	0.690***			0.574***	0.687***	0.584***
	(0.00)			(0.00)	(0.00)	(0.00)
Ln(ME)				0.0016***	0.001	0.002***
				(0.00)	(0.21)	(0.00)
AV_0		0.007***		0.0007***	0.001***	0.0009***
		(0.00)		(0.00)	(0.01)	(0.00)
$ABAS_0$			–0.002	–0.0005	–0.0015	–0.0007
			(0.11)	(0.625)	(0.70)	(0.58)
TP2	0.012***	0.005***	0.003**	0.012***	0.011**	0.013***
	(0.00)	(0.00)	(0.05)	(0.00)	(0.02)	(0.00)
TP3	0.015***	0.008***	0.006***	0.015***	0.008	0.016***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.15)	(0.00)
TP4	0.017***	0.010***	0.008***	0.019***	0.02***	0.019***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
$1/P_{cum}$				0.109***	0.163**	0.188***
				(0.00)	(0.04)	(0.001)
Risk				–0.07	–0.51***	–0.067
				(0.23)	(0.00)	(0.29)
$\bar{R}^2$	0.310	0.021	0.010	0.162	0.417	0.174
p–value of F	0.00	0.00	0.00	0.00	0.00	0.00
N	10,084	5,630	8,932	5,342	889	4,746
			Panel B: Germany			
Constant	0.007	–0.001	0.004	–0.011	–0.048*	–0.012
	(0.73)	(0.96)	(0.166)	(0.34)	(0.06)	(0.38)
Yield	0.033			–0.066	–0.033	–0.142
	(0.198)			(0.43)	(0.83)	(0.10)
Ln(ME)				0.001	0.002*	0.009**
				(0.40)	(0.06)	(0.03)
AV_0		–0.004				
		(0.635)				
$ABAS_0$			–0.004**	–0.003**	–0.004*	–0.004**
			(0.02)	(0.05)	(0.09)	(0.02)
TP2	0.004*					
	(0.08)					
TP3	0.004**	0.004				
	(0.05)	(0.986)				
TP4	0.006***	0.005	0.001**	0.002***	–0.021	0.021
	(0.01)	(0.82)	(0.05)	(0.05)	(0.46)	(0.61)
$1/P_{cum}$				0.022	0.064	0.125***
				(0.36)	(0.21)	(0.00)
Risk				0.023*	0.366	0.28**
				(0.08)	(0.16)	(0.04)
$\bar{R}^2$	0.02	0.00	0.04	0.04	0.087	0.04
p–value of F	0.05	0.931	0.09	0.06	0.03	0.00
N	2,909	829	854	845	209	721

Notes: The table reports the regression results of the ex–day abnormal returns against dividend yield (*DY*), size as measured by log of market value of equity at cum–dividend date price (*ln*(*ME*)), ex–day abnormal bid–ask spread ($ABAS_0$), ex–day abnormal trading volume (AV_0), dummy variables for tax periods (see Table 2 for respective dates), $1/P_{cum}$ to proxy for transaction costs and risk, the standard deviation of the abnormal returns over the estimation period [–200 to –41]. In Equation [5], the dependent variable $AR_{ex0,\ High\ Yield}$ includes only high yield stocks. In Equation [6], the dependent variable $AR_{ex0,\ Pex \neq Pcum}$ excludes events where $P_{cum} = P_{ex}$. All regressions include month and day of the week dummies and the coefficients are not reported. The p–values are in parentheses.

not sensitive to the choice of the dependent variable. In particular, in Germany, the relationship between the drop–off ratio and yield is weak and the impact of the transaction costs risk variables is mixed.

I also test for the robustness of the explanatory variables. As in Naranjo et al. (2000), I define dividend yield as the total dividend paid during the year. I also use the values of the bid–ask spread instead of the computed abnormal bid–ask spread. In addition, I compute the abnormal trading volume and bid–ask spread using [–20 to –6] and [+6 to +20] as the estimation period. Finally, I replicate the analysis by focussing on high–yield, low–bid–ask spread stocks. The results, not reported, are similar to Table 7.

I test further the tax hypothesis by running the regressions separately for high– and low–dividend–yield stocks. The results for high–yield stocks are reported in Table 7, Equation [5]. In the U.K., ex–day returns of low–yield stocks are significantly related to dividend yield and to the tax dummies. The coefficient of the dividend yield is about one, implying that the marginal investors who hold these low–yield stocks are likely to be indifferent between dividend and capital gains. In contrast, for high–yield stocks, the coefficient of the dividend yield is 0.69 (Panel A, Equation [5]), suggesting that the marginal investors who hold these stocks are taxed more on dividends than capital gains (TD < 1)—high taxpayers in Table 2. To the extent that dividend yield reflects long–term investors' expected yield, the results suggest that, unlike in the U.S. (e.g, Dhaliwal, Erickson, and Trezevant, 1999), the lowest–dividend–yield shares are likely to be held by basic taxpayers and tax–exempt institutions that are not affected by the various tax reforms. In this case, in line with previous U.K. studies (e.g., Lasfer, 1995, and Poterba and Summers, 1984), the reported results do not provide support for the dividend tax clientele hypothesis, which predicts that share prices of the high–yield group, owned by low–tax bracket investors, should drop by the full amount of the dividend on the ex–day, and imply that the assumption of Bell and Jenkinson (2002) that pension funds hold high–yield stock and ex–day share prices of these high–yield stocks were affected by the 1997 elimination of the tax credit is not likely to apply. In Germany, the various tax reforms had more impact on low–yield stocks. Given that, as in Table 2, Panel B, dividends are taxed more heavily than capital gains for high taxpayers with zero capital gains tax only, the results imply that these high taxpayers are likely to hold low–yield stocks. However, this tax hypothesis does not appear to be supported as dividend yield is not significant.

CONCLUSION

In this paper, I analyze the behavior of ex–day returns in Germany and the U.K. I find that, on average, ex–day returns are positive in both countries, suggesting that ex–day prices decrease by less than the amount of the dividend. I also find that ex–day returns are not homogeneous across the sample periods, as, in both countries, changes in the tax systems that affect taxes on dividend and/or capital gains significantly alter ex–day returns. However, the results provide support for the tax hypothesis only for the U.K. market as the relatively higher differential between dividends and capital gains has resulted in higher ex–day returns. In Germany, consistent with McDonald (2001), ex–day returns are likely to be driven by short–term traders.

Although the above results for the U.K. provide support for the tax hypothesis, the magnitude of ex–day returns suggests that they may also be affected by other factors. First, as shown in Table 2, ex–day abnormal returns should only be positive when the marginal investor

is a high taxpayer with no capital gains tax. Thus, the positive ex–day abnormal returns documented above appear to suggest that the marginal investors are only high taxpayers. Second, ex–day abnormal returns are higher than in the U.S., where dividends are taxed at a much higher rate than capital gains, as Graham et al. (2003) report mean ex–day returns of 0.1 percent and 0.24 percent for the 1997–2000 and 2001 periods, and Elton et al. (2002) report ex–day returns (drop–off ratios) of taxable funds of 0.08 percent (0.91) in 1997–2001 and of no significance in the pre–1996 period. One possible explanation for these results could be that, in the U.S., short–term traders capture dividends and, thus, lower ex–day returns up to the level of transaction costs.

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