Taxation, Dividend Payments and Ex-Day Price Changes*

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Abstract

The purpose of the paper is to study the effects of taxation on dividend payments and ex-dividend price changes in Sweden during 1991-1995. Under this period, dividends and capital gains were taxed at a flat rate. Tax changes in Sweden during the 1990s thus provide an opportunity to include direct measures of the tax treatment of dividends and capital gains in the empirical analysis, in contrast to previous studies. The results indicate that tax reforms have large effects on dividend payments, while the effects on ex-dividend price changes are less conclusive.

Key words: capital gain; censoring; dividend; flat tax; tax reform.

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1 Introduction

It has long been noticed that taxes on dividends and capital gains may have important effects on stock prices and corporate dividend policies. In an influential paper, Elton and Gruber (1970) argued that the price-drop-to-dividend ratio (DOR) on the ex-dividend day is determined by the net-of-marginal-tax ratio between dividends and capital gains.[1] Several studies since have used regime shifts in tax policy to infer the effects of taxation (e.g. Poterba and Summers, 1984; Robin, 1991; Skinner, 1993), the results of which appear to vary considerably.

The effects of taxation on corporate dividend policies have also been addressed frequently. A traditional view (e.g., Feldstein, 1970) is that increases in dividend taxation reduce the net return on investment and thus affect dividend pay-out by firms. The "irrelevance argument", on the other hand, suggests that changes in dividend taxation do not affect dividends or investment since the marginal investor is assumed to be taxed indifferently between dividends and capital gains.[2] There have been a number of recent empirical analyses of the U.S. dividend tax-cut in 2003 (Blouin, Raedy and Shackelford, 2004; Brown, Liang and Weisbenner, 2004; Poterba, 2004; Chetty and Saez, 2005).

In this paper, we use Swedish stock market data to infer the effects of dividend taxation. A crucial issue in many empirical studies of dividend taxation is identification of the "marginal shareholder". Since dividend taxes

[1] This hypothesis is hereafter refered to as the the tax-clientele hypothesis.

[2] Poterba and Summers (1985) discuss various hypotheses related to dividend taxation, dividend policy, and investment.

in most countries are considered part of personal-income taxation, and since tax schedules are usually progressive, private investors face different marginal tax rates. But under the 1991 Swedish tax-reform, dividends and capital gains became taxed separately from ordinary income, at a flat rate. During 1991 to 1995 there were then three succesive tax regimes for domestic individual investors: initially dividends and capital gains were taxed at the same rate (30%); then one where dividends were taxed more heavily; and finally one where capital gains were taxed more heavily. The fact that all domestic individual investors faced the same flat rate, means that the marginal tax rate was exogenously given at individual as well as market level.

Dividends are often tax penalized for private investors, while institutional investors usually face identical tax rates on dividends and capital gains (Boyd and Jagganathan, 1994). Kalay (1982, 1984) argued that this could create possibilities for arbitrage by institutional investors, who would then prefer high-dividend stocks. Possibilities for arbitrage might also induce institutional owners to demand high dividend pay-outs. Tests performed on estimation results of the impact of taxation on price changes on the cum- and ex-dividend day could not discriminate whether domestic individual investors or institutional investors were the marginal shareholders.

However, when dividends and capital gains are separated from other personal income and taxed at flat rates, as after the 1991 Swedish tax reform, then variation in the DOR cannot be explained by tax-induced clienteles among domestic individual investors. Therefore, the 1991 Swedish tax reform provides a unique opportunity for examining the tax-clientele hypoth-

esis using price data from the stock market.

The results here show that the decision to pay dividends is affected by having different tax rates on dividends and capital gains facing domestic individual investors. The effects are substantial, and robust to changes in specification. The direct impact on stock prices around the ex-dividend day is less clear. We also find the DOR positively related to dividend yields (statistically significant at the ten-percent level). In the Swedish tax system this relation cannot be explained by tax-induced clienteles among domestic individual investors.

The next section describes previous studies on determinants of dividend pay-outs and ex-dividend price behavior. Section 3 then describes the data used here and the tax policy changes in Sweden during 1991-95. Section 4 describes the empirical models, while Section 5 presents the results. The final section summarizes and draws conclusions.

