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The Effect of Tax Heterogeneity on Prices and Volume around the Ex-dividend Day: Evidence from the Milan Stock Exchange

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To investigate the effect of taxation on stock price and trading volume around the ex-dividend day, we use the Italian stock market, where dividends on two classes of stock are taxed differently. We find that the weighted average of investors' tax rates is reflected in the ex-day prices and the variance of the relative tax rate across investors is reflected in the volume of trades. We also show that higher transaction costs result in higher ex-dividend day excess returns and lower abnormal volume. This finding is consistent with "profit elimination" activity by institutions and corporations.

Do differential taxes really drive prices and affect investors' behavior? The evidence to date is less than

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conclusive. The hypothesis is that, because individuals are more heavily taxed on dividends than on capital gains, other things being equal, a larger dividend yield is associated with a larger pretax return [Brennan (1970)]. Elton and Gruber (1970) and Litzenberger and Ramaswamy (1979), among others, find evidence consistent with this hypothesis. On the other hand, other researchers [Miller and Scholes (1982), for example], conclude that pre-tax returns are invariant to the dividend yield. In addition, Eades, Hess, and Kim (1984) document positive excess returns around nontaxable distributions, which cannot be explained by differential taxes, and Karpoff and Walkling (1990) and Boyd and Jagannathan (1994) present evidence consistent with the effect of institutional and corporate traders on ex-day prices. With only a few exceptions [e.g., Grundy (1985), Lakonishok and Vermaelen (1986), and Michaely and Vila (1995a,b)], much less attention has been devoted to a direct examination of the effect of differential taxes on investors' trading behavior through volume.[1]

In this article we investigate the effect of differential taxes on prices and investors' behavior by looking at the Italian stock market, which has a unique market structure and different dividend taxes on two classes of stocks. In Italy, savings stock dividends are taxed at a fixed rate of 15 percent for all market participants, whereas the tax rates on common stock dividends vary widely across market participants.[2] This gives us an unusual opportunity to examine the interaction between prices, volume, and the valuation of dividends in relation to capital gains across market participants. The homogeneous tax rate for the savings stocks precludes gains made from trading these stocks. Consequently, we would not expect to observe abnormal volume for these stocks around the ex-dividend day. Furthermore, the price decline relative to the dividend should reflect the consensus after-tax valuation of the dividends. In contrast, common stock dividends are taxed at various rates for different investors. This differentiation in tax rate should induce an abnormally high volume of trade because there are positive gains to be made from trades.

To study this phenomenon, we use a simple equilibrium model that accounts for the tax structure on savings and common stock dividends. Using data on investors' holdings in the Italian stock market, we calculate the predicted average price decline in relation to the dividend amount. The relative price decline for the savings stock sample

[1] See Allen and Michaely (1994) for a recent review of the ex-dividend day literature. See Kato and Loewenstein (1995) for a recent investigation of ex-day prices in the Japanese market.

[2] The difference between savings and common stocks is explained in detail below.

is almost identical to what the theory predicts (an actual relative price decline with a mean value of 0.86 versus a predicted decline of 0.85). Consistent with the tax structure, we detect no abnormal volume for these stocks during the ex-day period.

Interestingly, the relative price decline for the common stock sample is much lower than expected, with a mean value of 0.25. In fact, even if the entire trading population were the one that is most averse to dividends, the relative price decline should be no less than 0.372. This finding may be explained by the fact that holders of common stocks have to register with the tax authorities on the ex-dividend day. (Savings stocks are not subject to registration with the tax authorities.) Since the registration date for common stocks coincides with the ex-dividend day, individual investors who prefer to maintain their fiscal anonymity may choose to sell the stock before the ex-day and repurchase it immediately thereafter. Such trades result in a relative price decline between the cum- and the ex-day that is lower than predicted by the direct effect of the differential taxation of dividends and capital gains. We label this effect the *registration effect.* We also find that the trading volume around the common stocks' ex-dividend day is higher than normal.

Despite the registration effect, we present evidence consistent with significant tax-related trading around the ex-dividend day. Our primary evidence comes from examining block trading activity around this event. Since most block trading activity is done by institutions and corporations who are not subject to the registration effect (they do not have an incentive to maintain fiscal anonymity), an increase in block trading activity around the ex-day provides a strong indication that at least part of the trading activity is motivated by differential taxes. Consistent with the tax effect, we find significantly higher block trading activity around the ex-dividend day. We also find that block trading activity increases with yield (and at a higher pace than nonblock trades). These findings suggest not only that at least part of the trading around the ex-dividend day occurs because different investors face different taxes, but also that institutions and corporations have an active role.

We should note that several studies argue that the assumption of homogeneous valuation of cash flow across agents is not a good approximation [see, for example, Harris and Raviv (1993) and Bagwell (1991)]. In this light, our findings can be viewed as additional evidence that, at least around the ex-dividend day, prices and volume reflect agents' heterogeneous valuation of cash flow.

In addition to differential taxes, market activity around the ex-day is also a function of the transaction costs involved in the trades [see Constantinides (1986), Kalay (1982), Lakonishok and Vermaelen (1986),

Karpoff and Walkling (1990), and Michaely and Vila (1995b,c)]. Our results are consistent with the assertion that the low transaction costs stocks are subject to more tax-related trading. Also, we found that the ex-day excess returns on these stocks were lower than on stocks with higher transaction costs. Taken together, these results are consistent with the notion that, when transaction costs are lower, corporations and mutual funds take advantage of individual investors' desire to sell the stock before the ex-day (because of their preference for dividends over capital gains and because of the registration effect) and consequently reduce the excess return.

Overall, our results suggest that taxes are important in determining prices and volume around the ex-dividend day. As predicted by a tax effect hypothesis, abnormal volume is higher for securities with greater tax heterogeneity. Further, trading activity is higher for stocks with lower transaction costs. We also find that savings stocks' prices behave exactly as predicted by tax considerations; since savings stock dividends are taxed at a fixed rate of 15 percent and no taxes are imposed on capital gains, the average price decline equals the differential tax between dividends and capital gains. Our results suggest that taxes affect the ex-day return and that an inference from both price and volume provides better information about investors' trading motives and preferences than does an inference from prices alone.

The article is organized as follows. Section 1 discusses some relevant institutional aspects of the Italian stock market and the tax structure in Italy. Section 2 describes our hypotheses. Data and methods are described in Section 3, and the empirical results are presented in Section 4. The final section contains a summary and some concluding remarks.

1. Italian Stock Market: Institutional Aspects

1.1 Classes of stock and dividend payments

In the Italian capital markets, companies issue four types of equity securities: common, preferred, convertible savings, and nonconvertible savings. Common and preferred stocks are registered: the shareholder's name is listed in the company shareholders' book and provided to tax authorities. Holders of bearer stocks, in contrast, can maintain their anonymity. Savings stocks are bearer stocks.

Savings stocks were introduced in 1974 as part of a regulatory overhaul of the Italian securities market. Although these shares do not provide voting rights, they do provide a privilege for dividends and for assets in liquidation.[3] Listed companies can issue savings stocks

[3] See Zingales (1994) for a discussion of the effect of differential voting rights of common and

for up to 50 percent of the par value of equity. This offering can be either convertible or nonconvertible. Saving stocks have the right to receive a yearly dividend of not less than 5 percent of par value or the common stock dividend plus 2 percent of par value, whichever is greater. However, in some instances the dividend payment to the holders of the savings stocks exceeds this constraint.

In our 1981–1990 sample period, approximately 84.77 percent of the firms pay dividends in any given year, with the lowest number paying dividends in 1981 (64.40 percent) and the highest number in 1990 (92.17 percent). The average annual dividend yield, calculated as the total cash dividends over total market capitalization at the beginning of the year (including the zero dividend firms), is 3.13 percent, and the average payout ratio is 65.90 percent. Most firms pay an annual dividend (only two firms in our sample pay a semiannual dividend). A majority (86.28 percent) of the firms paying dividends in our sample years have an ex-dividend day in May, June, or July. November accounts for 3.97 percent of the ex-days, April for 3.57 percent, and no other month had more than 2 percent.

