Ex-dividend day trading: who, how, and why?
Evidence from the Finnish market

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Abstract

This study examines the ex-dividend day trading behavior of all investors in the Finnish stock market. Consistent with dynamic dividend clientele theories, investors with a preference for dividend income buy shares cum-dividend and sell ex-dividend; the reverse is true for investors with the opposite preference. Investors also engage in overnight arbitrage, earning on average a 2% overnight return on their invested capital. Trades at the investor-level reveal that idiosyncratic risk is an important determinant in the choice of stock for short-term ex-day trading. Furthermore, transaction costs and dividend yield jointly determine whether the volume of short-term trading activity is nonzero.

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1. Introduction

Very few overnight share price changes convey as much fundamental information as stock returns on the ex-dividend day. Elton and Gruber (1970) introduced the idea that ex-day returns could be used to test whether personal taxes affect security prices and to infer the identity of the marginal investor. In more than three decades, hundreds of studies have examined the ex-day price behavior of stocks to find out the identity of the marginal investor.[1] There is a consensus that taxes affect security prices (Allen and Michaely, 2004), but the identity of investors trading around the ex-day and their impact on prices is still controversial.

An ideal starting point for an analysis of who trades and sets security prices around the ex-day is investors' trading records. Until very recently, however, researchers have had limited access to such information, and have resorted to various techniques to infer the identity of the marginal investor from price and volume data. Thus, our knowledge about the marginal investor comes largely from studies examining share price changes and aggregate trading volume on the ex-dividend day. It is unlikely that on any given ex-day the market would be populated by only one particular group of traders, an issue that complicates inference from aggregate data. Instead, the ex-day price and the total trading volume are likely to be driven by several trading clienteles.

To overcome the obvious shortfall of studying only price and volume data, this paper takes a direct look at trades that take place around the ex-dividend day in the Finnish market. High-quality data consisting of the trading records of *all* market participants allow for a close examination of investor behavior around the ex-dividend day in virtually every listed stock. Access not only to the identity of traders in the entire market, but also to detailed investor-level data such as capital gains, portfolio values, and portfolio composition facilitates a direct test of whether investors actually consider risk and transaction costs as described by dynamic dividend clientele theories (Kalay, 1982; Boyd and Jagannathan, 1994; Michaely and Vila, 1995; Michaely, Vila, and Wang, 1996).

In addition to the availability of high-quality data, Finland is especially suitable for studying ex-day trading for two reasons. First, in contrast to the United States where dividends are paid quarterly, dividends are paid only once a year in Finland. Because dividends are on average larger, stock price discreteness (Bali and Hite, 1998) is less of an issue in the Finnish stock market. Second, capital income preferences vary substantially across investor categories. While U.S.-based mutual funds trading in the Finnish market have an equal preference for a EUR 1.00 dividend and a EUR 0.85 capital gain, domestic taxable investors have an equal preference for EUR 1.00 in dividend income and up to EUR 1.41 in capital gains. Large dividends combined with considerable differences in the relative taxation of capital gains and dividends create ample opportunity for mutual gain by ex-day trading.

By using comprehensive investor-level data to study the trades around 885 ex-day events, I make three contributions to the literature. First, by disaggregating the trading volume around the ex-day, I document who trades, how much, and in which direction around the ex-dividend day. The results strongly suggest that tax status drives investors to change the direction of their trades around the ex-dividend day. Households and nonfinancial corporate traders, who have a preference for dividend income in the Finnish tax environment, switch from buys to sells after the ex-day. Correspondingly, foreigners who are taxed more heavily on dividend income switch from sells to buys on the ex-dividend day. Second, the data also show that investors engage in overnight arbitrage trading around the ex-day according to their tax status. Domestic taxable investors buy shares cum-dividend and sell ex-dividend, while mutual funds and foreigners sell shares cum-dividend and buy ex-dividend. On average, arbitrageurs engaging in short-term trading earn an overnight return of 2% after transaction costs. Finally, I provide empirical evidence on the determinants of short-term trading around the ex-dividend day by domestic taxable investors. These investors are found to engage in tax arbitrage in stocks with low beta, low idiosyncratic risk, and in which they have small or no position previously. Furthermore, high dividend yield and low transaction costs are a prerequisite for the arbitrageurs to enter the market on the ex-day, as first argued by Kalay (1982). On aggregate, however, the magnitude of short-term trading activity is rather low, only a small percentage of the total trading volume on the ex-day.

The remainder of the paper is organized as follows. The next section reviews the literature on dynamic dividend clienteles. Section 3 explains the relevant features of capital income taxation in Finland and how this affects the research design. Section 4 describes the data. Section 5 investigates the magnitude of ex-day stock price changes relative to the size of the dividend (ex-day ratio), the direction and magnitude of trading around the ex-day by investor category, timing and profitability of short-term ex-day trades, and the determinants of trading activity. Finally, Section 6 concludes and suggests avenues for further research.

2. Dynamic dividend clienteles

Unless every agent in the economy has the same tax rate on dividend income and capital appreciation, investors can realize mutual gains at the expense of the government by trading with one another around the ex-dividend day. Investors valuing dividends relative to capital gains hold and buy stocks cum-dividend, and investors who would be disadvantaged to receive dividends are on the sell side. These trades are subsequently reversed on the first ex-day. This tax heterogeneity leading to differential valuation of dividends is the key argument of dynamic dividend clientele models (Michaely and Vila, 1995; Michaely et al., 1996), which also propose that the ex-day ratio (also referred to as the ex-day premium, see Elton and Gruber, 1970) is driven not by any single group of investors but by the interplay of trading decisions by investors with different tax status. In addition to taxes, dynamic dividend clientele models incorporate risk and transaction costs.

Michaely and Vila (1995, 1996) assert that risk influences trading decisions around the ex-dividend day and argue that an investor engaging in tax arbitrage will trade only as long as the advantage from the expected short-term gain outweighs the disadvantage of being too heavily invested in the traded stock. This argument is consistent with Heath and Jarrow (1988), who show that an investor cannot make riskless profits simply because of the variation in the ex-day ratio. A similar argument on idiosyncratic risk is formalized in the model of Michaely et al. (1996).

Transaction costs can also influence ex-day prices and trading volume. Kalay (1982) incorporates transaction costs in a model of ex-day trading that predicts an equilibrium ex-day ratio of unity, plus or minus a proportion attributable to transaction costs. This is because short-term arbitrageurs will enter the market and drive the ex-day ratio close to one, to the point where profit opportunities no longer exist. Boyd and Jagannathan (1994) point out that arbitrageurs will enter the market only if transaction costs are low and the dividend yield is high enough, among a host of other factors that complicate the inference of ex-day price data. Michaely et al. (1996) combine transaction costs and their interplay with market and idiosyncratic risk in a model of ex-day trading volume. Not only do they demonstrate that transaction costs decrease trading volume around the ex-day, but they also propose that when transaction costs are nonzero, idiosyncratic risk has a more negative impact than market risk on trading volume.

Dynamic dividend clientele theories have gained empirical support in studies using price and volume data. Trading volume on the ex-day is found to increase with tax heterogeneity and dividend yield and to decrease with transaction costs and risk, particularly idiosyncratic risk (Michaely and Murgia, 1995; Michaely and Vila, 1995, 1996; Dhaliwal and Li, 2006). Hence, trading volume evidence is consistent with the notion that investors exploit differences in the relative taxation of dividends and capital gains, especially around ex-day events when potential gains are high and risks low.

Recent research has been able to directly examine ex-day trading volume by investor category, and the evidence broadly conforms to the dynamic dividend clientele literature. Koski and Scruggs (1998) examine NYSE audit file data and find evidence consistent with the idea that differences in tax rates drive investors to trade around the ex-day. Graham and Kumar (2006) investigate the trades of individual investors at a large discount brokerage house and find evidence of taxes driving trading decisions. Felixson and Liljeblom (2007) also provide direct evidence on trading around the ex-day by investor tax category.

However, the studies of Koski and Scruggs (1998), Graham and Kumar (2006), and Felixson and Liljeblom (2007) either cannot pinpoint the tax status of investors in the market or consider only a small subset of the trading population. The ex-dividend day literature is thus missing a detailed examination of the investor and stock characteristics that drive tax- and arbitrage-motivated trades. This study bridges the gap by performing a thorough analysis at the level of the market, the firm, and the investor with data on all trades by every investor in an entire stock market.

3. Capital income taxation in Finland

Capital income taxation was relatively straightforward in Finland during the sample period of 1995-2002. First, there are no differences among capital income tax rates of domestic investors within an investor category. Hence, once the legal status of an investor is identified, the applicable nominal tax rate on capital gains and dividends is also known. Second, the dividend and capital income tax rates are independent of the holding period of a security.

3.1. Dual income tax system

During the sample period, labor income and capital income were taxed separately for all sources of income, with the exception of private companies. However, labor income, which is unobservable in this study, never influences the marginal tax rate on capital income from publicly listed corporations, and hence does not affect the propensity of an investor to engage in ex-day trading.