2 Previous studies

2.1 Explaining the dividend pay-out

Dividends may be used as a signaling device (Battacharya, 1979; Miller and Rock, 1985; Ambarish, John and Williams, 1987), providing investors with information about future growth opportunities of firms that is not available elsewhere. Another use of dividends may be as an instrument to reduce agency-costs (Jensen and Meckling, 1976; Easterbrook, 1984), restricting managerial discretion. In addition, a number of studies (e.g., Bradley et al., 1998; Charitou and Vafeas, 1998) have been able to predict dividends

with precision using firms' free cash-flows, implying that they reflect high liquidity. Firms may also be more willing to pay high dividends when market risk is relatively low. The classical model (Lintner, 1956) suggests that dividends are highly persistent over time, implying that previous dividends can explain present dividends.

As noted earlier, differences in taxation might influence the size of dividends. In most countries, dividends are taxed at a higher rate than capital gains, creating a preference for low-dividend policies. But where they are treated as ordinary income subject to progressive rates both dividends and capital gains may be taxed differently for different domestic individual investors, those with high marginal tax rates prefering low-dividend stocks and those with lower marginal rates prefering high-dividend stocks, thus creating tax-induced clienteles.

Bell and Jenkinson (2002) offer a related explanation focusing on ownership, with evidence that the marginal traders on the UK stock market during 1995-1999 were pension funds. Institutional investors usually face the same tax rate on dividends and capital gains, while dividends are often tax penalized for private investors (Boyd and Jagganathan, 1994). This can provide incentive for institutional investors to demand high dividends, in order to develop arbitrage trading strategies around the ex-dividend day (Kalay, 1982, 1984). They may also demand high dividends to force firms to go to the capital market for future funds, thus reducing agency-costs (Zechhauser and Pund, 1990; Short et al., 2002).

2.2 Studying ex-dividend price-behavior: the traditional approach

The ex-dividend price-change has traditionally been analyzed using the DOR as the dependent variable. Elton and Gruber (1970) showed in a classic paper that it was determined by the net-of-marginal-tax ratio between dividends and capital gains, i.e., $DOR = (1 - \tau_d)/(1 - \tau_g)$, where τ_d is the tax rate on dividends and τ_g is the tax rate on capital gains. This implies that, where capital gains are taxed more favorably than dividends, the DOR should be lower for stocks which attract shareholders in high income-tax brackets. For example, assume that dividends are fully taxed as ordinary income, but that capital gains are only taxed at 40%. For an investor with a marginal tax rate of 60%, the net-of-marginal-tax ratio is $(1 - 0.6)/(1 - 0.24) = 0.53$; while for one with a lower marginal rate (e.g., $\tau_d = 40\%$) it is $(1 - 0.4)/(1 - 0.16) = 0.71$.

The Elton and Gruber (1970) model suggests that the DOR should change when the relative taxation of dividends and capital gains for domestic individual investors changes. A number of studies (Booth and Johnston, 1984; Poterba and Summers, 1984; Barclay, 1987; Michaely, 1991; Robin, 1991; Athanassakos and Fowler, 1993; Skinner, 1993; de Ridder and Södersten, 1995; and Wu and Hsu, 1996) have used such regime shifts to investigate the behavior of shareholders in the period around the ex-dividend day. These studies often regress

$$\frac{P_{it}^c - P_{it}^x}{D_{it}} = \beta_0 + \beta_1 \left(\frac{D_{it}}{P_{it}^c} \right) + \sum_{j=1}^{n} \delta_j I_j + \varepsilon_{it} \qquad (1)$$

where the dependent variable is the DOR[3] for stock i in year t, P_{it}^{c} and P_{it}^{x} are the closing prices on the cum- and the ex-dividend days, respectively, D_{it} is the dividend per share, β_0 is a constant, and ε_{it} is the error-term. Changes in the relative taxation of dividends and capital gains are indicated by I_j, a dummy that is equal to one during a specific tax regime j.