1.2 The taxation of dividends and capital gains

The Italian tax system is a complex set of rules and regimes for different classes of stocks and bonds. In the period covered by our study, the total taxation on corporate profits rose gradually from 36.25 percent to 46.37 percent. This taxation consists of a local tax (which rose from 15 percent to 16.2 percent) and a national tax (which rose from 25 percent to 36 percent) on earnings after local taxes.

Since 1977, taxes on dividends have been based on the imputation system, which allows stockholders to obtain a credit on the dividend tax payment. The tax credit has ranged from one-third of total cash dividends received to 56.25 percent, which permits total recovery of the corporate national tax. The tax-credit rule, therefore, reduces the double taxation of dividends on the national level that we observe in other countries (e.g., the United States) but does not eliminate the local tax. At the cash dividend payment date, common stock holders (both individuals and corporations) receive a net dividend of 90 percent, since 10 percent is withheld at the source as partial tax payment. Investors subsequently calculate their tax liability by grossing-up dividends with the tax credit. Personal taxes, distinct from corporate taxes, are progressive, currently ranging from 10 to 50 percent. There are no tax-exempt investors in Italy (unlike pension funds, university en-

savings stocks on the Milan Stock Exchange (MSE). This issue does not have any direct implication for our study.

Table 1
The Italian tax credit system on dividends[a]

A: Corporate taxation	
Profits	100.00
Local tax (ILOR) 16.2%	(16.20)
Earnings subject to national taxes	83.80
National tax (IRPEG) 36%	(30.17)
Net earnings available to shareholders	53.63

B: Dividend taxation for different classes of shareholders

	(1) Individual investor 1, 20% tax bracket	(2) Individual investor 2, 36% tax bracket	(3) Individual investor 3, 50% tax bracket	(4) Corporate investors	(5) Mutual funds
Cash dividend	53.63	53.63	53.63	53.63	53.63
10% withholding tax	5.36	5.36	5.36	5.36	5.36
Net dividend received	48.27	48.27	48.27	48.27	48.27
Personal tax (IRPEF) on the sum of gross dividend (53.63) plus tax credit (56.25% of 53.63 = 30.17)	(16.76)	(30.17)	(41.90)	(30.17)[b]	
Recovery of tax credit	30.17	30.17	30.17	30.17	
Recovery of withholding tax	5.36	5.36	5.36	5.36	
Effective dividend	**67.04**	**53.63**	**41.90**	**53.63**	**48.27**
Tax credit or (Net Tax)	18.77	5.36	(6.37)	5.36	(5.36)

[a] This table uses a simple stylized example to demonstrate the Italian tax credit on dividends. We consider a corporation that pays all profit as dividends and analyze the tax effect (including the imputation system) on several different claimholders. Withholding taxes are 10 percent of the dividend paid. Personal taxes are calculated as a percentage of the sum of the cash dividends plus the recovery (through the imputation system) of the national taxes paid by the corporation.

[b] Corporations do not pay the IRPEF (personal tax) but are subject to corporate tax (IRPEG) of 36%.

dowment funds, and foundations in the United States). In Table 1 we present an overview of the taxation of corporate profits and the Italian tax-credit mechanism, both for individual investors with different personal tax brackets and for corporate and mutual fund equity holders. Because of the imputation system, all investors in a tax bracket lower than 36 percent receive, in addition to the cash dividend, a cash rebate from the tax authorities. For such investors, the effective dividend tax rate is negative. For example, an individual investor with a marginal tax rate of 20 percent who receives a cash dividend net of withholding tax of 48.27 £ire will end up with an actual dividend of 67.04 £ire because of a tax refund of 18.77 £ire.

During the period of this study, there was no capital gains tax for individual investors. For corporate traders, capital gains are taxed as ordinary income and taxes on dividends are fully recovered, as illustrated in the fourth column of Table 1. A special tax system is provided for bearer savings stocks, which have a fixed, unique dividend tax of 15 percent, withheld at the dividend payment date.

Open-end mutual funds are subject to a different tax schedule. The 10 percent withholding tax on dividends is not refundable and is considered a final tax (Table 1, column 5). In addition, mutual funds pay a yearly property tax, based on the average monthly value of the portfolio, ranging from 0.10 percent for funds that are at least 55 percent invested in Italian industrial stocks to 0.25 percent for more diversified funds. Given these different tax regimes for mutual funds and individual investors, it seems that investors in high tax brackets may be better off buying securities through mutual funds than buying directly.

2. Theoretical Framework

We demonstrate how the Italian tax structure affects the relative valuation of dividends and capital gains and, consequently, prices and trading volume on the ex-dividend day. The following features of the Italian tax system and trading mechanism are relevant to our study: (1) separate tax schedules for dividends on common and savings stock; (2) the lack of a capital gains tax for individual investors; (3) the prohibition on brokers trading on their own accounts, which means they have no role in setting cum- and ex-day prices;[4] (4) the fixed tax on mutual funds' holdings and their 10 percent tax on common stock dividends and 15 percent tax on savings stock dividends; and (5) the imputation system. This tax regime results in three trading groups differentiated by their relative preference for dividends over capital gains: individual investors, corporations, and mutual funds.

Let α^i be the tax-induced preference for dividends relative to capital gains for investor i. Then, for the first trading group (the individual investors), ignoring imputed taxes, we can express α^{i^*} as

$$\alpha^{i^*} = \frac{1 - \tau_d^i}{1 - \tau_g^i} = 1 - \tau_d^i \qquad i = 1, \ldots, K,$$

where τ_d^i is the marginal tax rate on dividend income and τ_g^i is the marginal tax rate on capital gains (equals zero).

[4] A more detailed explanation of the trading mechanism on the MSE is provided in Appendix A.

Since investors are permitted to take a partial tax credit for corporate tax payments in calculating their tax liability, the effective tax rate on dividend income is substantially lower than it would be without the imputation system. Incorporating the imputation rate (τ_a), α^i becomes

$$\alpha^i = \left(1 - \tau_d^i\right)\left(1 + \tau_a^i\right) \qquad i = 1, \ldots, K. \tag{1A}$$

Corporations and institutional investors (excluding open-end mutual funds) also benefit from the imputation system, but they have to pay a capital gains tax at the same rate as their tax on ordinary income. Hence, their tax preference for dividend income can be expressed as

$$\alpha^i = \frac{(1 - \tau_d^i)(1 + \tau_a^i)}{(1 - \tau_g^i)} = (1 + \tau_a^i) \qquad i = K + 1, \ldots, M. \tag{1B}$$

The third group, the mutual funds, pays a fixed rate of 10 percent on dividend income:

$$\alpha^i = \frac{(1 - \tau_d^i)(1 - \tau_f)}{(1 - \tau_f)} = (1 - \tau_d^i) \qquad i = M + 1, \ldots, N. \tag{1C}$$

Here, τ_f is a fixed property tax, ranging from 0.10 percent to 0.25 percent of the market value of their holdings, depending on the fund's holdings of Italian industrial companies.