3.2. Statutory tax rates and dividend imputation system

Finland's imputation system of dividends is similar to the system in France, Germany, Italy, and Spain, but less complicated. Retained corporate profits and dividends are taxed at the firm-level at the same flat tax rate, and all investors, except for nonprofit institutions and mutual funds, are subject to capital income and dividend taxes at the investor-level. The statutory rate for capital income equals the statutory rate for dividend income during the sample period, although the tax rate changed twice. Until the end of 1995, the tax rate was 25%; it was raised to 28% at the beginning of 1996, and to 29% at the beginning of 2000. Despite the statutory tax rate of 25-29% on dividend income, dividends were fully imputed via a tax credit system that guarantees an effective dividend tax rate of zero percent for domestic investors. There are two minor exceptions: in 1996 and 2000, capital income tax rates were raised, but dividends were imputed at the previous year's tax rate. The effective tax rate on dividends was 4.0% in 1996 and 1.4% in 2000.

To illustrate how the full imputation system functions, consider a domestic investor who receives EUR 1,000 in dividend income in a fiscal year. On the tax form, the domestic investor declares EUR 1,000 in dividend income, EUR 290 in taxes on dividend, and a EUR 290 imputed dividend tax credit. The EUR 290 dividend tax and the EUR 290 tax credit are netted out, and the domestic taxable investor pays no tax on the dividend income of EUR 1,000. In essence, the full imputation system can be viewed as a smokescreen that helps quell political criticism that dividends are not taxed; dividends are taxed in principle, but they are effectively not taxed at the investor-level.

The imputation system does not generally apply to foreigners, who might have to pay an additional withholding tax of up to 29%, depending on the tax treaty between Finland and the country of residence of the foreign investor. For investors resident in the United States and the United Kingdom, the withholding tax is 15%. Domestic nontaxable institutions such as mutual funds and nonprofit foundations do not receive the imputation tax credit, as they do not pay taxes. Hence, they are indifferent between capital gains and dividend income.

3.3. Taxation of capital gains

Capital gains are taxed upon realization at a flat rate, which equaled the corporate tax rate during the sample period. An investor realizing capital gains has the option to calculate the gain on 20% of the sale price rather than on the purchase price (prior to fiscal year 1999, the alternative capital gains tax basis was 30% of the sale price.) Thus, realized capital gains can be calculated using the formula Min (sale price – purchase price, sale price x 80%), which applies to all domestic investors subject to taxes. For banks and stockbrokers holding stock for trading purposes, the ratio for computing capital gains in a given year is [Sum of sales - Sum of purchases + Ending balance – Starting balance] with mark-to-market value for starting and ending balances. The dividend preference and ex-day trading incentives for stockbrokers are the same as for other domestic taxable investors. Finally, realized capital losses can be deducted from realized capital gains without an upper limit, and carried forward for up to three years. For these reasons, the ex post realized capital gains tax rate can differ from the nominal tax rate. Kukkonen (2000, p. 150) estimates an effective capital gains tax rate of 15% in 1995 for a sample of wealthy individuals living in Helsinki.

Finnish tax law does not generally differentiate between and short- and long-term capital gains. The capital gain for a share held overnight is taxed at exactly the same rate as for a share held for up to ten years. Furthermore, the tax law does not explicitly ban the dynamic tax avoidance strategy where an investor creates capital losses by buying shares cum-dividend and selling the shares ex-dividend. Thus, in contrast to the United States, where there are holding period requirements for qualified dividends, there are no explicit legal restrictions under Finnish tax law banning tax avoidance by ex-day trading. Although the tax authorities can levy a tax on any transaction deemed to have a tax avoidance rather than economic purpose, they did not exercise this option during the sample period.[2]

3.4. Dividend preference of domestic taxable investors

The key implication of the effective zero tax rate on dividend income is that Finnish domestic investors prefer dividends to capital gains. Because of the full deductibility of capital losses, the magnitude of dividend preference depends on the net amount of realized capital gains.

An investor who has realized large capital losses in the fiscal year or who has tax loss carryforwards from previous years and thus does not expect to pay capital gains tax for the fiscal year is indifferent between EUR 1.00 in dividend income and EUR 1.00 in capital gains. The investor does not benefit from receiving EUR 1 in nontaxable dividend income instead of a capital gain of the same size, as the investor would not be subject to capital gains tax in the fiscal year anyway.

The Finnish capital gains tax rate changed twice during the sample period. From 1993 to 1995, the tax rate was 25%, effectively imposing a 1/(1-0.25) = 1.33 upper limit to the dividend preference ratio. The capital gains tax rate in 1996-1999 was 28%, and 29% in 2000-2002. This yielded a maximum dividend preference ratio of 1.39 and 1.41, respectively, (see Elton and Gruber, 1970, for the details of computing the dividend preference ratio. For an investor who has realized or anticipates realizing capital gains in the fiscal year EUR 1.00 in dividend income thus yields the same after-tax cash flow as EUR 1.00-1.41 in pretax capital appreciation. For such an investor, buy/sell tax arbitrage around the ex-day is possible unless the ex-day price drop is more than 1.33-1.41 times the dividend paid. For a more detailed discussion of the boundaries of ex-day tax arbitrage in a country with a dividend imputation system, see MacDonald (2001) for a German example and Liljeblom, Löflund, and Hedvall (2001) for a Finnish example.

3.5. Summary and implications of capital income taxation by investor category

Implications for the ex-day trading incentive for each investor category can be summarized as follows:

- Nontaxable domestic investors, such as nonprofit institutions, government entities, and mutual funds, have equal preferences for EUR 1.00 in dividend income and EUR 1.00 in capital gains. They have an incentive to engage in short-term trading as long as the price drop on the ex-dividend day does not equal the value of dividend.
- All other domestic investors, households, nonfinancial corporations, and financial corporations have identical nominal tax rates on capital income. With the imputation system, the effective investor-level tax rate for dividends is zero percent and 25-29% for capital gains. At most, EUR 1.00 in dividend income is equally preferred to EUR 1.33-1.41 in capital gains. Domestic taxable investors with capital gains to be sheltered have an incentive to buy shares cum-dividend and sell ex-dividend, unless the price drop is greater than 1.33-1.41 times the dividend paid.
- Most foreign investors do not receive the imputation tax credit, and could be subject to a withholding tax. For a foreign investor, EUR 1.00 in capital gains is, in most cases, preferred to EUR 1.00 in dividend income. The majority of foreign investors, mainly U.S.- and U.K.-based nontaxable mutual funds, have an incentive to sell shares cum-dividend and buy ex-dividend, unless the expected price drop on the ex-dividend day is significantly less than the dividend. In the particular case of a U.S.- or U.K.-based mutual fund, the dividend preference ratio is (1-0.15)/(1-0) = 0.85; Liljeblom et al. (2001) provide more detailed discussion on the dividend preference of foreign investors in Finland.

4. Data

The bulk of the data comes from the Finnish Central Securities Depositary (FCSD), which maintains an electronic and official register of all securities transactions in Finland for virtually all companies listed on the Helsinki Exchanges (HEX). The data comprise daily trading account records of all investors in the Finnish market. The sample period runs from January 1, 1995 to November 28, 2002, a period that includes both bull and bear markets. More detailed information on the data can be found in Grinblatt and Keloharju (2000, 2001), whose data are for 1995-1996.

The data provide information on the institutional and legal type of each investor, which unambiguously defines the investor's tax status. Furthermore, all transactions are tagged with a unique investor identification number that makes it possible to compute investor-level statistics, such as portfolio value, for each domestic investor in the entire market on every day. Trades are aggregated in the investor-level analyses, in which the daily change in the investor's position in a stock is considered as one observation.

Because of different tax rates within some investor categories used by Grinblatt and Keloharju (2001), I slightly modify their grouping. This paper uses six investor categories: domestic households, domestic nonfinancial corporations, domestic financial corporations, mutual funds, nonprofit institutions, and foreigners. As mutual funds have a different tax status from other financial institutions, I put these investors into a category of their own. I also combine general government and other nonprofit institutions, given their relatively modest share of the trading volume in the Finnish stock market and slight differences in their behavior, as documented in Grinblatt and Keloharju (2001). The aggregate group of foreigners, which consists primarily of large institutional investors such as foreign mutual and pension funds, accounts for 40-50% of the total trading volume of HEX. Foreigners trading in the Finnish stock market have the option to either register in their own name or execute trades anonymously via a domestic financial institution nominee account, which makes investor-level analysis of unregistered foreign investors impossible. Their trades appear in the data under the nominee institution's identification number, but with a separate flag for a nominee account trade. For this reason, I pool all foreigners in the market-level empirical analyses, but use data separately for a small subset (1.8%) of registered foreigners in the investor-level analyses.

The FCSD data on securities transactions are supplemented with dividend and stock price data from HEX. Stock price data are combined with the HEX Portfolio Yield Index (HPYI) logarithmic returns and either 12-month Helsinki Interbank Offered Rate (HELIBOR, until the end of 1998) or 12-month EURIBOR (from the beginning of 1999) data to compute betas for each stock. Betas from single-factor model betas are estimated from weekly data with a three-year historical window by using the HPYI as the market portfolio. Nokia has had a disproportionately large weight since the end of the 1990s, constituting 70% of the total market capitalization of HEX when the share price peaked at the beginning of May 2000. For this reason, I use the HPYI with a 10% value-weight restriction, where available. HPYI is available only since January 1, 1996. For the period 1st January 1995 to 31st December 1995, I use the value-weighted HEX General Yield Index instead. Data for the book value of assets are from Thomson/Datastream, and augmented from annual reports.