Some of the earlier studies (e.g., Poterba and Summers, 1984; Barclay, 1987; Robin, 1991) found that taxes influenced ex-dividend price behavior, while others (e.g., Skinner, 1993; de Ridder and Södersten, 1995) found that they did not. Most found the DOR positively related to dividend yield, perhaps as a result of tax-induced clienteles as discussed earlier (Elton and Gruber, 1970).

Kalay (1982, 1984) and Miller and Scholes (1982) argued that marginal tax rates cannot be derived from the DOR because institutional and individual investors often face different tax rules, e.g., institutional investors may be taxed equally on dividends and capital gains, while dividends are tax penalized for individuals (Boyd and Jagannathan, 1994). Kalay (1982, 1984) showed that institutional investors may be able to exploit such tax differences to make arbitrage profits and that such profit opportunities will be directly proportional to the dividend yield.

Hence, a positive relation between the DOR and dividend yield might occur either because of tax-induced clienteles or because of arbitrage trading by institutional investors. Previous ex-dividend price studies have not been

[3] The use of the DOR as the dependent variable means that the sample must be restricted to firms paying dividends; however, in every period some firms choose not to pay dividends, which restricts the sample.

able to empirically discriminate between these two hypotheses.

2.3 Studying ex-dividend price behavior: the new approach

The traditional approach focusing on the DOR has been critized because the error-term may be heteroskedastic (Lakonishak and Vermaelen, 1986; Barclay, 1987; and Michaely, 1991). Boyd and Jagganathan (1994) instead used the percentage price change between the cum- and ex-dividend days as the dependent variable, as did Green and Rydqvist (1999), McDonald (2001), Bell and Jenkinson (2002), and Florensen and Rydqvist (2002).

In this approach one regresses

$$\frac{P_{it}^c - P_{it}^x}{P_{it}^c} = \gamma_0 + \gamma_1 \left(\frac{D_{it}}{P_{it}^c} \right) + \sum_{j=1}^{n} \eta_j \left(\frac{D_{it}}{P_{it}^c} \times I_j \right) + \varepsilon_{it} \tag{2}$$

where the dependent variable is the percentage price change between the cum- and ex-dividend days for stock i in year t, D_{it} is again the dividend; γ_0 is a constant; ε_{it} is the error-term; and I_j is a dummy equal to one during a specific tax regime j, zero otherwise.[4]

In addition to tax-induced clienteles and arbitrage trading, non-tax factors may influence ex-dividend day price changes. For example, Frank and Jagganathan (1998) showed that prices in the Hong Kong stock market dropped less than the dividend amount, due to microstructure effects and transaction costs. Bali and Hite (1998) also provided some empirical evidence that the tick-effect, i.e., that stock prices change discretely, also leads to a DOR less than one. The constant (γ_0) was included in the model to

[4] In contrast to the traditional approach, the sample does not need to be restricted to firms paying dividends although previous studies have done so anyway.

control for such effects.

The new approach produces two parameters: an intercept (the constant, γ_0) and a slope-coefficient. Boyd and Jagganathan (1994) showed that the intercept will be negative (and statistically significant) if non-tax factors are important for ex-dividend price behavior, while the slope-coefficient estimates the DOR. Hence, this approach makes it possible to carry out more detailed hypothesis testing.

3 Data and Swedish Tax Regimes

Daily closing prices from the Stockholm Stock Exchange (SSE) during 1991-1995 are used here to study price changes between cum- and ex-dividend days in Sweden. The number of firms varies from 35 in 1991 to 94 in 1995, resulting in 302 ex-dividend dates. Firm-specific information, such as the market-to-book ratio, number of employees, and dividend amount is from Bonniers Findata. Information on ex-dividend dates is from the Swedish patent and registration office (PRV), while dividend announcement dates are from SIX Trust. Finally, shares of foreign ownership are from the yearly volume *Ägarna och Makten* provided by SIS Ägarservice.

Ex-dividend price changes on the SSE during this period are particularly interesting to study because, as noted earlier, a major tax reform was implemented in Sweden in 1991. As in most other countries, dividends and capital gains had previously been taxed as ordinary income at progressive rates. In addition, the marginal tax rate on capital gains had been lower than that on dividends. All this changed with the tax reform. First, tax-

ation of ordinary income and capital income were separated, with capital gains and dividends taxed at 30%. In 1992 the capital gains tax-rate was reduced to 25%. It was further reduced in 1994, while the tax on dividends was removed entirely. Uniform 30% taxes were reinstated in 1995. Hence, there were four different periods and three different relationships between the tax-rates on capital gains and dividends during the study period (Table 1, below). Compared to previous ex-dividend studies, these changes provide greater variation to study.