The majority of firms that pay dividends do so in the middle of May, June, or July. Hence, traders have only limited ability to hedge against unexpected movements in market prices. A trader who tries to "strip" the upcoming dividend is exposed not only to the idiosyncratic risk of the individual security, but also to the systematic market-wide risk as well. Moreover, the absence of a liquid derivative securities market prevents traders from reducing their risk exposure in a relatively inexpensive way. Using a simple model, described in Michaely and Vila (1995a), it is possible to show that in equilibrium the expected price decline in relation to the dividend reflects the average preference of all *traders*, weighted by their risk tolerance and wealth, and the risk involved in the ex-dividend day transaction.[5]

[5] The intuition behind this model is as follows: because of the risk involved in the ex-day trading, an investor equates the marginal benefit of trading (being more heavily invested in the dividend-paying stock if the investor's preference of dividends relative to capital gains is greater than the market's average preference, or the converse for investors that is averse to dividends) to the marginal cost (deviation from optimal risk sharing). Agents trade because they have heterogeneous valuation of dividends relative to capital gains (on an after-tax basis). This model incorporates the potential tradings of short-term, corporate and individual investors' desire to trade around the ex-dividend day. It differs from other models on this issue in several ways. First, it explicitly accounts for the risk involved in the trade, and therefore concludes that it is not arbitrage but equilibrium that determines prices and volume. Consequently, no trader will attempt to take an unlimited position in the stock, regardless of his tax preference. Second, because of the dynamic

Specifically,

$$E(\mathrm{Pr}) = \frac{P_c - E(P_e \mid P_c)}{D} = \bar{\mathrm{Pr}}^* - \frac{\nu}{D/P_c}, \tag{2}$$

where

$E(\mathrm{Pr})$ is the expected price decline in relation to the dividend amount (hereafter, "the premium"),
P_c is the cum-day price,
P_e is the ex-day price,
D is the dividend amount,
ν is the *risk* premium,

$$\bar{\mathrm{Pr}}^* = \frac{\sum_{i=1}^{N} K^i \alpha^i}{\sum_{i=1}^{N} K^i}$$

is the average of α_i $(i = 1, \ldots, N)$, weighted by the investors' risk tolerance, K^i.[6]

Our main interest is in $\bar{\mathrm{Pr}}^*$, the direct effect of differential taxes on prices. Therefore, we adjust the premium to the risk associated with the ex-dividend day trading.

To assess the effect of the tax-related trading on ex-dividend day pricing, Table 2 presents some possible combinations of investors' relative preferences for dividends over capital gains and their relative weight in the marketplace. To make the table more than just illustrative, we collect data on the actual proportional holdings of individuals, corporations, and mutual funds in the Italian market. (The holdings of the different groups are served as a proxy for their risk tolerance K.) The data were collected from the yearly publication of the Bank of Italy and *Il Calepino dell' Azionista* (Mediobanca).

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nature of the model, it is possible to derive volume as well as price behavior implications. As it turns out, the second moment of the heterogeneity distribution can be extracted from the trading volume around the ex-day. The model also allows for the existence of a tax clientele. For example, if a perfect tax clientele exists [such as in Elton and Gruber (1970)], the relative price drop will reflect the marginal preferences of this investor group. The abnormal volume would be zero, since there are no gains from trade (i.e., all investors in the clientele group are homogeneous in their valuation of dividends relative to capital gains). It should be pointed out, however, that because of the dynamic nature of the model, a clientele group is defined on the basis of *trading*, and not only on *holdings*. For example, say high yield stocks are *held* only by investors in low tax brackets, but around the ex-day, many of the stocks are bought by corporate investors (and sold back shortly thereafter). Then the model predicts that prices and volume will reflect the activity of both groups, and in fact a perfect *trading* clientele does not exist in this case. See Michaely and Vila (1995a) for a detailed exposition.

[6] The model is derived under the assumption of constant absolute risk aversion. When constant relative risk aversion is used, the weights are a function of investors' wealth.

Table 2
Expected premium according to the tax effect hypothesis[a]

	Individual investors		Corporations		Mutual funds		
	α^I	W^I	α^C	W^C	α^M	W^M	Expected premium $\bar{P}r^*$
				A: Common stocks			
(1)	0.372 (72%)	0.41	1.33 (33%)	0.59	(—)	0.0	0.937
(2)	0.372 (72%)	0.20	1.33 (33%)	0.80	(—)	0.0	1.138
(3)	0.372 (72%)	1.00	1.33 (33%)	0.00	(—)	0.0	0.372
(4)	0.590 (62%)	0.41	1.56 (56%)	0.53	0.9 (10%)	0.06	1.123
(5)	0.590 (62%)	0.20	1.56 (56%)	0.70	0.9 (10%)	0.10	1.300
(6)	0.590 (62%)	0.80	1.56 (56%)	0.10	0.9 (10%)	0.10	0.718
				B: Savings stocks			
(7)[b]	0.85	W^I	0.85	W^C	0.85	W^M	0.85

[a] The expected premium is calculated for some possible values of the relative valuation of dividends with relation to capital gains by three trading groups: individual investors, corporations, and mutual funds. The weights to each group (W^I, W^C, W^M) are determined according to the actual weight of these investors in the marketplace, collected from the yearly publication of the Bank of Italy and Il Calepino dell' Azionista. The first three rows describe the environment in the Italian stock market before mutual funds entered the market. The weights in rows (1) and (4) are the relative wealth of these trading groups. The weights in rows (2) and (5) account for the possibility that individuals' weight in the stock market is lower than their relative wealth in the economy. Rows (3) and (6) describe an extreme scenario, where individuals are the most dominant traders in the market place. α^I, α^C, and α^M are the relative after-tax valuations of dividends of individual investors, corporations, and mutual funds [Equations (1A), (1B), and (1C)]. The relevant marginal tax rates for computing the relative valuation of dividends are in parentheses. Individual investors' tax rates are represented by the highest marginal tax rate for the relevant time period. In panel B, we calculate the expected premium for the savings stocks sample according to the tax effect hypothesis.

[b] Since the relative preference for dividends versus capital gains is equal across groups, the expected premium equals 0.85, regardless of the relative weights of the different tax groups.

First, consistent with Zingales' (1994) study, we find that the mean holding by the largest shareholder in the years 1980–1990 is 57.8 percent (Zingales reports a mean holding of 52 percent). Second, during the same time period, the largest 12 business groups hold, on average, 80 percent of the total market value of all listed firms. Third, Bank of Italy publications show that, in the years 1984–1990, families held 40.9 percent of the value of (reported) wealth in the Italian economy, corporations held 53.2 percent, and mutual funds held 5.9 percent of this value. Given the structure of the Italian economy, the actual weight of individuals in the stock market is less than 40.9 percent. In addition, officials claim that mutual funds trade significantly more than their proportional holdings, and corporations trade less than their propor-

tional holdings, mainly because of control issues. (Despite our efforts, we could not find any available data on the actual trading weights of these groups, but only on their holdings.)

Using this information, we calculate some possible values of the adjusted premium, $\bar{Pr}^*$, for the common and savings stocks. The first three rows of Table 2 describe the environment in the Italian stock market before mutual funds entered the market (1981–1983 and most of 1984). In this period, the mutual funds' weight, W^M, is set to zero.

We describe three potential scenarios. In the first row, individuals have a weight of 41 percent and corporations have a weight of 59 percent, similar to their relative wealth as reported by the Bank of Italy. In the second row of the table, we assign a weight of 20 percent to individuals and 80 percent to corporations. We base this on the fact that individuals' weight in the stock market is significantly lower than it is in the entire economy. As the weight shifts from individuals to corporations, the expected premium increases from 0.937 to 1.138. In the third row, we report the calculation of the premium under the extreme assumption that individual investors are the only traders around the ex-dividend day. With a marginal tax rate of 72 percent, the implied premium is 0.372. This premium value is the absolute minimum value of premium that can be explained solely by the differential taxes between dividend and capital gains.[7]

Several changes occurred in 1984: mutual funds entered the stock market, the corporate tax rate increased to 46.37 percent, the individual maximum tax rate was reduced to 62 percent, and the imputation rate increased to 56.25 percent. We describe the potential effect of these changes in rows 4 through 6 of Table 2. As before, we assign different weights to the various trading groups and examine the effect on the expected premium. Both corporations and mutual funds have a stronger tax incentive to hold the stock on the ex-day than do individuals; hence, the expected premium is higher than in earlier years. When individuals, corporations, and mutual funds have a weight of 41 percent, 53 percent, and 6 percent, respectively (in line with their relative holdings), the expected premium is 1.123. When we assume that mutual funds' trading weights are greater than their proportional holdings and that individual investors have a weight of 20 percent (row 5), the resulting premium is 1.300. If individuals trade more than their market share and corporations trade less, the expected premium

[7] From a pure tax perspective (ignoring factors such as diversification and liquidity considerations), individual investors in tax brackets above 42.5 percent are better off holding savings stocks than common stocks, at least around the ex-dividend day, whereas corporations should not have any desire to hold savings stocks. Changing the marginal tax bracket of individuals to 42.5 percent results in an expected premium higher than that described in Table 2.

drops (comparing rows 5 and 6). Finally, in panel B, we calculate the expected premium for savings stock. Since all market participants face the same tax rate on savings stock income, the expected premium is 0.85 regardless of the relative sizes of the various tax groups.