The initial sample of FCSD registered firms from 1995 to 2002 has 916 ex-day events and 190 unique stocks. However, the data permit using only 672 events (164 stocks) in Section 5.1, 885 events (185 stocks) in Section 5.2, and 479 events (119 stocks) in Section 5.5. Zero trading volume on the cum- or ex-dividend day, and missing stock price data (e.g., for computing bid/ask spreads or betas) limit the availability of ex-day events.

5. Empirical analysis

5.1. Descriptive statistics and ex-day premiums

Equal-weighted statistics on the sample of 672 events for which ex-day premiums can be reliably estimated are shown in Panel A of Table 1; Panel B presents the ex-day premiums. The median premiums vary from 0.917 in the sample of 638 observations without outliers to 0.934 in the full sample of 672 observations. Given that the median premium is below unity, domestic investors with a preference for dividend income are clearly better off buying stocks cum-dividend and selling ex-dividend (see Section 3.4.). Correspondingly, the results also imply incentives for short-term trading by untaxed investors, and modest incentives for selling cum-dividend and buying ex-dividend by foreign investors. To investigate who trades and how much around the ex-day, I next document the relative trading volumes by investor category, the changes in the direction of trades, and the number and size of overnight trades around the ex-day.

5.2. Who trades around the ex-dividend day?

I compute gross and net trading volumes around the ex-day for each investor category. To prevent giving too much weight to Nokia (the most traded stock in HEX during the sample period) in the analysis, I calculate the equal-weighted gross proportion of the daily trading volume for each investor category k and trading day t with 885 ex-day events and six investor categories:

$$Gross\ proportion_{k,t} = \frac{1}{885}\sum_{j=1}^{885}\frac{(Volume\ of\ buys_{k,j,t} + Volume\ of\ sells_{k,j,t})}{\sum_{i=1}^{6}(Volume\ of\ buys_{i,j,t} + Volume\ of\ sells_{i,j,t})}\ . \qquad (1)$$

Correspondingly, net proportion is defined as

$$Net\ proportion_{k,t} = \frac{1}{885}\sum_{j=1}^{885}\frac{(Volume\ of\ buys_{k,j,t} - Volume\ of\ sells_{k,j,t})}{\frac{1}{2}\sum_{i=1}^{6}(Volume\ of\ buys_{i,j,t} + Volume\ of\ sells_{i,j,t})}\ . \qquad (2)$$

Eq. (1) gives the share of trading volume for each investor category by calculating the gross proportion of trading volume for each ex-day event and averaging over the 885 ex-day events. Correspondingly, Eq. (2) gives the direction of the trading volume for each investor category by taking the average of the net trading volume over the 885 events.

Table 2 indicates that foreign investors dominate the market around the ex-dividend day: they account for over 40% of the gross trading volume. The second-largest category is domestic households (26%), followed by nonfinancial corporations with a 16% share of the total volume. Mutual funds account for roughly 2.5% of the gross volume in the Finnish stock market, but they double their share on the last cum-dividend and the first ex-dividend day. I also perform robustness checks by using the proportional number of trades, instead of proportional volume, and by dividing ex-day events to quintiles by dividend yield. However, these alternative unreported specifications do not change the previous conclusions on the relative importance of different investor groups trading around the ex-day.

The next analysis of buy/sell ratios attempts to shed light on the within-group changes in trading behavior around the ex-day. The buy/sell ratio for each investor category *k* on trading day *t* is defined as

$$Buy\,/\,sell\ ratio_{k,t} = \frac{1}{885}\sum_{j=1}^{885}\frac{Number\ of\ buy\ transactions_{k,j,t}}{Number\ of\ buy\ transactions_{k,j,t} + Number\ of\ sell\ transactions_{k,j,t}}\ . \quad (3)$$

The buy/sell ratio is computed by taking the proportion of buy transactions by investor category for each ex-day event and then averaging over the 885 events. In essence, the ratio describes whether the median investor in a particular category is on the buy side or on the sell side of the market. Fig. 1 plots the ratios by investor category for all events and for the highest and lowest dividend yield quintiles.

The results for buy/sell ratios in Fig. 1 are well in line with the gross and net volume changes, and they are also consistent with the dynamic tax clientele explanation. Domestic investors with a preference for dividend income accelerate their buys before a stock goes ex-dividend and increase their sells after the stock has gone ex-dividend, while foreigners with a preference for capital gains increase sells cum-dividend and accumulate buys ex-dividend. A closer look at the data reveals that domestic financial corporations are rather active in ex-day trading, but the graph is flat in Fig. 1 because these investors trade in both directions in almost equal magnitude. Of 14,764 trades by domestic financial corporations around the ex-dividend day, in 1,296 cases, shares bought cum-dividend were sold ex-dividend within the 22-day window, whereas in 1,330 cases, a financial corporation sold shares cum-dividend and bought ex-dividend within the 22-day window.[3]

The change in the buy/sell ratio is especially pronounced for mutual funds, which sell stocks cum-dividend and buy ex-dividend. The change in the buy/sell ratio for mutual funds is most extreme in the highest dividend yield quintile, with an overnight change from 0.82 to 0.17. Nonprofit institutions such as municipalities, foundations, and religious institutions also trade around the ex-day, but the change in the buy/sell ratio is less pronounced for this group. This difference between mutual funds and nonprofit institutions in the magnitude of trade direction shift is likely due to differences in regulatory risk and incentives. By law, nonprofit institutions cannot engage in for-profit activities without jeopardizing their tax-exempt status. A mutual fund, on the other hand, is by law bound to act in the best interest of its shareholders, and its status as an untaxed entity does not depend on its trading behavior. Moreover, the incentives to perform in the mutual fund industry are likely to be considerably greater than those in the nonprofit sector. Given the median ex-day premium below unity, as reported in Table 1, untaxed investors must be either losing money or more active around the ex-day events with an ex-day premium above unity. The profitability of their trades is investigated in Section 5.4.

To put the magnitude of ex-day trading into yet another perspective, I investigate the number of overnight trades around the ex-dividend day. An overnight buy/sell (sell/buy) trade is defined as a roundtrip transaction in which an investor first buys (sells) shares on a given trading day and then sells (buys) any number of same shares on the following trading day.

Panels A and B in Fig. 2 graph the number of overnight trades around the ex-dividend day. The size of ex-day trades in comparison with other overnight trades is shown in Panel C. In Panels A and B, the number of overnight transactions increases sharply on the last cum-dividend day; mutual funds in particular are active in short-term sell/buy trading around the ex-day with their number of overnight transactions more than doubling. Panel C in Fig. 2 shows that short-term traders also take larger positions around the ex-dividend day. While the median value of an overnight position held by a household (mutual fund) is EUR 9,524 (EUR 198,125) in cases where a stock is going ex-dividend, the median value of an overnight position is only EUR 4,480 (EUR 96,902) on other trading days.

In an unreported analysis, I investigate whether buy/sell traders transact within a broader window than just on the last cum-dividend day and the first ex-dividend day (see, e.g., Allen and Michaely, 2004). To this end, I examine all observations in which an investor has a strictly positive change in the position of a stock going ex-dividend in the 11-day window before the ex-day, and an offsetting strictly negative change in the position in the 11-day window after the ex-day. The results indicate that there are six times more traders buying on the last cum-dividend day and selling on the first ex-day than on other trading days.

Taken together, two broad conclusions can be drawn from the market-level results. First, all analyses so far indicate that nonfinancial corporations and households shift sharply from the buy side on the last cum-dividend day to the sell side on the first ex-dividend day. The reverse is true for foreign investors and mutual funds. Both observations are consistent with the dynamic tax clientele theories, which predict that differences in tax rates drive trading behavior around the ex-dividend day. Second, the observed active short-term trading behavior of mutual funds is consistent with Kalay (1982), who argues that investors with low transaction costs and an equal preference for dividends and capital gains should engage in trading around the ex-dividend day, as long as the ex-day premium is not equal to unity.

But do the trading clienteles have an impact on the ex-day premium? Michaely and Vila (1995) show that the expected ex-day premium is the sum of two components: risk and the average risk-aversion-weighted dividend preference ratio of all agents trading around the ex-dividend day. Assuming constant absolute risk aversion across investors, as in Michaely and Vila (1995, p. 180), the first component of the expected premium can be expressed as a linear combination of the proportions of the various investor categories trading on the ex-day. In an unreported analysis, I regress the ex-day premium on the relative proportions of both trading volume and ownership, but find no robust evidence that trading or holding clienteles have an impact on the ex-day premium. This finding is at odds with Graham and Kumar (2006), who find modest evidence of a tax-induced clientele effect being compounded in stock prices. The controversy is most likely explained by the difference in statistical power: Graham and Kumar have data on almost 10,000 ex-day events, whereas my sample is limited to 672 events.

5.3. Profitability of overnight trading

Because as the tax code creates opportunities for mutually beneficial trading around the ex-day at the expense of the government, such trades could generate considerable overnight returns. However, returns from the overnight risky arbitrage are constrained by transaction costs.

I compute absolute returns from overnight trading around the ex-day under three different scenarios. First, I calculate returns without transaction costs and assume zero tax deductibility of capital losses generated by buy/sell trading, which is the case when an investor does not have enough capital gains to utilize the generated losses. Second, I assume that losses from buy/sell trading are not deductible, but investors must pay transaction costs. In the third scenario, I assume that investors must pay transaction costs, and losses are fully deductible. The typical transaction costs during the sample period vary from 0.00244% (for brokers that are members of HEX) to EUR 8.25 + 0.2% (for active private investors), and are described in Table 3.