Table 1 About Here

Definitions of all the variables included in the empirical analysis, as well as means and standard deviations, are given in Table 2. The variables included are further discussed in Section 4.

Table 2 About Here

A majority of the firms (225 of 302) paid dividends, the average yield beeing 2.1%. The average yield is thus larger than those in previous ex-dividend studies (e.g., Lakonishok and Vermaelen, 1986), which is not surprising, since dividends are paid yearly in Sweden, rather than quarterly as in the US.

4 Empirical Models

We estimate equations for both the ex-dividend price-change and the dividend amount, and we will start with the latter.

4.1 Estimating the determinants of dividend payments

Previous studies usually restricted attention to firms paying dividends. However, since dividends are censored at zero, valuable information may be lost by excluding non-paying firms (Kim and Maddala, 1992). In addition to the standard least squares regression model, we therefore use a censored normal regression model (Tobit model) to estimate the determinants of dividends.

Our main attention is focused on the effects of dividend and capital gains taxation, but it is difficult to estimate the effects of each of two taxes separately, since the marginal tax rate on dividends remained the same, except for 1994. Unfortunately, the period under study also coincides with a major downturn of the Swedish economy, making it difficult to separate changes in tax rates from changes in the business cycle. Therefore, in order to address the effects of taxation and at the same time control for the business cycle, taxation is measured as the net-of-tax ratio ($TAX\ RATIO$) between the dividend tax and the capital gains tax, defined as $(1-\tau_d)/(1-\tau_g)$. The hypothesis to be explored is that, other things equal, $TAX\ RATIO$ should have a positive effect on dividends. To capture the business cycle, the regressions are conditioned on GDP per capita at fixed prices (Table 2 above provides definitions of all variables).

In the Tobit model, D_{it}^* is a latent variable describing the dividend per share for stock i in year t, with equation

$$
\begin{aligned}
D^*_{it} &= \alpha_0 + \alpha_1(D_{it-1}) + \alpha_2(TAX\ RATIO_t) + \alpha_3(GDP_t) \qquad (3)\\
&\quad +\alpha_4(O\text{-}LIST_{it}) + \boldsymbol{\theta}^{'}\mathbf{F}_{it} + \upsilon_{it}
\end{aligned}
$$

where $TAX\ RATIO$ and GDP are defined as above; D_{it-1} is the dividend per share in the previous period; $O\text{-}LIST$ is a dummy, equal to one if the firm's shares are available on any list besides the so-called A-list on the SSE; $\mathbf{F}_{it}$ is a vector of firm-specific characteristics; and υ_{it} is an error-term, assumed normally distributed with constant variance. The vector $\boldsymbol{\theta}^{'}$ and $\alpha_0 - \alpha_4$ are parameters to be estimated.

Lintner (1956) argued that dividends are mainly determined by the dividend in the previous period, so we expect α_1 to be positive. The $O\text{-}LIST$ variable is assumed to capture the maturity of the firm; those not on the A-list are expected to pay lower dividends.

The firm-specific vector, $\mathbf{F}_{it}$, contains variables commonly used in the analysis of dividend pay-outs. $MARKET\text{-}TO\text{-}BOOK$ is the ratio of market value to book value, assumed to capture growth opportunities of the individual firm.[5] According to the dividend-signaling hypothesis (discussed in Section 2), such growth firms pay high dividends to inform investors about their growth prospects, so $MARKET\text{-}TO\text{-}BOOK$ should be positively related to dividends. On the other hand, Gaver and Gaver (1993) suggest that growth firms might pay low dividends to exploit their high growth opportunities, so there is no clear-cut hypothesis about the sign of this coefficient.

[5] The market-to-book ratio is given by firm market-value divided by total asset-value.