By observing the premium alone, we can infer only the weighted-average relative tax rates, not the entire distribution of tax rates for the trading population. As shown in Michaely and Vila (1995a), the second moment of the distribution can be extracted from the volume behavior on the ex-dividend day. Consider the following example: assume that the mean premium is 0.9. This result could be achieved in different ways: (1) mutual funds are the trading group that sets prices (see Table 2) (i.e., only mutual funds trade around the ex-dividend day) or (2) a particular equilibrium prevails in which all trading groups participate in the ex-dividend trading. For example, suppose individual investors with a marginal tax rate of 62 percent have a market weight of 0.426, corporations with a marginal tax rate of 46.37 percent have a market weight of 0.2, and mutual funds with a marginal tax rate of 10 percent have a market weight of 0.374. This market composition will also result in an average premium of 0.9. The only way to distinguish between the two scenarios is by incorporating volume into the analysis. In the first case, there are no gains from trade and consequently no excess volume is observed around the ex-day. In the second case, there are gains from trade, excess volume is observed, and a particular equilibrium point is at a premium equal to 0.9. More formally,

$$AV = \frac{1}{2}\left\{D\sum_{i=1}^{N}|(\alpha^i - \bar{\alpha})(K^i/\sigma^2)|\right\}, \tag{3}$$

where AV is the abnormal trading volume on the ex-dividend day and σ^2 is the price variance. The trading volume is positively related to the tax heterogeneity in the economy. In the first example, all agents face the same relative tax rates on dividends and capital gains ($\alpha_i = \bar{\alpha}$), and the distribution of dividends will not generate any excess trading volume. As the difference across investors widens (second example), the amount of trade increases.

The inference about the tax distribution from both price and volume is particularly important in comparing the characteristics of common and savings stocks. For common stocks, we do not have any a priori reason to believe that the trading population values dividends in the same way. For savings stocks, on the other hand, the same tax rate is imposed on the entire trading population. Consequently, we expect significantly higher volume for common stocks around the ex-

dividend day and ex-day volume that is insignificantly different from normal for savings stocks.[8]

Another factor not captured by the model may influence behavior on the ex-dividend day: namely, the ex-day is also the date on which the stock owner must be registered with the tax authorities. Since owning stocks is considered a sign of wealth, individual investors may prefer not to be known to hold equity by the tax authorities, who then may investigate whether the investors pay taxes on their entire income.[9]

3. Data and Methods

3.1 Data

Our sample contains all common and nonconvertible, bearer-savings, dividend-paying stocks traded on the MSE between 1981 and 1990. Price and volume data are obtained from a database constructed by the Department of Business Research at the University of Pavia. Ex-dividend dates and dividend amounts are obtained from the publications of the MSE. For any given stock, an ex-dividend day is excluded if it coincides with other corporate events such as stock dividends, splits, or subscription rights. Also, events whose prices were missing on the cum-day or the ex-day are excluded. The final sample contains 1663 cash dividend distributions, of which 1236 are paid on common stocks and 427 on saving stocks.

Block trading has been officially monitored since January 1992. We were able to obtain the monthly block trading activity on all stocks traded on the MSE for the period February through September 1992. The data source is the *Listino Ufficiale*, the official publication of the MSE. For most stocks, a block is defined as a trade with a value over 200 million £ira (approximately $125,000). But the definition can vary somewhat across stocks, depending on their average trading volume.

3.2 Methods

We use both the adjusted premium and excess return to measure price reaction to the payments of cash dividends. Although the premium offers more economic intuition about the relationship between relative taxes and price movement on the ex-day, it suffers from the problem

[8] Even without differential taxation on savings stocks, some of the ex-day trading on the common stocks may be hedged by trading in the corresponding savings stocks. As we discuss in Section 4.2.2, we do not find significant hedging activity using savings stocks.

[9] The "grey" economy (i.e., transactions that are not reported to the tax authorities so that tax is not paid on them) in Italy is quite large, estimated at about one-third of the GNP. For example, Bernardi (1989) estimates that, in 1984, individual investors declared only two percent of their taxable investment income.

of heteroskedasticity [see Lakonishok and Vermaelen (1986), Barclay (1987), and Michaely (1991)]. Therefore, we also use the excess return as a measure of performance.

We adjust for the risk involved in the ex-dividend day trading by using the ordinary least squares (OLS) market model as in Brown and Warner (1985). By adjusting prices to the general market movement, we account for the different settlement intervals of the cum-day and ex-day as well (see the Appendix for an explanation concerning the different settlement intervals).

We use the value-weighted index of the MSE (MIB Storico) as the market index. Using the Scholes-Williams (1977) procedure, we estimate the model's parameters from days −35 to −6, and +6 to +35, where day 0 is the ex-dividend day. Because the ex-dividend days are clustered, the t-statistics are calculated under the assumption of cross-sectional dependency.

To calculate the abnormal trading volume, we first calculate the expected daily volume (in millions of £ire) using the OLS market model and data from the estimation period. We then estimate the abnormal volume as the difference between the actual and the predicted volume for security i at day t:

$$AV_{it} = V_{it} - E[V_{it}], \tag{4}$$

where

AV_{it} is the abnormal value for security i at day t,
V_{it} is the actual volume of security i at day t, and

$$E[V_{it}] = \hat{a}_i + \hat{b}_i V\,\mathrm{MKT}_t$$

($V\,\mathrm{MKT}_t$ is the daily total volume on the MSE.)

4. Empirical Results

4.1 Prices and volume around the ex-dividend day

Table 3 compares the value of the two relative price change statistics, the adjusted premium, and the excess returns for 1981–1984 and 1985–1990, as well as the entire 1981–1990 period. The results are reported for the common stocks in the first column and for the savings stocks in the second column. Most of the dividend payments occurred in the second period: 898 for common stocks and 363 for savings stocks. It is evident that the market has a strong aversion to common stock dividends. The mean premium is 0.250 in the years 1981–1990, and the excess return on the ex-dividend day is 1.670 percent, significantly different from zero at the 1 percent level. The

two subperiods show the same pattern: the premium is significantly below one (0.213 for 1981–1984 and 0.264 for 1985–1990), and the excess return is significantly above zero (1.735 and 1.645 percent for the first and second subperiods, respectively). A test statistic of the difference (last row) reveals that the premiums are insignificantly different from each other in the two subperiods ($t = 0.363$). The mean premium of 0.250 is significantly lower ($t = 2.40$) than the *minimum* premium of 0.372 predicted by differential taxes alone (see Table 2).[10] In fact, given the Italian tax structure, there is no feasible combination of traders that results in a mean premium of 0.250. These results are consistent with the compounding effect of the registration hypothesis, which predicts that individual investors prefer not to hold the stock on the ex-dividend day for reasons not directly related to the distribution of cash dividends. Since the registration day coincides with the ex-dividend day, these investors sell the stock before the ex-day.

Since savings stocks are bearer stocks, we do not expect to observe any registration effect, and traders do not have a motive to trade the savings stocks around the ex-dividend day to preserve their fiscal anonymity. The most important feature of the savings stocks is the homogeneous taxation of dividends across investors. According to the tax effect hypothesis, there are no incentives to trade under such a tax schedule, and the price decline relative to the dividend paid should be equal to relative taxation of dividends to capital gains. Indeed, as reported in Table 3, column 2, the mean premium for the savings stocks is 0.860 for the entire period, significantly different from one at the 1 percent level. There is no significant difference in the mean premium between the first and second subperiods. Without the registration effect, the predicted mean premium (Table 2, row 7) and the actual mean premium are almost identical: 0.850 compared with 0.860 (the t-statistic of the difference is 0.20).[11]

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[10] It should be noted that the empirical estimate of the premium is adjusted for risk; therefore, we compare it to $\bar{P}r^*$.

