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Tax Reform and Ex-Dividend Day Behavior

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ABSTRACT

This paper investigates the effect of a major Canadian tax reform on the ex-dividend day behavior of companies on the Toronto Stock Exchange. The results are inconsistent with the hypothesis that price changes on ex-dividend days reflect the relative taxation of dividends and capital gains for the "representative" investor, but are consistent with the hypothesis that ex-dividend day price behavior reflects short-term trading activities.

THERE EXISTS EXTENSIVE EVIDENCE (e.g., see Elton and Gruber [6], Kalay [10], Green [8], and Auerbach [1]) that, on ex-dividend days, stock prices fall by an amount smaller than the dividend per share. This result seems consistent with the view that investors value dividends less than capital gains because of the differential taxation of dividends and capital gains. Furthermore, as originally argued by Elton and Gruber, the results are consistent with a tax-induced clientele effect: the price change relative to the dividend per share is found to be positively correlated with the dividend yield, which could be expected if investors in high tax brackets hold low dividend yield stocks (and vice versa).[1] We shall refer to this interpretation of ex-dividend day behavior as the *tax-clientele hypothesis.*

More recently, the above interpretation has been challenged by Kalay [10] and Miller and Scholes [14], who argue that the Elton-Gruber analysis is incorrect because it ignores short-term trading by members of the exchange and tax exempt investors. Moreover, they show that the observed relation between dividend yield and relative price changes can be explained by short-term trading rather than by so-called "clientele" effects. We shall refer to this hypothesis as the *short-term trading hypothesis.*

The purpose of this paper is to examine the ex-dividend day behavior of Canadian companies on the Toronto Stock Exchange around a major reform in the taxation of dividends relative to capital gains, which enables us to compare the predictions of these two hypotheses.

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[1] Direct analysis of stock ownership (see Lewellen, et al., [11]) does not reveal any significant clientele effect. Moreover, the theory fails to explain why we don't observe corner solutions (e.g., see Hess [9]).

Table I

Taxation of Dividends and Capital Gains in 1971 and 1972[a], for Individual Investors, in Canada

	Value of 1 Dollar of Capital Gains After Taxes	Value of 1 Dollar of Dividends After Taxes
1971	1	$1.2 - T_f + 0.28\,(T_f - 0.2)$ $= 1.144 - 0.72\,T_f$
1972	$1 - \frac{1}{2}\,T_f - \frac{0.305}{2}\,T_f =$ $1 - 0.652\,T_f$	$1 - 1.33\,T_f + (1.33)(.2)$ $- 0.305\,(1.33\,T_f - (1.33)(.2))$ $= 1.35 - 1.74\,T_f$

[a] **Notes:** T_f = federal tax rate. In *1971* there exists a 20% dividend tax credit and a 28% provincial tax credit on the federal tax (net of the 20% dividend tax credit). Capital gains are untaxed. In *1972* half of the capital gain is taxed and the dividend is grossed up by 33%, after which a 20% tax credit is taken. A provincial tax equal to 30.5% of the net federal tax is taken.

The tax reform *increased* the value of a dollar of taxable dividends relative to a dollar of capital gains for all taxable investors. Consequently, the tax-clientele hypothesis predicts an increase in the relative price change after the tax reform. At the same time, the reform *decreased* short-term trading profits for individual members of the exchange (and, to a lesser extent, for incorporated members and corporations). Therefore, for reasons explained below, the short-term hypothesis predicts a change in ex-dividend day behavior opposite to that predicted by the tax-clientele hypothesis.

The paper is organized as follows. In Section I we explain the 1971 tax reform and its implications for ex-dividend day behavior according to each of our working hypotheses. In Section II, we present the data and propose two statistics to assess the effect of the tax reform on stock prices. The empirical results which are reported in Section III are inconsistent with the tax-clientele interpretation of ex-dividend day behavior since, contrary to its predictions, prices fall by a significantly smaller amount after the tax reform relative to the dividends than before. Furthermore, the relative price drop is much smaller than reported in similar studies which employ U.S. data (in spite of the more favorable Canadian tax treatment of dividends relative to capital gains). However, all the results are consistent with the predictions of the short-term trading hypothesis. Section IV summarizes our main conclusions and suggestions for further research.