$EARNINGS$ is net per share; more profitable firms are assumed to pay higher dividends than less profitable ones. $CASHFLOW$ (from operation per share) is included to reflect liquidity; we expect firms with higher liquidity to pay higher dividends. $LOG\ EMPLOYMENT$ is the (log of the) number of employees expressing the size of the firm; as agency-costs associated with managerial discretion are thought to increase with size, high dividends might be paid to reduce them. Therefore, we expect that dividends should be increasing in employment. $BETA$ is a measure of the riskiness of the stock, expected to decrease the dividend.[6]

Short et al. (2002) found that institutional ownership may influence a firm's dividend policy. Unfortunately, we have no information on institutional ownership. However, the variable $FOREIGN\ SHARE$, indicating the share of stocks held by foreigners, is included since we believe most foreign owners to be institutional investors.

The censoring-rule for the Tobit regression can be written as

$$\begin{aligned} D_{it} &= D^*_{it} \qquad if \quad D^*_{it} > 0 \\ &= 0 \qquad otherwise \end{aligned}$$

In the least squares model, only positive values of the dependent variable

[6] The beta value for stock i in year t (b_{it}) is estimated, using daily data from the year preceding the dividend pay-out, with

$$R_{is} = a_i + b_{it} R_{ms} + e_{is},$$

where R_{is} is the individual return on stock i on day s; a_i is a constant; R_{ms} is the market return on day s (approximated by Affärsvärlden's value weighted general index); and e_{is} is the error-term.

are included, implying that $D_{it} = D_{it}^{*}$.

4.2 Estimating ex-dividend price behavior

Next we estimate price changes on the ex-dividend day, using both the traditional approach where the dependent variable is the price-drop-to-dividend ratio (DOR) and the new approach, comparing ex-dividend to the cum-dividend prices.

As noted earlier, in the traditional approach the sample must be limited to firms paying dividends. The estimating equation is

$$\frac{P_{cit} - P_{xit}}{D_{it}} = \beta_0 + \beta_1 \left(\frac{D_{it}}{P_{cit}} \right) + \eta(TAX\ RATIO_t) + \varepsilon_{it} \qquad (4)$$

which is almost identical to equation (1), except that there are no dummies for tax regimes, because the flat tax-rates for domestic individual investors on dividends and capital gains, following the Swedish tax-reform in 1991, allow inclusion of direct measure of their differential tax treatment ($TAX\ RATIO_t$). Tax rate changes can thus be separated from other period specific developments, such as technological changes or the business cycle.

During the years when dividends and capital gains were taxed equally at a flat rate of 30% irrespective of total taxable income (i.e., 1991 and 1995), $TAX\ RATIO_{91,95} = 1$. For the period 1992-93, $TAX\ RATIO_{92-93} = \frac{(1-0.3)}{(1-0.25)} = 0.933$, and for 1994 $TAX\ RATIO_{94} = \frac{(1-0)}{(1-0.125)} = 1.14$. Thus the effect of changes in the relative taxation of dividends and capital gains is measured by η.

The 1991 Swedish tax reform provides a unique opportunity to examine the tax-clientele hypothesis using aggregate price data from the stock market. As discussed earlier, the documented positive relation between the DOR and dividend yield could be a consequence of either tax-induced clienteles or arbitrage trading by professional institutional investors, or both (Lakonishok and Vermaelen, 1986). Previous studies of ex-dividend price behavior have not been able to distinguish empirically between these two competing hypotheses. However, the tax-clientele hypothesis implicitly assumes that dividends and capital gains are taxed as ordinary income. When they are separated and taxed as investment income subject to a flat rate, as in Sweden after 1991, a positive relation between the DOR and dividend yield cannot be explained by tax-induced clienteles. Hence, if ex-dividend price changes, as suggested by Elton and Gruber (1970), are solely driven by the differential tax treatment of dividends and capital gains, then $\eta = 1$ and $\beta_0, \beta_1 = 0$.