[11] We adjusted the premium to the heteroscedasticity problem directly [see Lakonishok and Vermaelen (1986) and Michaely (1991)]. The results are similar to those of the unadjusted premium. The corrected premium is 0.39 for the common stocks and 0.89 for the savings stocks. It is worth noting that the corrected premium for the common stock sample is slightly above the minimum premium of 0.372 predicted by differential taxes alone. It is still unlikely that differential taxation is the sole explanation of our findings. We also calculate the excess return in the 11 days around the ex-dividend day (from day −5 to +5, where day zero is the ex-dividend day), for both the common and savings stocks. For common stocks, the only day that shows a positive, significant excess return is the ex-dividend day itself ($t = 19.83$). Except on day −2, the excess returns are insignificantly different from zero. Because of the very large excess return on the ex-day itself, however, the cumulative excess return in this period is positive and significant. Savings stocks show a positive mean excess return on days −2 and 0, and a negative mean excess return on days 3 and 4. Overall, the cumulative mean excess return around the ex-day is positive but insignificantly different from zero.

Table 3
Estimates of the ex-dividend price changes[a]

	Common stocks	Savings stocks
A: (1981–1990)		
Premium	0.250	0.860
	(−14.7)	(−2.89)
Excess return (%)	1.670	0.392
	(19.83)	(3.47)
Number of observations	1236	427
B: (1981–1984)		
Premium	0.213	0.691
	(−6.03)	(−3.12)
Excess return (%)	1.735	0.9
	(10.27)	(4.01)
Number of observations	338	64
C: (1985–1990)		
Premium	0.264	0.890
	(−14.64)	(−2.04)
Excess return (%)	1.645	0.231
	(17.67)	(1.82)
Number of observations	898	363
T-statistics of the difference[b]	0.363	1.46

[a] Price changes between the cum- and ex-dividend day in relation to the dividend (the premium) and the ex-dividend day excess return for a sample of stocks on the Milan stock exchange in the years 1981–1990. The sample is separated into common and savings stocks, for which the relative taxes on dividends and capital gains are different. We report the mean premium and excess return as well as the *t*-statistics (in parentheses), testing the null hypothesis that the mean premium equals one and the mean excess return equals zero, for the entire sample period and for two subperiods. Tests are conducted under the assumption that the events are cross-sectionally dependent.

[b] Tests whether the mean premium in the period 1981–1984 is different from that in 1985–1990.

Knowledge of the price movement around the ex-dividend day is insufficient to determine the tax distribution of traders. The volume statistic provides information about their tax heterogeneity. In Table 4, we report the excess volume for the common and savings stocks in the 11 days around the ex-dividend day. Because of data unavailability, the volume sample starts in 1984 instead of 1981. For the common stocks, significant excess volume is detected on days −2, −1, and 0. The mean trading volume on the cum-dividend day is more than 25 percent higher than the average trading volume and more than 15 percent higher on the ex-day.[12] These findings are consistent with the

[12] The clustering of the event may elevate the daily total volume in the overall market. Consequently, our measure of abnormal volume (eq. 4) may be downward biased which may result in accepting

Table 4
Abnormal volume on the Milan stock exchange around cash dividend distributions[a]

Day	Common stocks (995 obs.)		Savings stocks (381 obs.)	
	Abnormal volume	*T*-statistic	Abnormal volume	*T*-statistic
−5	−13.49	−0.30	13.77	0.79
−4	19.17	0.42	17.60	1.01
−3	18.64	0.41	−0.47	−0.03
−2	88.61	1.98	20.48	1.17
−1	226.36	5.01	31.85	1.82
Ex-day	153.77	3.40	2.43	0.14
+1	34.39	0.76	30.98	1.77
+2	17.13	0.38	−7.71	−0.44
+3	17.72	0.39	1.39	0.08
+4	−7.74	−0.12	−9.34	−0.53
+5	14.88	0.33	−2.89	−0.17

[a] The table reports abnormal volume for common and savings stocks and its significance for the 11 days surrounding the ex-dividend day. The abnormal volume (AV) is the volume above the volume predicted by the OLS market model. *T*-statistics are calculated assuming the events are cross-sectionally dependent. The sample contains all ex-dividend day events in the period 1984–1990 in which there are no other corporate events such as stock dividends or distribution of rights issues.

idea that tax heterogeneity within the trading population provides the opportunity for gains from trade. They are also consistent with the registration hypothesis.

The savings stocks sample (Table 4, column 2) does not show significant excess volume in any of the days surrounding the ex-dividend day or on the ex-day itself. These results are consistent with homogeneous preferences for savings stock dividends relative to capital gains across investors. Such preferences imply that, because no gains can be made from trades, there is no significant excess volume.

4.1.1 Tax effect versus registration effect. The empirical results presented in the previous section show that, when all investors face the same relative tax rate on dividends and capital gains (the savings stocks sample), the average ex-day price decline equals the after-tax dividend amount. When traders face heterogeneous valuation of dividend and capital gains, as is the case with common stocks, the observed ex-dividend day volume of trade is significantly higher than the

the null hypothesis of no abnormal volume too frequently. We, therefore, use an alternative measure of abnormal volume which does not use the market volume on the right hand side. Specifically, $AV_{it} = V_{it} - \bar{V}_i$, where $\bar{V}_i$ is the mean daily volume for security i in the estimation period (day −35 to −6 and +6 to +35, where day zero is the event day). Using this method the cumulative abnormal volume for the common stock sample in the 11 days around the ex-day are about 20% higher than what is reported in Table 4. Most of the difference is a result of much higher abnormal volume on the cum-day. It is important to remember, however, that this procedure does not account for the difference between the settlement intervals of the cum-day and ex-day trading, while the OLS market model does. See Appendix for details.

average daily trading volume and the average price decline is smaller than the dividend amount. The confounding registration effect present in the common stock sample, however, implies a price and volume behavior similar to that documented above. Moreover, a relative price decline of 0.250 of the dividend amount gives a strong indication that the "registration aversion" by individual investors has at least some effect on ex-dividend day prices. It is useful to examine whether the entire activity in the common stocks around the ex-dividend day is due to the registration effect.

We suggest two ways to analyze whether the tax effect has significant influence on prices and trading activity around the ex-dividend day. A direct way to isolate the effect of the differential taxes (as opposed to the registration effect) is to analyze the activity of investors who are not affected by the registration effect: the institutional and corporate investors. As it is in the United States, the vast majority of block trading activity on the MSE is done by institutions and corporations rather than by individual investors. Since these traders are not affected by the registration effect, examining their activity can help us determine whether the tax effect has a significant effect on traders' activity. Because of data limitations, our sample contains block trades executed on the MSE between February and September 1992. The overall block trading activity on the MSE in those eight months of 1992 is described in Table 5. There were 2419 block trades involving common stocks and 521 trades involving savings stocks, with a combined value of over 8000 billion £ire. A comparison of Table 5, panels A and B, reveals that the proportion of block trades (either in number of blocks or in their £ire value) in the ex-months of dividend-paying stocks is much larger than in any other month. In the common stock sample, over half of the total block trading activity is done in the ex-dividend month for the ex-dividend stock.[13]

We see further evidence of the influence of differential taxes between dividends and capital gains taxes on block trading activity when we examine the sensitivity of block trades (both frequency and amount) to the dividend yield. If the tax effect is at work, then block trading activity should increase with yield. We divide the sample into three yield groups and then calculate the market value and number of blocks for the ex-months and non-ex-months. The results are presented in Table 6. For the ex-months, the block trading ac-

[13] If dividend announcement occurs just before the ex-dividend day, it is possible that the higher block trading activity in the ex-dividend month is due to the information contained in the announcement of dividends rather than to the tax effect associated with dividend payments. However, in our sample, the median distance between the announcement and the ex-dividend day is 55 trading days, almost three months apart. Such a long time period between announcement and the ex-day makes this explanation unlikely.