Table 3 also reports the results for the profitability of overnight trading around the ex-day. The results indicate that nontaxable investors and foreigners, who mostly engage in sell/buy trading, are successful in generating positive returns, even after transaction costs. For domestic households and nonfinancial corporations, profitability depends on whether the investor is able to utilize the capital losses generated by buy/sell trading. So, short-term ex-day trading is profitable, on average, even after transaction costs. However, if the investor is unable to utilize the capital loss generated from an overnight buy/sell transaction, short-term ex-day trading is, on average, unprofitable.

Translated to overnight returns, the gains from overnight investments are considerable: in aggregate, an overnight risky arbitrage trade around the ex-day yields a 2% return after tax deductions and transaction costs. Nontaxable investors and registered foreigners achieve the highest returns, although this finding could be influenced, at least partially, by the rather modest number of observations. In contrast, households and nonfinancial corporations have below-average returns, a result that can be explained in two ways. First, even though domestic households and nonfinancial corporations have the same tax status as domestic financial corporations, Table 3 indicates that they generate smaller returns before transaction costs. Hence, domestic households and nonfinancial corporations are less likely to trade around ex-day events, which (from their perspective), have the most favorable ex-day ratios. Second, higher transaction costs to retail investors further bring down their net returns.

5.4. Determinants of ex-dividend day trading: investor-level analysis

The remainder of this paper investigates the factors that drive ex-day trades. The theoretical work in the ex-day literature concentrates primarily on the influence of taxes on trading incentives around the ex-day. Risk and transaction costs could also have an impact on trading decisions. I use an investor-level analysis to document which stocks investors choose for tax arbitrage around the ex-dividend day.

I model this choice with a logit regression by coding overnight buy/sell tax arbitrage trades as ones, and observations in a control group as zeros. For the control group, I pick all overnight trades not related to ex-day trading by the investors in my sample. Hence, I am comparing the determinants of ex-day trades against other overnight trades by the very same investors. The sample consists of 31,961 (initially 48,882) trades by nonfinancial corporations and households, and 37,042 (initially 48,592) trades by financial corporations. The unavailable observations are largely explained by the lack of past returns to compute betas. Descriptive statistics on the sample are given in Table 4.

The investor-level variables include the logarithm of market value for all shares in the portfolio one day before the trade, and the percentage weight of the traded stock in the portfolio one day prior to the trade. The variable for capital gains is defined as:

$$\text{Capital gains} = \frac{\text{Realized capital gains year to date}}{|\,\text{Realized capital gains year to date}\,| + \text{Value of portfolio}} \,. \qquad (4)$$

This variable measures the expected capital gains tax liability of an investor in the fiscal year of the trade, normalized by the investor's portfolio value. To avoid very high variation in the variable, the absolute value of capital gains is included in the denominator. Capital gains for the fiscal year can be calculated for a subsample of observations consisting of 2,653 out of 31,961 observations for domestic households and nonfinancial corporations. For financial corporations, the subsample comprises only 193 observations, and for this sample the results are not reported.[4]

The set of firm-level variables consists of dividend yield (dividend from the last fiscal year divided by the current market price of the stock), bid/ask spread [defined as 2(ask – bid)/(ask + bid)], beta (three-year historical weekly rolling beta), idiosyncratic risk (standard deviation of the residual term of beta estimation regression divided by the standard deviation of the market index during the same period), and standard deviation of the market index (estimated from daily market returns around the trade, using a window of [-10, 10]). I also control for year, gender, investor age, and the investor's log-number of overnight trades in the sample.[5] The reason for including the last variable has to do with the sample construction. An investor can engage in overnight ex-day arbitrage in a given stock usually only once a year, while the control observations are from all other trading days. This limited window for ex-day trading causes the probability of ex-day trading to also be a function of trading activity in my sample, which must be controlled for.

The results for the investor-level determinants of tax arbitrage activity are reported in Table 5. An investor's propensity to engage in tax arbitrage is positively related to dividend yield, and negatively related to transaction costs. Higher risk also deters ex-day traders.

Market volatility, beta risk, and idiosyncratic risk all diminish the probability that an investor will engage in overnight tax arbitrage. Based on inference from unreported marginal effects at the sample means, the results in all specifications indicate, consistent with Michaely et al. (1996), that idiosyncratic risk discourages trading more than beta risk. There is also evidence that investors are less likely to a trade stock around the ex-day when they already have a position in that stock, a finding that further supports the argument that idiosyncratic risk is a determinant of ex-day trading activity.

Using risk measures estimated from the national market index assumes that international capital markets are fully segmented. As a robustness check, I rerun all analyses with the

Datastream Europe Total Return Index and Datastream World Total Return Index as the market portfolio. The results are not sensitive to the change in market index. Furthermore, adding stock dummies to the regressions does not qualitatively change the results.

In addition to risk, transaction costs influence the investor's propensity to engage in overnight ex-day trading, a conclusion that has also been drawn earlier from aggregate volume data. The coefficient on the bid/ask spread is negative and significant at the 5% level or better in all regressions, except in the sample of trades by financial corporations. This finding for bid/ask spread conforms to the prediction of Boyd and Jagannathan (1994), who argue that transaction costs have an influence on the arbitrageur's decision to undertake ex-day trading, and also with Michaely et al. (1996), who show ex-day volume to be a decreasing function of transaction costs.

Wealthier and arguably more sophisticated investors are more likely to engage in overnight ex-day trading, as shown by the positive coefficient of portfolio value for both domestic households and nonfinancial corporations. Age dummies (unreported) exhibit almost a monotonic pattern; young investors tend to be financially savvier and trade more around the ex-day.

Nonfinancial corporate investors tend to trade more around the ex-day than domestic households. There is also evidence that they are less risk-averse: the results for beta and idiosyncratic risk, as well as for current holdings, are stronger for households than for corporations. For financial corporations, however, the results are rather modest. For the risk and transaction cost variables, the coefficients are much weaker approximately one-third to one-half of the magnitude in the sample of nonfinancial corporations and households. Because financial corporations trade very frequently (the sample median is 3,020 trades a year), it could be difficult to disentangle their motives for ex-day trades from the constant flow of transactions.

The last column in Table 5 reports the results from a regression that includes a variable for capital gains in the sample of nonfinancial corporations and households. An investor with large realized capital gains would be expected to have a greater incentive to generate tax-deductible losses by ex-day trading than an investor with no or negative realized capital gains. However, the capital gains variable does not capture this expectation: the coefficient is negative, but not statistically significant at conventional levels.

To sum up, my results provide strong support for dynamic dividend clientele theories: transaction costs, dividend yield, beta risk, and especially idiosyncratic risk influence trading decisions around the ex-day. Another way to investigate the determinants of ex-day trading is to study which firms attract the most tax arbitrage activity as a fraction of the total trading volume. This requires an analysis from the firm-level perspective, which I address next.

5.5. Determinants of ex-day trading: firm-level analysis

To explain which firms attract short-term trading on the ex-day, I use as a dependent variable the volume of short-term trading activity (buy/sell or sell/buy trades) divided by the total trading volume on the ex-day. In essence, this measure indicates the proportion of total trading volume that is related to overnight trading (either buy/sell or sell/buy) by domestic investors and registered foreigners. The variable averages 4% (buy/sell) and 1% (sell/buy), varies from zero to 100%, and is nonzero in 278 (buy/sell) and 276 (sell/buy) out of 479 cases. Further statistics on short-term arbitrage, along with firm-level descriptive statistics on the 479 stocks with sufficient data, are given in Table 6.

A priori, there are strong grounds for expecting the degree of short-term trading activity to be non-normally distributed. The expected ex-day ratio of firms that attract a nonzero degree of tax arbitrage activity should lie inside the no-arbitrage boundaries, which are determined by the dividend yield and transaction costs (Kalay, 1982). Similarly, there should also be many ex-day events with absolutely no short-term trading, as arbitrageurs would not expect to make a profit because of excessively high transaction costs and too low a dividend yield. This requirement for a non-negative level of tax arbitrage activity is consistent with Kalay, and creates a potential selfselection bias, for which I correct by modeling the proportion of tax arbitrage activity using Heckman's (1979) sample selection specification. I also include a firm size variable in the first stage to control for the fact that the smallest and most illiquid stocks generally do not attract any ex-day trading. The firm size variable is removed from the second stage of the Heckman estimation to ensure model identification.

The results, reported in Table 7, corroborate the findings from the previous investor-level regressions. Transaction costs are negatively related to the probability that a firm attracts a strictly positive volume of overnight transactions on the ex-day, and dividend yield, along with firm size, is positively related. In the second stage of the Heckman model, the proportion of short-term trades is not driven by any of the first-stage explanatory factors. The only unexpected result is the coefficient on beta in the first-stage probit estimates, which is positive and significant.

In Columns 3 and 6 of Table 7, a nonlinear specification is introduced to model the relation between dividend yield, transaction costs, and short-term trading activity. This specification is motivated by the functional form of no-arbitrage boundaries derived in Kalay (1982), which are determined by the quotient of dividend yield and proportional transaction costs, rather than by their linear combination. To estimate the nonlinear specification, I divide observations into 25 groups according to dividend yield and bid/ask spread, assign a dummy for each group but one, and re-estimate the first-stage probit regression. As shown in Table 8, the dummy coefficients decline almost monotonically from the highest dividend yield and lowest bid-ask spread quintiles to the lowest dividend yield and highest bid-ask spread quintiles. Hence, the joint effect of high dividend yield and low transaction costs, rather than an extreme value in either of the variables alone, generates short-term trading activity around the ex-day.