I. Predictions of Tax-clientele and Short-term Trading Hypotheses

Prior to 1971, Canadian investors who received income from Canadian companies in the form of dividends were granted a dividend tax credit equal to 20 percent of the dividend. In addition, shareholders received a provincial tax credit[2] equal to 28% of the net federal tax paid (see Table I). Capital gains were tax exempt however, so that in spite of the dividend tax credit, capital gains would have been preferred to dividends by all shareholders with a marginal federal tax rate above 20%. Using the 1971 tax rate schedule, this would apply to anyone earning more than $4,000 per year.

[2] The provincial tax rate varies slightly across different provinces. Throughout the paper we use the rates of Ontario.

As a result of the 1971 tax reform, from January 1972 dividends were to be grossed up by a third and a tax credit equal to 20 percent taken for federal tax purposes (see Table I for an illustration). In addition, a capital gains tax (at half the ordinary income tax rate) was introduced. Marginal federal tax rates were reduced, but the provincial tax credit was abolished; instead, a provincial tax equal to 30.5% (in Ontario, see footnote 2) of the net federal tax had to be paid. As shown in Table I, this reform made every ordinary investor with a marginal Federal tax rate below 32% prefer taxable dividends to taxable capital gains. In 1972, this would apply to persons with taxable income below 14,000 dollars. Marginal federal tax rates were also drastically reduced, however, so that for an investor in the highest marginal tax bracket (47%), a dollar of dividends was now equivalent to 76.8 cents of capital gains (or 20 cents more than in 1971).[3]

A. *The Tax Clientele Hypothesis*

Following Elton and Gruber [6], we assume initially that there are no transactions costs or restrictions on short sales, that investors are risk neutral, and that there are no short-term traders.

In equilibrium, market prices will be set so that the median shareholder is indifferent between buying and selling before or after the stock goes ex-dividend, so that under the 1971 regime (see Table I for an illustration)

$$P_B = P_A + D(1.44 - 0.72T_f) \tag{1}$$

where

P_B is the price per share cum dividend
P_A is the price per share ex-dividend
D is the dividend per share
T_f is the marginal federal tax rate of the median shareholder

(1) can be rewritten as

$$\frac{\Delta P}{D} = \frac{P_B - P_A}{D} = 1.144 - 0.72\ T_f \tag{2}$$

Table II shows the calculated value of $\Delta P/D$ using Equation (2) for selected income groups. For all shareholders with $T_f > 0.2$, $(P_B - P_A)/D < 1$. As the largest marginal tax rate equals 80%, the smallest $\Delta P/D$ equals $1.144 - (0.72)(.8) = 0.568$. The argument above applies to a seller as well as to a buyer.

Elton and Gruber argue that Equation (2) can be used to infer "clientele" effects (originally proposed by Miller and Modigliani [12]): if investors with high marginal tax brackets hold low dividend yield stocks, then those stocks should have relatively small values of $\Delta P/D$, reflecting the tax bracket of their median shareholder.

[3] To prevent the pre-reform undistributed surplus from being affected by the new tax changes, the 1971 reform established different undistributed surplus accounts from which dividends could be paid tax-free to shareholders after a public corporation had paid 15% on the account. Corporations consequently created class B shares on which tax-free dividends could be paid. For these shares $\Delta P/D$ should be larger than for the "A" shares. However, because of the trivial number of "B" shares in our sample (less than 1%) we decided to ignore this special case.

Table II

Theoretical Predictions of the Tax Hypothesis for Selected Taxable Incomes[a]

Taxable Income	Canada 1971		Canada 1972		Predicted Change (1972–1971)	U.S. 1966	
	T_f	$\Delta P/D$	T_f	$\Delta P/D$		T_p	$\Delta P/D$
5,000	0.22	0.986	0.21	1.119	0.133	0.22	0.88
10,000	0.30	0.928	0.27	1.068	0.140	0.28	0.84
14,000	0.40	0.856	0.31	1.012	0.166	0.36	0.78
20,000	0.45	0.820	0.35	0.960	0.141	0.45	0.71
25,000	0.45	0.820	0.39	0.900	0.080	0.50	0.67
40,000	0.50	0.784	0.43	0.833	0.049	0.58	0.59
60,000	0.55	0.748	0.43	0.833	0.085	0.62	0.55
90,000	0.60	0.712	0.47	0.768	0.056	0.68	0.48
125,000	0.65	0.676	0.47	0.768	0.092	0.70	0.46
225,000	0.70	0.640	0.47	0.768	0.128	0.70	0.46
400,000	0.75	0.604	0.47	0.768	0.164	0.70	0.46
<400,000	0.80	0.568	0.47	0.768	0.200	0.70	0.46

[a] **Notes:** Δp = price change on the ex-dividend day; D is the dividend per share; T_f is the marginal federal tax rate; T_p is the marginal tax rate on ordinary income in the U.S. In Canada, $\Delta P/D$ is computed as $1.144 - 0.72T_f$, in 1971, and as $(1.35 - 1.74T_f)/(1 - 0.652T_f)$ in 1972. In the U.S., $\Delta P/D$ is computed as $(1 - T_p)/(1 - T_p(.5))$. U.S. income tax schedules are based on the prevailing rates in 1966, the year studied by Elton-Gruber [6] and Kalay [10].