Table 5
Block trading activity on the Milan stock exchange, February–September 1992[a]

	Number of stocks	Number of blocks	Market value of block trades (in billions of £ire)
A: MSE stocks February–September 1992			
Common	170	2419	7089.21
Savings	52	521	1072.76
Total	222	2940	8161.97
B: Only ex-dividend month block trades (for ex-month stocks)			
Common	133	1281	4772.20
Savings	42	190	580.57
Total	175	1471	5352.77

[a] Panel A documents the block trades activity (number of blocks and their market value) by stock type (common and savings) in February–September 1992. Panel B describes the block trades activity in ex-dividend months only for stocks that had an ex-dividend day in that month.

tivity increases from 1072 to 1619 to 2079 billion £ire for the low-, medium-, and high-yield groups, respectively. The difference in the level of block trading activity between ex-dividend months and non-ex-months is striking. The average block trading activity for a non-ex-month ranges between 99.9 billion £ire and 51.4 billion £ire for the low- and high-yield groups, respectively. The block trading activity in the ex-month is more than 10 times higher for the low-yield group stocks and more than 40 times higher for the high yield stocks.[14] The block trading volume increases relative to the nonblock trading volume in the ex-dividend month, as well. For each stock we calculate the ratio of block trading volume to nonblock trading volume in the ex-dividend months and the average in the non-ex-dividend months. We report the averages of these ratios in the third and sixth columns of Table 6 for the ex-month and non-ex-months, respectively. For an ex-month, the block trading activity is at least 2.8 times higher than the non-block trading volume and is more than four times higher for the high-yield group. In a non-ex-dividend month, the block trading activity is much lower than the non-block trading volume. Taken together, the findings of (1) higher block trading activity in the ex-dividend months relative to non-ex-months, (2) block trading activity that increases with yield in the ex-months and not in the non-exmonths, and (3) increase in the block trades relative to nonblock trades in those months are consistent with the tax effect on institutions and corporate traders.

[14] Both cum-day and ex-day trading are centered around the middle of the month. Therefore, all dividend-related tradings are in the same calendar month.

Table 6
Comparison of block trading activity in ex-dividend months to non-ex-dividend months on the MSE[a]

	Ex-months			Non-ex-months		
D/P (%)	(1) Number of blocks	(2) Market value (in billions of IL)	(3) Market value of blocks rel. to nonblock trading[b]	(4) Number of blocks[c]	(5) Market value (in billions of IL)[d]	(6) Market value of blocks rel. to nonblock trading[e]
1.82	304	1072.8	2.87	52.20	99.9	1.20
3.83	436	1619.7	3.97	38.72	63.4	0.32
6.21	541	2079.6	4.18	37.84	51.4	0.20

[a] Common stocks that paid dividends in the period February–September 1992 are divided into three groups by dividend yield. Dividend yield is calculated as the stock's cash dividend over the cum-day price. There are 133 common stocks in the sample, equally divided across subgroups (45, 44, 44, respectively).

[b] The average ratio of market value of blocks relative to nonblock trading activity in the ex-dividend month.

[c] The average number of blocks traded for this group of stocks in a non-ex-month.

[d] The average market value of blocks in a non-ex-month.

[e] For each stock and for each non-ex-month, we calculate the ratio of the market value of block trading activity to non-block-trading volume. The number in this column is the average across stocks and months.

To ensure that these results are not an artifact of a positive association between yield and liquidity, we also divide the sample into three groups by liquidity (measured by either prior year volume or market capitalization). We find that block trading activity increases with liquidity both in ex-months and in non-ex-months. This result reinforces our assertion that the positive association between block trading activity and dividend yield in the ex-dividend months (and the lack of positive association in the non-ex-months) is a tax-related effect and not a surrogate for liquidity.

To gain further insight into the interaction between block trading activity and the stock's dividend yield and liquidity, we use a cross-sectional regression analysis. In this analysis, the dependent variable is either the value of block trades or the number of blocks traded and the independent variables are the stock's dividend yield and liquidity. The results are reported in Table 7. In the first row of panel A (panel B), the dependent variable is the value (number) of block trades in the ex-dividend month. Consistent with prior analysis, both the yield coefficient and the liquidity coefficients are highly significant for both dependent variables. In the second row of each panel, we examine whether these variables can explain block trading activity in non-ex-months as well. The insignificant yield coefficient can be explained by greater block trading activity in higher-yield stocks only

Table 7
The relationship between block trading activity, yield, and liquidity[a]

	Dependent variable	Intercept	Yield[b]	Liquidity[c]	$\bar{R}^2$ (%)
		A: Market value of block trading			
(1)	VBEX	−0.29 (−0.96)	15.57 (2.78)	1.02 (12.43)	53.94
(2)	VBNM	0.336 (1.26)	−9.23 (−1.48)	0.675 (8.89)	39.17
(3)	RELV	0.967 (2.81)	19.74 (2.99)	0.0024 (4.38)	16.42
		B: Number of block trades			
(1)	NBEX	0.387 (2.05)	11.2 (3.22)	0.003 (10.05)	44.89
(2)	NBNM	−2.02 (−0.91)	−30.22 (−0.65)	5.48 (8.17)	33.80
(3)	RELN	0.944 (3.93)	17.27 (3.74)	0.00126 (3.30)	14.75

[a] Using a cross-sectional regression analysis, we examine whether block trading activity in ex-dividend and non-ex-dividend months can be explained by the stock's dividend yield and liquidity. The dependent variables in panel A are the log market value of block trades in the ex-dividend month (Equation 1), VBEX; the log market value of block trades in an average non-ex-month, VBNM (Equation 2); and the log ratio of the value of the block trades in an ex-month to an average non-ex-month, RELV (Equation 3). In panel B the definition of the dependent variables is based on the number of block trades rather than their value: NBEX is the number of blocks traded in an ex-month (Equation 1); NBNM is the number of blocks traded in an average non-ex-month (Equation 2); and RELN is the log ratio of the number of blocks traded in an ex-month relative to an average non-ex-month (Equation 3). There are 133 common stocks in the sample. Standard errors are adjusted for heteroskedasticity using White's (1980) procedure. *T*-statistics are in parentheses.

[b] Dividend yield is calculated as the dividend amount relative to previous-day price.

[c] Liquidity is measured as the square root of prior year's volume.

in the ex-month. This is consistent with the explanation that these are tax-related trades. The liquidity coefficient, on the other hand, is significant, indicating that stocks with higher liquidity experience higher block trading activity also in non-ex-dividend months. In the third row of each panel, we use as the dependent variable the log ratio of the value (number) of blocks in the ex-month relative to an average non-ex-month block trading volume. This gives us an opportunity to examine the effect of liquidity and yield on the incremental change in block trading activity in the ex-dividend months. Not surprisingly, the yield coefficient is positive and significant, indicating that high-yield stocks are block-traded at a disproportionally higher volume on the ex-dividend month. Likewise, the finding of positive liquidity coefficient is consistent with the assertion that those trades tend to concentrate on stocks with relatively higher liquidity. (We elaborate on this point further in the next section.)

We extract corroborating evidence of the significance of differential taxes on investors' activity around the ex-day by examining the relationship between dividend yield and volume. Consider a trader who wishes to conceal his holdings from the tax authorities. Because of the institutional structure of the Italian market, he sells the dividend-paying stock just before the ex-day. This trading strategy implies that his portfolio will not be affected by the tax consequences and dividends (since he does not receive them). Therefore, his (a priori) portfolio allocation will be independent of dividend yield. Consequently, the ex-day trading volume implied by the registration hypotheses is invariant to dividend yield. The tax effect, on the other hand, implies positive association between dividend yield and abnormal trading volume: the higher the yield, the more severe the tax consequences, and the incentive to trade based on tax consideration increases [see Equation (3)]. Therefore, a positive association between dividend yield and volume changes is consistent with the tax effect. Calculating the Spearman rank correlation shows that the correlation coefficient between abnormal volume and yield is positive (0.18) and highly significant ($t = 5.45$).[15]

In summary, block trading activity shows a significant increase on ex-dividend months for ex-dividend stocks. This increase in block trading is positively associated with the stock's dividend yield. While the stock's past liquidity affects the level of block trading in ex-dividend months as well as in non-ex-dividend months, its yield affects block trading only in ex-months. This evidence strongly indicates that taxes affect the trading activity of investors not subject to the registration effect. We are also able to show that a stock's trading volume around the ex-dividend day is positively correlated with its dividend yield, consistent with a tax effect.[16]

[15] We have argued that 'registration' motivated trades are invariant to dividend yield. It is possible, however, that they are sensitive to transaction costs. If transaction costs on high yield stocks are lower than on low yield stocks, then our findings of positive association between trading volume and yield may still be consistent with the registration effect. However, this is not the case: the reciprocal of transaction costs (measured by past liquidity) and yield are negatively correlated ($\rho = -0.22$), significant at the one percent level. This negative correlation combined with the registration effect implies higher volume for low yield stocks than for high yield stocks. Evidently, this is inconsistent with the empirical findings.