Overall, the firm-level results are consistent with the earlier evidence. In particular, the analysis shows that a high dividend yield and low transaction costs is necessary to attract a strictly positive amount of short-term trading. Otherwise, consistent with the prediction of Boyd and Jagannathan (1994), short-term traders do not enter the market. However, the variation in the fraction of short-term trades (Heckman's second-stage OLS) is not correlated with any of the variables explaining whether the volume of short-term trading activity is nonzero (Heckman's first-stage probit). This result could be driven by the low fraction of volume related to short-term trading: the total trading volume (dependent variable denominator) dominates the variation in the volume of short-term trading activity (dependent variable numerator).

6. Conclusions

This study documents which investors trade around the ex-dividend day and what determines their trading behavior. In addition to demonstrating that investors change the direction of their trades around the ex-day according to their tax status, I also show that investors engage in overnight trading around the ex-day if transaction costs are low and dividend yield high enough. Domestic taxable investors engage primarily in overnight buy/sell tax arbitrage, and nontaxable institutions are active in selling stocks cum-dividend and buying ex-dividend. Both trading strategies are profitable, even after transaction costs. This is exactly what should happen in a market with differential tax rates on capital income and with no short-term capital loss deductibility restrictions.

However, even in a country with few legal restrictions on ex-day trading, the majority of investors fail to understand the potential tax savings achievable by ex-day trading as only a small percentage of the total trading volume on the ex-day is attributable to short-term traders. This finding is consistent with earlier studies on individual trading decisions with respect to taxes. Evidence from the Finnish market in Grinblatt and Keloharju (2001, 2004), as well as from the United States (Barber and Odean, 2003; Graham and Kumar, 2006), indicates that although taxes matter in trading decisions, individual investors do not necessarily behave in a tax-optimal way.

Dynamic dividend clientele models do a fairly good job in predicting the trading behavior of domestic taxable investors. Market risk, dividend yield, transaction costs, and, in particular, idiosyncratic risk explain which stocks investors trade. The relevance of idiosyncratic risk also extends beyond the ex-day literature. Whether idiosyncratic risk affects security prices is debatable (see, e.g., Bali et al., 2005), but my results suggest that it has at least an impact on investor trading decisions.

My analysis shows that several investor groups take advantage of the differences in tax rates by trading around the ex-dividend day. Given this result, the search for one group on marginal investors could be misleading. So far, there is very little theory or empirical evidence of the interaction of various investor groups trading around the ex-day, although the work of Michaely and Vila (1995) and Dhaliwal and Li (2006) are steps in this direction. A natural extension of this study would be an analysis of the behavior of the various trading clienteles in the order book on the ex-day. This could shed more light on which investors set the market price when investors have different preferences for pretax dividend income and capital gains.

Footnotes

[1]The empirical work is voluminous and includes contributions by Eades, Hess, and Kim (1984), Lakonishok and Vermaelen (1986), Karpoff and Walkling (1988), Kato and Loewenstein (1995), Lasfer (1995), Green and Rydqvist (1999), Naranjo, Nimalendran, and Ryngaert (2000), Bell and Jenkinson (2002), Callaghan and Barry (2003), and Graham, Michaely, and Roberts (2003), to name a few.

[2]The Supreme Administrative Court of Finland resolved a precedent case in 2004 (KHO: 2004:8, 2725/2/02) for the deductibility of capital losses in an intraday transaction, where the same shares were sold to and bought from the same broker during the same trading day. The court deemed that no capital loss deduction could be made for shares bought back within the same day. This decision was handed down 15 months after the end of the sample period and did not concern a transaction in which shares were held overnight. Hence, it is unlikely the investors considered short-term ex-day trading to have potential legal implications.

[3]There are three reasons why financial corporations *appear* to be rather inactive around the ex-day. First, financial corporations act as market makers trading in both directions, even around the ex-dividend day. Second, corporations cannot utilize the tax loss from a buy/sell trade without having to book in a corresponding reduction of profit in the income statement. Third, Finland experienced a banking crisis at the beginning of the 1990s, which caused major financial corporations to have substantial tax loss carry forwards, which could be deducted in corporate taxation for up to ten years. Because of the existing tax loss carry forwards, financial corporations generally had no incentive to engage in buy/sell trading to generate additional losses. My evidence is consistent with Grinblatt and Keloharju (2004) who find that Finnish financial corporations do not usually engage in wash sales around the turn of the year.

[4]For details of capital gains calculation, see Grinblatt and Keloharju (2001). Because I measure the realized capital gains for the whole portfolio (unlike for individual stocks as in Grinblatt and Keloharju, 2001), any sale of stocks in the fiscal year with no purchase price available will obscure the information on the investor's total capital gains tax liability, which explains the rather small subsample (2,653 out of 31,961 observations).

[5]Although correlated with portfolio size ($\rho = 0.47$), including log-number of trades in the analysis does not signal any serious multicollinearity problems. The highest variance inflator factor statistics (VIFs) have values well under 5, where 10 is typically considered a critical value.

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Table 1
Firm characteristics and the ex-day premium
This table reports equal-weighted statistics on the sample of 672 ex-day events. From the initial sample of 926 ex-dividend dates, 254 events were excluded. These observations had nonidentical price data in HEX and FCSD files, or zero trading volume on the last cum-day and/or ex-day. In Panel A, *dividend yield* is the absolute value of the dividend divided by the share price on the last cum-dividend day, *volatility* is the annual standard deviation in the fiscal year of the observation calculated from weekly data, and *bid/ask spread* is defined as 2(ask-bid)/(bid+ask). *Average volume* is computed from daily volumes in the fiscal year of the ex-day event. *Beta* is calculated from weekly three-year historical observations by using the HEX Portfolio Yield Index as proxy for the market portfolio. Panel B reports the ex-day premiums, defined as $(P_{cum}-P_{ex})$/Dividend. For r_m *adjusted* premiums, the ex-day close price is corrected with the HEX Portfolio Yield Index return consistent with Elton and Gruber (1970). For ex-day premiums, the results are reported for the full sample (672 observations) and for a sample with the top and bottom 2.5% outliers removed. Reported standard deviations for sample means in Panel B are bootstrapped.

Variable	Min	Max	Mean	Median	St.dev.	Skew-ness	Kurtosis	N
Panel A: Firm characteristics								
Dividend yield	0.0009	0.39	0.04	0.03	0.001	5.24	42.37	672
Volatility	0.14	1.64	0.43	0.37	0.01	1.87	6.98	672
Average volume, EUR	370	625,000,000	4,889,851	298,266	1,573,637	13.35	188.59	672
Volume on the cum-dividend day, EUR	980	635,000,000	6,457,861	328,260	1,632,752	12.92	180.64	672
Volume on the ex-dividend day, EUR	980	522,000,000	5,495,895	261,176	1,350,126	12.44	170.04	672
Bid/ask spread on cum-dividend day	0.0002	0.17	0.02	0.01	0.00	2.49	11.36	661
Bid/ask spread on ex-dividend day	0.0002	0.20	0.03	0.02	0.00	2.17	8.53	652
Panel B: Ex-day premiums								
Full sample								
−r_m adjusted	-10.11	100.12	1.24	0.93	0.18	14.34	275.32	672
−Not r_m adjusted	-9.86	107.00	1.26	0.92	0.22	14.33	270.78	672
2.5% outliers removed								
−r_m adjusted	-5.75	24.95	0.97	0.93	0.07	7.13	91.29	638
−Not r_m adjusted	-2.55	25.10	0.93	0.92	0.07	8.16	109.86	638

Table 2

Gross and net trading volume around the ex-day by investor category

The table reports the equal-weighted average gross and net relative trading volume around the ex-dividend date. The proportion of gross volume is defined as the average of the buys and sells by investor category divided by total trading volume. The net proportion of trading volume for each investor category is calculated as (Volume of buy transactions – Volume of sell transactions) / Total volume. Event date 0 corresponds to the last cum-dividend day and event date 1 to the first ex-dividend day. The analysis uses 2,527,996 trades from 885 ex-day events.