The estimating equation for the new approach is

$$\begin{aligned} \frac{P_{cit} - P_{xit}}{P_{cit}} &= \gamma_0 + \gamma_1 \left(\frac{D_{it}}{P_{cit}} \times I_{91,95} \right) + \gamma_2 \left(\frac{D_{it}}{P_{cit}} \times I_{92-93} \right) \\ &\quad + \gamma_3 \left(\frac{D_{it}}{P_{cit}} \times I_{94} \right) + \varepsilon_{it}, \end{aligned} \tag{5}$$

where the dependent variable ($EX\text{-}PRICE\ CHANGE$) is the percent price change between the cum- and ex-dividend days for stock i in year t; and $I_{91,95}$, I_{92-93} and I_{94} are dummies for the tax regimes during the study period (Table 1, above).

With the new approach we thus estimate the DORs directly, i.e., the

parameters γ_1, γ_2, and γ_3 measure ex-dividend price changes relative to the dividend. Given the flat tax rates, there are two null hypotheses, depending upon who is the marginal shareholder: If domestic individual investors are driving the market, we would expect $\gamma_1 = 1$, $\gamma_2 = 0.933$, and $\gamma_3 = 1.143$ (again see Table 1 above); and the null hypothesis $H_0 : (\gamma_1, \gamma_2, \gamma_3) = (1, 0.933, 1.143)$ can be tested against an unrestricted alternative. If institutional investors (facing identical tax-rates) are driving the market, the null hypothesis is $H_0 : (\gamma_1, \gamma_2, \gamma_3) = (1, 1, 1)$, which can be tested the same way.

5 Results

Table 3 presents estimation results from four models of equation (3), i.e, the determinants of dividend pay-outs: Models I and II are OLS models, while Models III and IV are Tobit. For comparison, Models I and III are stripped-down versions with firm specific information left out.

Table 3 about here

As indicated by the parameters on $DIVIDEND_{t-1}$, dividends were highly persistent, in accordance with previous studies (e.g., Fama and Babiak, 1968) which found that firms' dividend policies were seldom subject to major revision. The parameter associated with GDP is positive and statistically significant in all specifications, indicating that dividends varied procyclically over the business cycle. It does not appear important to control for list effects, however; the parameter on the dummy variable $O\text{-}LIST$ is not significant and varies in sign.

Among the firm variables, the $MARKET\text{-}TO\text{-}BOOK$ ratio is negative and significant in both the OLS and the Tobit specifications. Since it is assumed to reflect growth possibilities, the sign suggests that high-growth firms pay lower dividends, either to exploit those possibilities or because some of them are less mature firms that have not yet started to pay dividends. There do in fact appear to be size effects, as measured by $LOG\ EMPLOYMENT$, when non-dividend firms are included in the analysis (the Tobit model); size may affect the decision to pay dividend more than the amount paid. The other firm-specific variables are not significant though both $EARNINGS$ and $CASHFLOW$ have the expected signs.

The net-of-tax ratio ($TAX\ RATIO$) is significant and positive in all specifications, with the parameter somewhat smaller when firm specific variables are included. Using the OLS result of Model II, the variation in dividends because of taxation can be calculated to over 7%.[7] And more radical comparisons can be made: Suppose that dividends and capital gains have been taxed at 30%, and policymakers abolish the dividend tax; average dividends would increase 40%. If the capital gains tax were instead abolished, dividends would drop about 28%. Thus, large tax reforms may have substantial effects on dividends.

Table 4 presents estimation results from equation (4) (the traditional approach, where the DOR is the dependent variable) in the first column and from equation (5) (the new approach, where $EX\text{-}PRICE\ CHANGE$ is the dependent variable) in the second.

[7] The parameter associated with taxation is multiplied times the ratio of the standard deviation of $TAX\ RATIO$ to the standard deviation of $DIVIDEND$ for the dividend-paying firms, i.e., $2.626 * (0.081/2.86) = 0.074$.

Table 4 about here

The parameter on $DIVIDEND\ YIELD$ is significant (at 10%) and positive, indicating higher DOR for higher dividend yield stocks. Since dividends and capital gains were taxed at flat rates independently of ordinary income, this cannot be explained by tax-induced clienteles. The parameter on the net-of-tax ratio ($TAX\ RATIO$) is not significant, though positive.