[16] Shareholders of non-dividend paying stocks also have to register with the tax authorities. For such stocks, the stockholders' activity due to their aversion to being registered is not contaminated by any other effect. According to the Italian securities laws, such firms have to report the names of their stockholders (of registered stocks only) on February 15 of the following year. However, the law requires them to report only stockholders who participate in the annual stockholder's meeting. Hence, a holder of a registered stock who does not want to be identified can either sell the stock before the annual meeting or hold the stock and avoid the meeting (i.e., not vote). Examining all stocks that fall into this category (246 events between 1980–1990), we did not find any excess return or abnormal volume around February 15.

4.2 The effect of transaction costs and hedging on prices and volume

4.2.1 Transaction costs. Transaction costs affect investor's decisions about whether to trade around the ex-dividend day. Previous research [Lakonishok and Vermaelen (1986), Karpoff and Walkling (1990), and Michaely and Vila (1995b,c)] shows that ex-dividend day trading is correlated with transaction costs.

Transaction costs on the MSE comprise fixed processing costs and liquidity costs, which vary across securities. The two components of the processing costs are a government security transaction tax (0.2 percent for individual investors and 0.1 percent for intermediaries) and the stockbroker's commission, which ranges from 0.2 percent (applied to financial institutions and corporations) to 0.7 percent (applied to individual investors).[17] Accounting for transaction taxes and commissions, a round-trip transaction cost for individual investors approximates 1.8 percent, whereas for financial institutions the effective cost is about 0.6 percent.

The liquidity component of the transaction cost is of greatest interest to our study. Since liquidity varies across stocks, it enables us to examine the effect of transaction costs on the ex-dividend day activity. Karpoff and Walkling (1990) approximate the cost of liquidity in this context by using the bid-ask spread at the end of the trading day. Given that the MSE is an auction market, we cannot use a "quoted" bid-ask spread as a proxy for liquidity.[18] Instead, we use two alternative measures of liquidity: prior year volume and the security market capitalization on the first trading day of the year. The use of volume to measure liquidity is largely motivated by empirical findings of a negative relationship between volume and bid-ask spread [e.g., Demsetz (1968), Tinic (1972), and Copeland (1979), among others]. The second proxy is the security market capitalization. Other research [see, for example, Karpoff and Walkling (1988) and Stoll and Whaley (1983)] has shown that market capitalization is a good proxy for the cross-sectional variation in transaction costs.

In our study, the two proxies yield very similar results, and there are no differences in the inferences we make concerning the effect of transaction costs. For the sake of brevity, we report the results only when past volume is used as the transaction costs' proxy. It should be noted, however, that the positive correlation between volume (or

[17] Commissions and transactions tax figures are calculated from the yearly publication (1981–1990) of the statistical division of the MSE.

[18] While Roll (1984) suggests a method of calculating the implied bid-ask spread, the fact that most covariances are positive, using daily data on the MSE, makes this method essentially undefined, (see Murgia, 1992).

market capitalization) and transaction costs is documented in markets with different market structure and should be interpreted with caution.

Liquidity may affect both prices and volume. Given the tax structure and the fact that the registration hypothesis does not apply to mutual funds and corporations, we would expect the excess return to be lower for more liquid stocks. The reason is simple: corporations prefer dividends to capital gains [see Equation (1B)], and mutual funds have a slight aversion to dividends. Whether individual investors prefer capital gains over dividends because of differential taxes or because of the desire to maintain their fiscal anonymity, their effect on the ex-dividend day prices gives mutual funds and corporations a profit opportunity. (It is worth noting that the round trip transaction costs of 1.8 percent for individual investors make it prohibitively expensive for them to participate in any profit elimination activity, regardless of the level of liquidity.) This potential profit increases as the cost of execution decreases and as the dividend yield rises.

We run the following regression:

$$\underset{}{EXR_i} = \underset{(6.11)}{0.014} + \underset{(1.91)}{0.08}\text{Yield}_i - \underset{(-1.93)}{0.48}\,\text{Liquid}_i - \underset{(0.65)}{0.001}D\,\text{period}_i \quad N = 1,236 \quad \bar{R}^2 = 0.044 \tag{5}$$

where

EXR is the excess return in the three days around the ex-dividend day,
Yield is the dividend paid, divided by the cum-dividend day price,
Liquid is the square root of the total trading volume (in millions of £ire) in the year before the ex-dividend day,
*D*period is a dummy variable that takes the value of zero if the ex-dividend day occurred before 1984 and one otherwise.
T-statistics are reported in parentheses.

Consistent with prior analysis, the period in which the dividend occurs does not have a significant effect on the excess return (the period dummy coefficient is insignificantly different from zero). Consistent with a tax effect [e.g., Litzenberger and Ramaswamy (1979) and Poterba and Summers (1984)], the yield coefficient is positive.[19] The liquidity coefficient is significantly negative, indicating that stocks with higher past trading volume experience lower excess returns on the ex-dividend day. This result is consistent with the assertion that

[19] We may expect the potential clientele effect to weaken (or even reverse) this relation (see, for example, Litzenberger and Ramaswamy, 1980, and Lakonishok and Vermaelen, 1986). Therefore, the yield coefficient should be interpreted with caution. When we divide the sample into three groups according to dividend yield, we find that the excess returns increase with yield, but the differences are not significant.

corporations and mutual funds focus their "dividend capture" activity in stocks with lower transaction costs. If this assertion is correct, we should also observe that the ex-day abnormal volume of trade is negatively related to transaction costs. In fact, Constantinides (1986) shows that the cost of transacting has more effect on volume than on prices.

We analyze the effect of transaction costs on common stocks' abnormal trading volume, using a linear regression analysis. The results, adjusted for heteroskedasticity, are reported below (T-statistics are in parentheses).

$$\begin{matrix} AV_i = -282.1 & + 5066\,\text{Yield}_i & + 0.002\,\text{Liquid}_i & + 31.41 D\,\text{period}_i & N = 995 \\ (-2.49) & (2.11) & (2.92) & (0.71) & \bar{R}^2 = 0.24 \end{matrix} \quad (6)$$

The dependent variable is the ex-dividend day abnormal volume, and the independent variables are the stock's dividend yield, a liquidity measure, and a dummy variable for the period (1984 or 1985–1990). The yield coefficient is positive and significant, consistent with the assertion that trading volume is positively correlated with yield. If, as we argue, registration-related tradings are not related to yield, while tax-related tradings are, then the positive yield coefficient is consistent with the assertion that at least part of the ex-day trading is because of differential taxes.

The positive liquidity coefficient indicates that stocks with higher past volume (lower costs of transacting) experience higher abnormal volume on the ex-dividend day.[20] When this analysis is repeated for the savings stock sample, neither the yield nor the liquidity coefficients are found to be significant. This is not surprising, given the insignificant ex-day abnormal trading volume for the savings stocks sample.