Panel A: Gross volume

Event date	Domestic taxable investors			Domestic nontaxable investors		Foreigners
	Nonfinancial corp.	Households	Financial corp.	Mutual funds	Nonprofit institutions	
-3	0.123	0.280	0.088	0.025	0.038	0.446
-2	0.122	0.286	0.082	0.026	0.036	0.447
-1	0.131	0.282	0.085	0.029	0.029	0.444
0	0.158	0.262	0.089	0.052	0.031	0.406
1	0.155	0.256	0.105	0.050	0.028	0.407
2	0.119	0.298	0.094	0.021	0.035	0.430
3	0.118	0.270	0.097	0.018	0.035	0.456

Panel B: Net volume

Event date	Domestic taxable investors			Domestic nontaxable investors		Foreigners
	Nonfinancial corp.	Households	Financial corp.	Mutual funds	Nonprofit institutions	
-3	-0.015	0.026	0.004	-0.003	-0.006	-0.017
-2	0.003	0.036	-0.006	0.002	-0.005	-0.028
-1	-0.011	0.047	0.016	-0.019	0.002	-0.028
0	0.101	0.057	-0.009	-0.065	-0.010	-0.069
1	-0.098	-0.059	0.022	0.062	0.009	0.064
2	-0.031	-0.005	0.012	0.005	0.011	0.006
3	-0.029	0.012	0.012	0.004	0.005	-0.001

Table 3

Profitability of overnight trading around the ex-day

This table reports the profitability of overnight ex-day trading. The sample includes all overnight buy/sell transactions (an investor buys shares on the last cum-dividend day and sells on the ex-day) and sell/buy transactions (an investor sells shares on the last cum-dividend day and buys on the ex-day) around the ex-day between years 1995 and 2002. The columns *Tr. costs* and *Tax ded.* indicate whether transaction costs and tax deduction are included in the calculation of trading profit. Transaction costs are calculated by assuming a EUR 8.25 + 0.2% commission (smallest commission charged by an online broker) for households, nonfinancial corporations, and registered foreigners; 0.2% commission (most common commission agreement for institutional investors) for mutual funds and nonprofit institutions; and 0.00244% commission with maximum of EUR 75 (fee charged from brokers members of HEX) for financial corporations. Tax deduction is calculated for buy/sell transactions as MIN(Transaction price on the cum-day – Transaction price on the ex-day)*(Volume of shares traded) x Tax rate, 0). If an investor has multiple trades on the same trading day, the volume-weighted price is used. Furthermore, if the transaction volumes are not equal on the cum- and ex-dividend days, the trading profit is calculated for the smaller transaction volume. For absolute trading profits, all values reported below are in EUR. Relative trading profit from an overnight transaction is calculated by dividing the absolute trading profit by the value of shares traded on the cum-dividend day.

	Tr. costs	Tax ded.	Absolute trading profit from overnight buy/sell or sell/buy transaction							Relative trading profit from overnight buy/sell or sell/buy transaction		
			Mean	Median	St.dev.	Skew.	Kurt.	Min	Max	Mean	Median	N
Panel A: Taxable domestic investors												
Household	No	No	-509.10	19.00	7,332	-5.72	188.52	-144,253	118,313	0.0030	0.0025	1,484
	Yes	Yes	1,594.94	177.10	8,581	7.05	93.77	-78,636	124,909	0.0172	0.0158	1,484
	Yes	No	-824.54	-38.21	7,972	-6.97	182.84	-161,896	117,040	-0.0081	-0.0042	1,484
Nonfinancial corporation	No	No	-18,085.60	-0.03	472,618	-29.01	844.39	-13,800,000	185,900	0.0079	0.0000	850
	Yes	Yes	-6,402.31	485.84	334,026	-28.91	840.70	-9,712,376	200,446	0.0118	0.0075	850
	Yes	No	-20,241.13	-346.32	476,494	-28.99	843.76	-13,900,000	184,428	-0.0031	-0.0048	850
Financial corporation	No	No	8,533.67	119.89	51,819	13.74	238.43	-51,426	973,000	0.0188	0.0116	522
	Yes	Yes	10,058.68	498.68	51,760	13.68	237.50	-48,885	972,784	0.0261	0.0175	522
	Yes	No	7,939.44	64.84	51,816	13.74	238.70	-51,543	972,784	0.0176	0.0096	522
Panel B: Nontaxable investors and foreigners												
Mutual fund	No	No	13,594.95	6,264.99	22,364	4.06	24.70	-20,576	190,080	0.0470	0.0308	324
	Yes	No	13,544.70	6,248.02	22,347	4.07	24.74	-21,632	189,978	0.0468	0.0307	324
Nonprofit institution	No	No	13,387.23	3,827.82	40,526	1.07	9.52	-127,440	173,800	0.0712	0.0444	52
	Yes	No	11,283.71	3,528.40	41,794	0.12	10.67	-161,155	165,273	0.0672	0.0404	52
Foreigner	No	No	20,285.01	1,374.00	56,580	3.65	16.34	-4,617	310,310	0.0301	0.0364	54
	Yes	No	17,776.89	1,230.36	51,420	3.74	17.05	-10,954	284,917	0.0192	0.0264	54

Table 4
Descriptive statistics of the sample of tax arbitrage trades
This table reports descriptive statistics on the sample of tax arbitrage and other overnight (control observation) trades by domestic taxable investors. The investor-level statistics in Panel A are based on equally weighted data, where one investor is treated as one observation. The rest of the statistics are based on trade-weighted statistics, with one trade (aggregated on a daily basis) representing one observation. Statistics in Panel B and Panel C are reported for the combined sample of household and nonfinancial corporate investors with results reported in Column 1 of Table 5. Variables are defined in Table 5.

	Mean	Median	Std. Dev.	Skewness	Kurtosis	Min	Max	N
Panel A: Investor-level statistics								
Nonfinancial corporate investors								222
Financial corporate investors								48
Household investors								760
- of which males								623
- of which females								137
Age	42.98	42.00	13.31	0.10	0.27	2.00	91.00	760
Nonfinancial corporations								
Portfolio value, million euros	8.64	0.81	19.22	4.21	34.97	0.00	375.82	18,512
Weight in target stock	0.07	0.10	0.18	0.06	13.66	-1.00	1.00	18,512
Capital gains	0.02	0.00	0.34	0.34	6.74	-1.00	1.00	789
Number of trades	1318.49	794.00	1555.33	1.32	3.13	1.00	4431.00	18,512
Number of shares in portfolio	22.67	13.00	25.13	1.59	4.55	0.00	108.00	18,512
Financial corporations								
Portfolio value, million euros	41.70	9.85	77.10	3.44	20.48	0.00	1090.00	37,042
Weight in target stock	0.06	0.01	0.19	1.09	14.72	-1.00	1.00	37,042
Capital gains	0.05	0.02	0.10	1.65	13.34	-0.48	0.51	193
Number of trades	3274.51	3020.00	2249.42	0.44	2.09	3.00	7215.00	37,042
Number of shares in portfolio	41.32	37.00	22.64	0.74	3.09	1.00	107.00	37,042
Households								
Portfolio value, million euros	0.38	0.05	2.10	8.67	81.81	0.00	30.40	13,449
Weight in target stock	0.36	0.28	0.37	16.30	1277.61	-12.27	23.94	13,449
Capital gains	0.06	0.03	0.30	0.45	7.09	-1.00	1.00	1,864
Number of trades	145.95	81.00	145.02	1.13	3.22	1.00	574.00	13,449
Number of shares in portfolio	8.75	5.00	12.99	6.75	87.46	0.00	250.00	13,449
Panel B: Firm-level statistics								
Dividend yield	0.04	0.02	0.06	6.66	63.28	0.00	0.91	31,961
Bid/ask spread	0.01	0.00	0.01	6.24	90.96	0.00	0.40	31,961
Beta	1.12	1.01	0.58	0.25	2.14	-0.27	2.54	31,961
Idiosyncratic risk / St. dev. of market	2.02	1.93	0.69	2.13	17.99	0.00	9.16	31,961
Panel C: Other								
Daily standard deviation of market index	0.03	0.03	0.03	14.24	347.12	0.00	0.78	31,961

Table 5
Choice of arbitrage stock: stocks bought on last cum-day and sold on first ex-day
This table reports the results for the choice of tax arbitrage stock. The binary dependent variable has the value of 1 if an investor accumulates a position in a stock going ex-dividend on the last cum-dividend day and subsequently reduces the position in the same stock on the first ex-dividend day. The control group coded as zeros consists of all other overnight transactions by the same investors. *Beta* is estimated from weekly historical returns over a period of three years. *Idiosyncratic risk* is the residual term from the regression of *beta*, scaled with the standard deviation of the market index. *Dividend yield* is the cash dividend per share divided by last closing price, whereas *bid-ask spread* is defined as 2(ask-bid)/(ask+bid). *Ln* (*portfolio value)* is the natural logarithm of the portfolio value held by an investor on the day before the trading day. *Nonfinancial corporation* dummy has the value of 1 if the investor is a nonfinancial corporation, 0 if a household. *Weight in target stock* is the value of holdings in the traded stock divided by total portfolio value one day before the transaction. *Capital gains* is defined as (realized capital gains year to date) / (|realized capital gains year to date| + value of portfolio). *Ln* (*number of trades)* is the natural logarithm of the number of overnight trades the investor has in the sample. *Standard deviation of market index* is the daily standard deviation of the HEX Portfolio Yield Index calculated from a [-10, 10] window around the trade. Specification 1 is a logit regression with all observations for households and nonfinancial corporations. Specification 2 includes only households and also has a gender dummy and six age dummies. Specification 3 includes only nonfinancial corporations, and specification 4 includes only financial corporations. Specification 5 includes household and nonfinancial corporation observations for which the realized capital gains for the fiscal year are known. The reported results are estimated coefficients of the probability density function. There are no observations from year 1995 in specification 4. *t*-values are reported under coefficient estimates. *, **, and *** denote significance at 10%, 5%, and 1% levels, respectively.