In the new approach (the second column), the $DORs$ are estimated directly, tracking differential taxation over time fairly closely. For 1991 and 1995, the estimated DOR is 1.04 (corresponding $TAX\ RATIO$ is 1, from Table 1). For 1992-93 the DOR is 0.95 ($TAX\ RATIO$ 0.93), and for 1994 it is 1.33 ($TAX\ RATIO$ 1.14). The hypothesis that private individuals were the marginal investors, $H_0 : (\gamma_1,\ \gamma_2,\ \gamma_3) = (1, 0.933, 1.143)$, cannot be rejected using an F-test ($F(3, 298) = 0.34$; p-value = 0.80), nor can the hypothesis $H_0 : (\gamma_1, \gamma_2, \gamma_3) = (1, 1, 1)$ that equally-taxed institutional investors were driving market prices ($F(3, 298) = 1.37$; p-value = 0.25). However, the much higher p-value for individual investors favors that hypothesis.[8]

6 Summary and Conclusions

Swedish stock market data from 1991-1995 was used to analyze the effects of taxation on dividend payments and ex-dividend price changes. This data is especially suitable since dividends and capital gains were taxed at flat rates

[8] A possible source of bias is if the ex-price change and dividends are affected by the same unobserved factors. This would be the case if dividends are affected by unobserved information and this information is revealed after the cum-dividend day. We have therefore estimated models where dividends are potentially endogenous in the $EX\text{-}PRICE\ CHANGE$ equation. However, the hypothesis of (weak) exogeneity could not be rejected.

separately from ordinary income. It was thus possible to test hypotheses regarding the role of private investors in much more detail than is usually the case. To our knowledge, this is the first attempt to study the determinants of dividends and ex-dividend day price changes jointly, which is important because the effects of the taxation of dividends and capital gains on ex-dividend prices cannot be treated independently from its effects on dividends themselves. In contrast to previous studies, we also incorporated zero-dividend stocks when analyzing the percentage change between cum- and ex-dividend prices.

The results indicate that dividends were influenced by the taxation of dividends and capital gains. This effect found is relatively large and robust to changes in specification, meaning that firms took account of tax rates when deciding the size of dividends. To get a sense of the magnitudes involved, assume dividends and capital gains are initially taxed at a flat rate of 30%, and that policymakers abolish the dividend tax, while leaving the capital gains tax rate unaffected. The results here indicate that dividends would increase about 40%.

In accordance with most previous studies, we find the price-drop-to-dividend ratio positively related to dividend yields, which cannot be explained in this case by tax-induced clienteles among domestic individual investors because, as noted above, dividends and capital gains were taxed at flat rates, separately from ordinary income. This suggests that the observed positive relation was a result of arbitrage trading among professional institutional investors. We cannot reject the hypothesis that ex-day price changes were driven by domestic individual investors as the marginal shareholders,

but neither can we reject the hypothesis that equally taxed institutional investors were the marginal shareholders. Finally, as suggested by Bali and Hite (1998) and Frank and Jagannathan (1998), non-tax factors seem to have influenced ex-dividend price changes.

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Table 1: Tax regimes for individual domestic investors in Sweden, 1991-95

Year	Dividends tax-rate	Capital gains tax-rate	Tax ratio[a]
1991	30%	30%	1
1992-93	30%	25%	0.933
1994	0%	12.5%	1.143
1995	30%	30%	1

[a]Given by $(1-\tau_d)/(1-\tau_g)$; where τ_d=marginal tax-rate on dividends and τ_g= marginal tax-rate on capital gains.

Table 2: Definitions, means and sources of variables.