Overall, the results indicate that higher liquidity is associated with higher abnormal trading volume and lower excess returns around the ex-dividend day. This finding is consistent with more active trading by corporations and mutual funds. Common stocks, which present profit opportunities because different groups of investors value dividends differently, experience significantly higher volume, while sav-

[20] We also ran the regression in equation 6 when the dependent variable is scaled by the expected volume, i.e., $AV_i/E[V_i]$. The yield and liquidity coefficients are positive with t-statistics of 3.20 and 2.16, respectively. It may be that the association between abnormal volume and our transaction cost measure is a manifestation of the statistical properties of volume, i.e., the persistence of volume. We examined this possiblity by calculating an abnormal volume measure for one day in the estimation period, randomly chosen, for each event. We regress the abnormal volume on the liquidity measure. The insignificant slope coefficient is consistent with the notion that the persistence of volume is not the driving force behind our results. Also the fact that the liquidity coefficient in equation (6) is significant when market capitalization is used as the proxy is consistent with our argument.

ings stocks do not. This indicates that ex-day trading is, at least partially, a consequence of tax considerations. Our evidence on block trading activity is also consistent with this conclusion: stocks with greater liquidity experience higher block trading activity than do stocks with lower liquidity. Although this phenomenon is true for ex-dividend months as well as for non-ex-dividend months, we show that the sensitivity of the block trading activity in ex-dividend months is significantly greater than in non-ex-dividend months (Table 7, third regression in panel A and in panel B).

4.2.2 Hedging the ex-day trading using savings stocks. Many firms in our sample have both savings and common stocks traded. A priori, it seems that investors who want to maintain the characteristics of their portfolio and who are not averse to dividends can buy the common and short the savings stock before the ex-dividend day and then reverse the position on the ex-day (or shortly after). However, such a strategy implies a higher trading volume for the savings stocks around this event even without differential taxes. As previous analysis reveals (Table 4), the savings stock sample does not exhibit any unusual activity around the ex-day.

Another implication of the use of the savings stocks as a hedging vehicle is that it should result in a higher abnormal volume for the corresponding common stock, since the risk involved in the ex-day transaction is reduced. We analyze the abnormal volume for common stocks with, and without, matched savings stocks. This analysis reveals that, after controlling for liquidity (measured by either market capitalization or by past year volume), there is no significant difference between the two groups in terms of the ex-dividend day trading volume. This is surprising if the returns behavior of a matched savings and common are highly correlated. But this is not the case. Calculating the correlation for 393 pairs of common and savings stocks in the 21 days around the ex-dividend day results in a correlation coefficient with a mean value of 0.35, a median of 0.36, and a standard deviation of 0.31. That is, a common and a savings stock of the same firm are not perfect, or close to perfect, substitutes for each other.

We have also considered a similar test for the savings stocks (i.e., to see whether savings with matched common stocks experience higher abnormal volume and higher excess returns). However, there are only 427 savings stocks in our sample, of which 393 have a matched common; hence, there are not enough savings stocks without matched common to conduct such an experiment.[21]

[21] Comparing the excess return and abnormal volume of the 393 stocks with matched savings to the

Despite the low correlation between the savings and the matched common stocks, the block trading activity in the savings stocks reveals that more than half of the total savings stocks' block trading activity in the sample period (eight months) occurs in the ex-dividend month for the ex-dividend stocks.

5. Conclusions

We investigate the effect of differential taxes on dividends and capital gains by looking at the Italian stock market, which has different dividend taxes on two classes of stocks. While all investors pay a fixed tax of 15 percent on savings stock dividends, taxes on common stock dividends vary widely. The heterogeneity in the after-tax valuation of dividends relative to capital gains for the common stock sample should result in higher volume of trade on the ex-day, and prices that reflect traders' preference for dividends relative to capital gains. Because of the homogeneous valuation of dividends relative to capital gains for the savings stock sample, there are no gains from trades, and we would expect to find no abnormal trading volume around the ex-day. A second reason to trade in common stocks around the ex-day is the desire of some traders in the Italian stock market to maintain their anonymity. Since common stocks are registered and the registration day coincides with the ex-day, individual investors may want to sell the stock before the ex-dividend day. In contrast, savings stocks are bearer stocks whose holders remain anonymous.

Our findings for the common stock sample indicate that the ex-dividend day price decline in relation to the dividend cannot be explained by the relative after-tax valuation of dividends and capital gains alone. Although the theory predicts a premium not lower than 0.372, we find an average premium of only 0.250. These findings are not affected by the introduction of mutual funds to the Italian market in 1984. These results are consistent with the hypothesis that, in addition to tax considerations, individuals sell stock before the ex-day to maintain their anonymity. The excess volume for common stocks is found to be positive and highly significant on the ex-dividend day. This finding is consistent with the heterogeneous valuation of dividends in relation to capital gains across market participants: there are gains from trade, especially given investors' desire to maintain their anonymity. Examining the block trading activity around the ex-dividend day and the relationship between the stock's dividend yield

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entire savings stocks sample reveals that the former exhibits a slightly higher abnormal volume than the entire sample (4.79 vs. 3.46) and higher excess return (0.40 vs. 0.39). The differences in both abnormal volume and excess returns are insignificant.

and price and volume changes, we bring evidence consistent with the hypothesis that a significant portion of the ex-day activity is motivated by differential tax valuation. Since block trading is done by investors who do not have an incentive to maintain their fiscal anonymity, our findings of a much higher block trading activity around the ex-day are consistent with tax-induced trading. Also, the findings of significant positive relations between dividend yield and volume and between dividend yield and ex-day price changes indicate that at least part of the ex-day volume and price changes occurs because investors face different tax treatments.

For the savings stock sample, we find that the ex-day price decline in relation to the dividend almost exactly equals the market's valuation of dividends in relation to capital gains. Consistent with existing theories, we find that there is no excess volume for the savings stocks around the ex-dividend day. Because all market participants face the same tax rate on savings stock dividends, there are no gains from trade, and we predict that the excess volume of trade is equal to zero.

Finally, we examine the effect of transaction costs and hedging on prices and trading volume around the ex-day. Consistent with more active trading by corporation and mutual funds in the more liquid stocks, we find that the excess return is lower, and the abnormal volume is higher, as the cost of execution is lower. Likewise, we show that the block trading activity around the ex-day is more pronounced for stocks with lower transaction costs and higher yield. Interestingly, we do not find conclusive evidence for the use of savings stocks as a hedging vehicle to the trading activity in the common stocks around the ex-dividend day.

Appendix A: Trading on the Italian Stock Exchange

The Italian stock market comprises 10 regional exchanges, with more than 90 percent of the transaction volume concentrated in the Milan Stock Exchange (MSE). Between 1981 and 1990, the number of companies listed on the MSE ranged between 132 and 220, and the number of nonconvertible savings stocks was between 16 and 92.

The Italian stock market is a forward market. Delivery and payment are governed by the rules of a monthly account (known as the stock exchange calendar), which lasts from one midmonth to the next. Actual settlement of the trade occurs anywhere between 15 and 45 days after the purchase order. Buy and sell orders executed in the first half of the month, up to the *riporti* day, are settled at the end of that month, and orders executed in the second half of the month are settled at the end of the following month. For example, an order executed on April 5 is settled around April 30, whereas an order executed on April 18

is settled around May 31. Forward contracts are used to trade stocks, derivative securities, and some corporate bonds.

In Italy, the first day of the stock exchange calendar month coincides with ex-days. In fact, ex-days for cash dividends, stock dividends, splits, and other subscription rights must occur on the first day of the monthly account. By extension, this requirement implies that the cum-day coincides with the last day of the stock exchange calendar (usually the 15th of the month), with transactions settled after nearly 15 days. Consequently, transactions executed on the ex-day are settled after about 45 days.

The structure of the Italian market resembles that of a batch system in which a daily call establishes a unique official price (the *listino* price) for all orders executed. Major stocks also trade in a continuous market in which orders are matched through bilateral bargains that produce transaction prices (the *durante* prices). Trading in the market is conducted by official stockbrokers, who act solely on behalf of their clients and cannot trade on their own account. The recorded official prices are actual trading prices between brokers, rather than bid or asked prices between investors and dealers. [See Amihud, Mendelson, and Murgia (1990) for a more detailed description of trading mechanisms in the Italian Stock Market and evidence of price behavior in the call and in the continuous market.] Similar to the procedure on the NYSE, the starting auction price on the ex-dividend day is the listing price of the previous day minus the dividend amount.

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