Dependent variable		Binary: 1 if investor arbitrages a stock going ex-dividend				
		Logit				
Specification	Expected sign	HH and Nonf. corp.	Household	Nonfinancial corporation	Financial corporation	Capital gains available
		1	2	3	4	5
Constant	+/-	3.42***	4.00***	3.40***	-1.34**	4.71***
		16.80	*12.21*	*11.65*	*-1.99*	*9.41*
Nonfinancial corporation	+/-	0.25***				0.45***
		3.49				*2.67*
Ln (portfolio value)	+	0.05***	0.03*	0.07***	0.03	0.07***
		5.49	*1.89*	*4.79*	*1.20*	*3.11*
Weight in target stock	-	-1.04***	-0.09	-1.89***	-0.69	-1.68***
		-5.15	*-0.32*	*-6.48*	*-1.27*	*-3.09*
Capital gains	+					-0.06
						-0.26
Ln (number of trades)	-	-0.91***	-0.81***	-1.01***	-0.42***	-1.31***
		-43.85	*-28.01*	*-32.11*	*-8.14*	*-18.76*
Dividend yield	+	4.53***	4.08***	4.75***	1.71**	8.53***
		14.92	*7.80*	*12.16*	*2.39*	*7.81*
Bid/ask spread	-	-20.77***	-11.72**	-27.88***	-12.42*	-15.18**
		-6.24	*-2.51*	*-5.86*	*-1.70*	*-2.37*
Beta	-	-0.62***	-0.54***	-0.64***	-0.21	-0.53***
		-7.22	*-3.54*	*-5.97*	*-1.06*	*-3.23*
Idiosyncratic risk	-	-0.78***	-0.95***	-0.70***	-0.04	-0.54***
		-9.35	*-6.21*	*-6.91*	*-0.22*	*-4.39*
Standard deviation of market index	-	-59.08***	-82.50***	-43.01***	-47.45***	-81.35***
		-8.09	*-6.88*	*-4.46*	*-2.94*	*-4.15*
Year dummies		Included	Included	Included	Included	Included
Age and gender dummies			Included			
McFadden´s pseudo R^2		0.335	0.273	0.368	0.029	0.506
Chi-square statistic		4,222.85	1426.78	2612.03	85.32	1,262.02
Number of observations		31,961	18,512	13,449	37,042	2,653

Table 6

Descriptive statistics on firm characteristics and short-term ex-day trading

This table reports equal-weighted statistics on the sample of 479 stocks with results reported in Table 7. *Dividend yield* is the absolute value of dividend divided by the share price on the last cum-dividend day, and *bid/ask spread* is defined as 2(ask-bid)/(bid+ask). *Beta* is calculated from weekly three-year historical observations by using the HEX Portfolio Yield Index as a proxy for the market portfolio, and *book value of assets* is measured at the beginning of the year. *Number of buy/sell* (*sell/buy*) *trades* is the number of overnight transactions with a buy (sell) on the last cum-dividend day and a sell (buy) on the ex-day. Correspondingly, *volume of buy/sell* (*sell/buy*) *trades* is the total volume of buy/sell and sell/buy transactions. *Proportion of buy/sell* (*sell/buy*) *trades* is the volume of corresponding overnight trades divided by the total trading volume.

Variable	Min	Max	Mean	Skew-ness	Kurtosis	St. dev.	Median	N
Panel A: Stock characteristics								
Dividend yield	0.00	0.39	0.04	5.16	34.91	0.04	0.03	479
Bid/ask spread	0.00	0.20	0.03	2.18	5.95	0.03	0.02	479
Beta	-0.17	2.06	0.62	0.85	1.04	0.38	0.56	479
Book value of assets, MEUR	10.62	50,243.28	2,644.07	4.68	29.55	5,408.06	910.82	479
Panel B: Short-term ex-day trading								
Number of buy/sell trades	0.00	93.00	3.28	6.89	58.72	8.76	1.00	479
Number of sell/buy trades	0.00	36.00	1.97	4.05	29.40	3.23	1.00	479
Volume of buy/sell trades, EUR	0.00	3,208,400.00	71,889.11	7.50	65.42	275,766.85	1,000.00	479
Volume of sell/buy trades, EUR	0.00	5,796,400.00	145,613.35	6.49	49.58	534,109.85	1,240.00	479
Proportion of buy/sell trades	0.00	1.00	0.0399	6.06	43.40	0.11	0.00	479
Proportion of sell/buy trades	0.00	0.02	0.0102	0.95	0.37	0.00	0.01	479

Table 7

Firm-level regressions on volume of tax arbitrage

This table documents results for the degree of overnight tax arbitrage activity as a fraction of total trading volume. The results are reported for overnight buy/sell and sell/buy trading activity. The dependent variable is binary in specifications 1, 3, 4, and 6, taking the value of 1 if there is any overnight trading around the ex-dividend day, zero otherwise. Specifications 2 and 5 report results from the second step of Heckman's (1979) two-step estimation procedure, with a continuous dependent variable defined as ex-day overnight tax arbitrage trading volume divided by the total trading volume. In specifications 3 and 6, all observations are grouped into 25 groups according to their dividend yield and bid/ask spread with a dummy for each group except for one. *Ln* (*assets)* is the natural logarithm of total assets from the last reported fiscal year. All other variables are specified as in Table 5. *t*-values are reported under coefficient estimates. Asterisks mark significance at standard levels (***, **, and *, for 1%, 5%, and 10%, respectively).

Dependent variable:		Tax arbitrage activity on cum-dividend day					
		Proportion of buy/sell tax arbitrage			Proportion of sell/buy tax arbitrage		
Specification	Exp. sign	Probit	Heckman 2^{nd} stage	Probit w/ dummies	Probit	Heckman 2^{nd} stage	Probit w/ dummies
		1	2	3	4	5	6
Constant	+/-	-0.46	-0.04	0.65	-0.35	-0.05	0.68
		-1.01	*-1.15*	*0.95*	*-0.72*	*-0.42*	*0.97*
Bid/ask spread	-	-16.39***	-0.75		-20.76***	-0.004	
		-5.59	*-1.17*		*-6.02*	*-0.002*	
Dividend yield	+	4.56**	0.25		5.20***	0.14	
		2.51	*1.56*		*2.72*	*0.28*	
Beta	-	0.56**	-0.01	0.58**	1.25***	-0.01	1.29***
		2.11	*-0.30*	*2.04*	*4.07*	*-0.08*	*4.04*
Idiosyncratic risk	-	-0.24	0.01	-0.07	-0.40**	0.02	-0.38*
		-1.44	*0.79*	*-0.37*	*-2.08*	*0.31*	*-1.88*
Ln (assets)	+	0.11**		0.11**	0.12**		0.13**
		2.27		*2.24*	*2.46*		*2.55*
Standard deviation of market index	-	12.14	-0.54	-4.33	12.29	9.41	3.68
		0.49	*-0.25*	*-0.17*	*0.44*	*1.23*	*0.13*
Lambda			0.10**			-0.02	
			1.98			*-0.18*	
Year dummies		Included	Included	Included	Included	Included	Included
D/P and Bid/ask quintile dummies				Reported in Table 8			Reported in Table 8
Pseudo R^2		0.199		0.257	0.311		0.341
Adjusted R^2			0.095			-0.009	
Chi-square statistic		129.76	55.54	167.57	203.26	25.35	222.83
F-statistic			3.24			0.82	
Number of observations		479	278	479	479	276	479

Table 8
The effect of bid/ask spread and dividend yield on tax arbitrage
This table represents the coefficients of regressions 3 and 6 in Table 7. Lowest bid/ask and highest D/P quintile is the reference level with no dummy. *t*-values are reported in parentheses.

Panel A: Coefficient estimates–buy/sell tax arbitrage

D/P quintile	Bid/ask quintile				
	5 (Highest)	4	3	2	1 (Lowest)
5 (Highest)	-1.35 (-2.18)	-1.15 (-1.77)	-1.68 (-2.62)	-0.32 (-0.46)	Omitted
4	-1.58 (-2.61)	-1.57 (-2.52)	-1.47 (-2.33)	-0.96 (-1.57)	-0.36 (-0.54)
3	-2.56 (-4.12)	-1.46 (-2.32)	-1.89 (-3.24)	-1.62 (-2.71)	-0.64 (-1.03)
2	-2.02 (-3.22)	-2.00 (-3.37)	-1.76 (-3.07)	-1.71 (-2.70)	-1.81 (-2.91)
1 (Lowest)	-2.39 (-3.73)	-2.74 (-4.24)	-2.54 (-3.78)	-1.99 (-3.40)	-2.04 (-3.38)

Panel B: Coefficient estimates–sell/buy tax arbitrage

D/P quintile	Bid/ask quintile				
	5 (Highest)	4	3	2	1 (Lowest)
5 (Highest)	-1.19 (-1.89)	-0.72 (-1.05)	-1.16 (-1.67)	-0.63 (-0.96)	Omitted
4	-1.01 (-1.59)	-0.86 (-1.26)	-1.22 (-1.89)	-0.92 (-1.47)	-1.04 (-1.71)
3	-1.60 (-2.58)	-1.21 (-1.92)	-1.08 (-1.82)	-1.38 (-2.29)	-0.97 (-1.61)
2	-1.47 (-2.29)	-1.78 (-2.97)	-2.31 (-3.88)	-2.48 (-3.52)	-1.05 (-1.65)
1 (Lowest)	-2.29 (-3.53)	-2.85 (-4.13)	-2.13 (-3.14)	-1.93 (-3.23)	-1.88 (-3.03)