Variable	Mean (SD)	Definition and source
DIVIDEND	2.20	Dividend per share (SEK) measured in 1995 consumer prices.
	(2.904)	Source: Bonniers Findata
MARKET-TO-BOOK	1.924	Ratio of market value to book value.
	(7.68)	Source: Bonniers Findata
LOG *EMPLOYMENT*	7.10	The logarithm of the number of employed individuals.
	(2.949)	Source: Bonniers Findata
CASH-FLOW	22.08	Cash-flow per share (SEK) measured in 1995 consumer prices.
	(21.02)	Source: Bonniers Findata
EARNINGS	6.17	Net earnings per share (SEK) measured in 1995 consumer
	(14.92)	prices. Source: Bonniers Findata
FOREIGN SHARE	0.155	The share of stocks held by foreigners at the end of December
	(0.178)	each year. Source: SIS Ägarservice.
BETA	0.605	The beta value, estimation given by footnote 2 in the paper.
	(2.20)	Source: Stockholm Stock Exchange
DIVIDEND TAX	0.220	The tax on dividends paid by domestic individual investors in
	(0.133)	Sweden. Source: National Tax Board
CAPITAL GAINS TAX	0.238	The tax on capital gains paid by domestic individual investors
	(0.072)	in Sweden. Source: National Tax Board
TAX RATIO	1.018	The net-of-tax ratio, calculated from the dividend tax and the
	(0.081)	capital gains tax. Source: National Tax Board.
O-LIST	0.313	Dummy, equal to one if the stock is listed on the O-list or the
	(0.464)	OTC-list. Source: Stockholm Stock Exchange.
DOR	0.535	Price-drop-to-dividend ratio. Source: Stockholm Stock Exchange
	(2.12)	and Bonniers Findata.
EX-PRICE CHANGE	0.013	The percent price-change between the cum- and ex-dividend
	(0.049)	days. Source: Stockholm Stock Exchange
DIVIDEND YIELD	0.021	Dividend per share divided by the price on the cum-dividend
	(0.019)	day. Source: Stockholm Stock Exchange and Bonniers Findata.
GDP	203.3	GDP in 1000's of SEK per capita at 1995 consumer prices.
	(3.66)	Source: Statistics Sweden.
Number of observations.	302/225	Full sample/ those stocks that paid dividends during 1991-95.

Table 3: Determinants of Dividend Pay-outs (Robust-White t-values in parentheses).

	OLS		TOBIT	
Independent variable	I	II	III	IV
CONSTANT	-30.17***	-32.20***	-33.41***	-33.49***
	(-5.10)	(-5.50)	(-5.18)	(-5.58)
$DIVIDEND_{t-1}$	0.987***	0.918***	1.031***	0.951***
	(11.63)	(10.81)	(12.75)	(11.03)
TAX RATIO	2.975***	2.626***	2.373**	1.990**
	(3.61)	(2.64)	(2.58)	(1.97)
GDP	0.136***	0.146***	0.154***	0.151***
	(4.87)	(5.35)	(4.99)	(5.40)
OLIST	0.023	-0.043	-0.297	-0.034
	(0.08)	(-0.16)	(-0.99)	(-0.12)
MARKET-TO-BOOK		-0.057**		-0.061**
		(-2.04)		(-2.27)
EARNINGS		0.011		0.019*
		(0.92)		(1.66)
CASH-FLOW		0.016		0.014
		(1.32)		(1.18)
LOG *EMPLOYMENT*		0.008		0.113**
		(0.16)		(2.16)
BETA		0.016		-0.013
		(0.90)		(-0.68)
FOREIGN SHARE		-0.342		-0.537
		(-0.75)		(-1.17)
Number of observations	225	217	302	291
Log likelihood	-383.50	-352.14	-352.88	-316.69
ADJ. R^2	0.79	0.82		

Note: The dependent variable is the dividend per-share calculated in 1995 prices.

Variable definitions are given in Table 2.

* denotes significance at the ten-percent level.

** denotes significance at the five-percent level.

*** denotes significance at the one-percent level.

Table 4: Price Changes on the Ex-dividend Day
(Robust-White t-values in parentheses).

Independent variable	*DOR*	*EX-PRICE CHANGE*
CONSTANT	-1.981	-0.010**
	(-0.73)	(-2.07)
DIVIDEND YIELD	19.73*	
	(1.74)	
TAX RATIO	1.910	
	(0.80)	
$DIVIDEND\ YIELD_{91,95}$		1.041***
		(5.95)
$DIVIDEND\ YIELD_{92,93}$		0.949***
		(4.88)
$DIVIDEND\ YIELD_{94}$		1.335***
		(6.10)
Number of observations	225	302
ADJ.R^2	0.014	0.153

* denotes significance at the ten-percent level.

** denotes significance at the five-percent level.

*** denotes significance at the one-percent level.