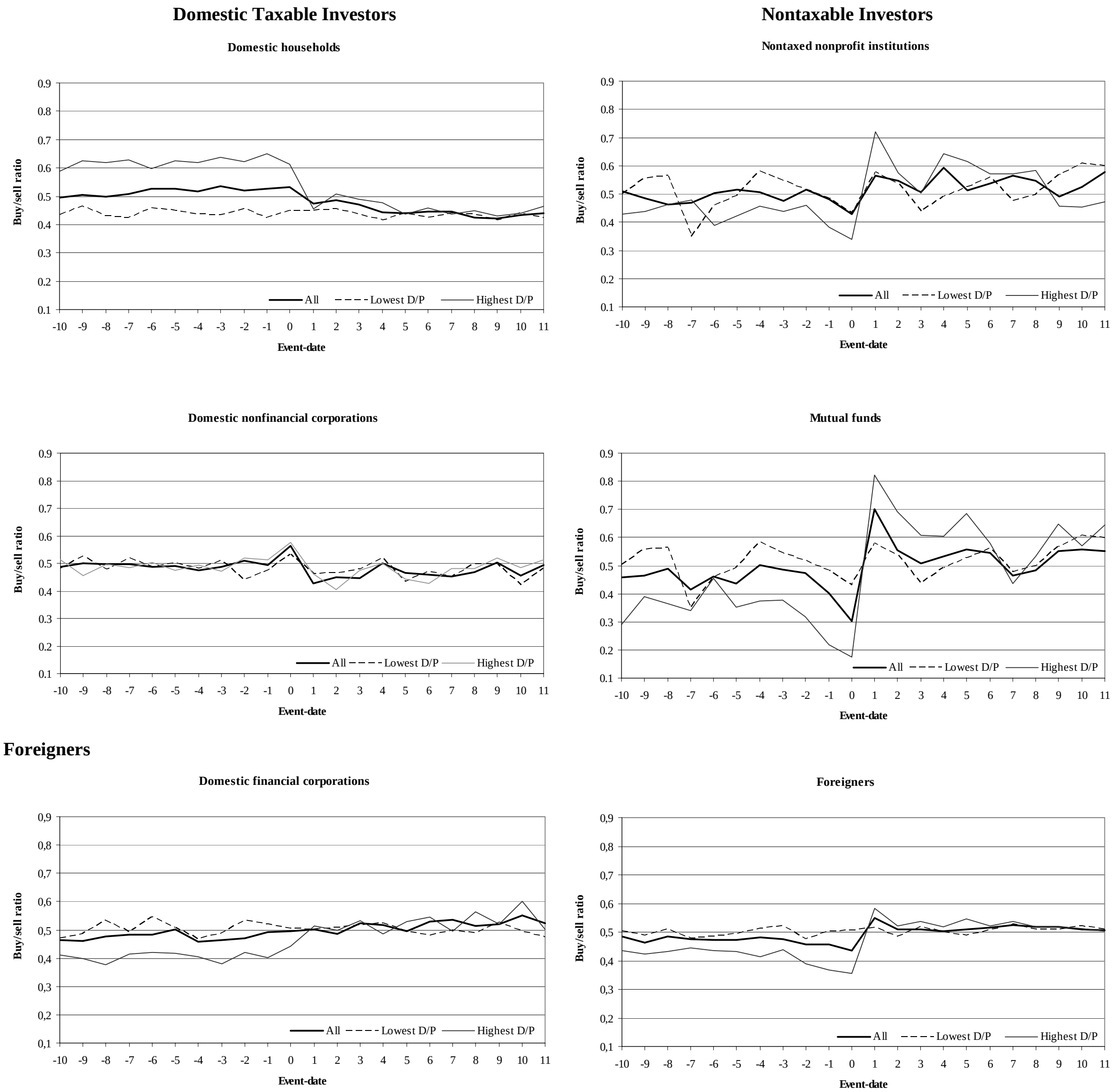
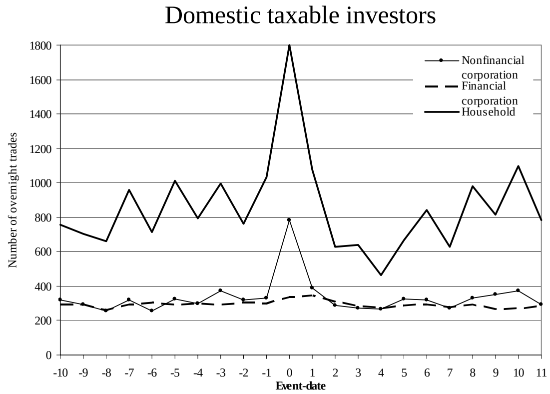
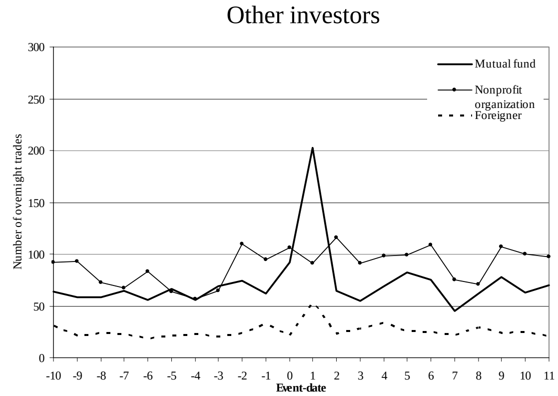


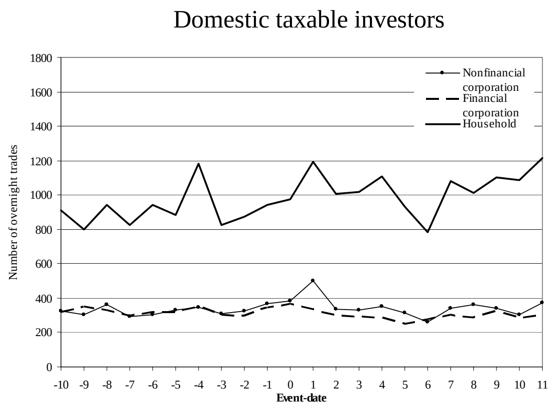
Fig. 1. Trading around the ex-dividend day by investor category. The figures plot the relative frequencies of buy and sell transactions by investor group around the ex-dividend day. The buy/sell ratio for an investor category is defined as (# of buy transactions)/(# of buy transactions + # of sell transactions) and is plotted on the y-axis, weighting each ex-dividend day event equally. Event date 0 corresponds to the last date a stock trades cum-dividend and event date 1 to the first date the stock trades ex-dividend. Results are reported for all events as well as for the lowest and the highest dividend yield quintile. The results are based on the full sample of 916 ex-dividend events. There are 885 ex-day events with at least one buy/sell ratio observation available around the ex-day. The total number of trades to compute the averages is 2,527,996.

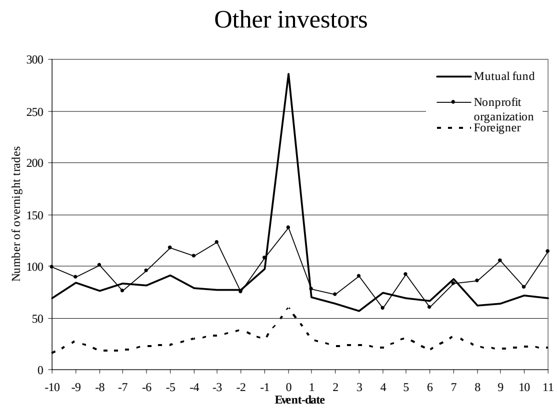
Panel A: Number of overnight buy/sell trades around the ex-dividend day



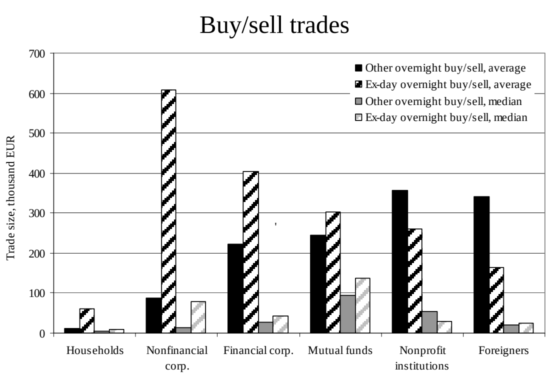


Panel B: Number of overnight sell/buy trades around the ex-day





Panel C: Trade size of overnight trades by investor category



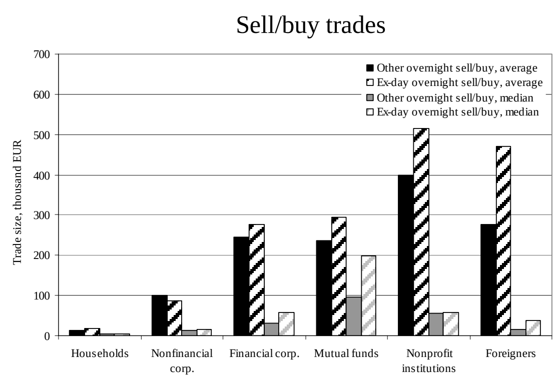


Fig. 2. Number and size of overnight trades. Panel A depicts the number of overnight buy/sell and Panel B the number of sell/buy trades around the ex-dividend day. Panel C illustrates the size of ex-day trades compared with other overnight transactions. The value of a position is calculated by multiplying the number of shares traded by the daily close price. The number of observations are 32,588 (domestic taxable investors) and 4,116 (other investors) in Panel A. The corresponding figures are 35,937 and 4,489 for Panel B. In total, there are 494,474 observations in Panel C. For the category of foreigners, only registered investors are included in the analysis.