Similar arguments imply that under the 1972 tax regime, in equilibrium, investors will be indifferent between selling at the cum dividend and ex-dividend share price, so that (see Table I),

$$P_B - (P_B - P_0)0.652T_f = P_A - (P_A - P_0)0.652T_f + D(1.35 - 1.74\ T_f) \quad (3)$$

or

$$\frac{\Delta P}{D} \equiv \frac{P_B - P_A}{D} = \frac{1.35 - 1.74T_f}{1 - 0.652T_f} \quad (4)$$

with P_0 being the original purchase price per share. Table II shows that, for all investors with marginal federal tax brackets below 32 percent, $\Delta P/D > 1$ and the smallest value[4] of $\Delta P/D$ (corresponding to $T_f = 47$ percent) equals 0.768.[5]

Table II also shows that the expected increase (relative to 1971) in ΔP/D differs for different income classes and ranges between 4.9% and 20%. Finally,

[4] Recall that when the government introduced the provincial tax (and abolished the provincial tax credit) it also reduced the marginal federal tax rates. In 1972, the maximum rate applied to anyone with a taxable income above $60,000 was 47 percent.

[5] The introduction of the capital gains tax induces an additional complication: investors with appreciated stocks will be put in a *locked-in* capital gains position. This alters their incentive to sell, although the price drop-off on ex-day arguments will stand regardless because they are predicated on investors who have decided to sell ("delinking"). It does imply, however, that the usual argument that one employs in delinking may not be valid: other considerations in an overall tax strategy may move the timing decision, such that an optimal sale occurs well before or after the ex-date, even though the ex-date trajectory looks favorable (for the tax code (U.S.) induced trading rules, see Constantinides [5]).

in the U.S. dividends are taxed as ordinary income (at T_P) and until recently, half of the long-term capital gains were tax-exempt. So that, in equilibrium

$$P_B - (P_B - P_0)0.5T_p = P_A - (P_A - P_0)0.5T_p + D(1 - T_p) \tag{4a}$$

or

$$\frac{P_B - P_A}{D} = \frac{1 - T_p}{1 - 0.5T_p} \tag{4b}$$

The last two columns in Table II show the theoretically expected $\Delta P/D$ for the U.S., using the 1966 tax rate schedule. We chose 1966 because we compare our results with the ones reported by Kalay [10] and Elton and Gruber [6], who employ U.S. data for 1966. It is interesting that, even before the tax reform, we expect $\Delta P/D$ to be larger in Canada than in the U.S.[6]

Summarizing, under the assumptions specified above, the tax clientele hypothesis predicts that the average $\Delta P/D$ will be larger in 1972 than in 1971, that high dividend yield stocks should experience high values of $\Delta P/D$ and that in both years, $\Delta P/D$ will be larger in Canada than in the U.S.

B. *Short-term Trading Hypothesis*

Kalay [10] and Miller and Scholes [14] argue that the tax-clientele hypothesis has a major flaw because it is consistent with positive trading profits for various short-term traders. In order to illustrate this reasoning (and its implications), we shall distinguish five types of possible traders: (i) ordinary individual investors who pay regular transactions costs; (ii) individual members of the exchange (brokers, dealers); (iii) incorporated brokers and dealers; (iv) regular corporations; and (v) tax exempt institutions. We describe for each type in the U.S. and Canada, the after-tax (but before transactions cost) short-term trading profit opportunities that existed in 1971 and 1972. Two types of short-term trading strategies are considered: first, buying cum dividend and selling on the ex-dividend day; second, short-selling around the ex-dividend day. For each investor type (and for each type of trading activity), the equilibrium $\Delta P/D$ imposed by a zero profit condition is determined. Details of the analysis are presented in the Appendix. The predictions of the short-term trading hypothesis can be summarized as follows:

(i) $\Delta P/D$ will tend to be smaller in Canada than in the U.S. both in 1971 and in 1972. Indeed, in the U.S. and Canada all short term traders have an incentive to prevent ex-dividend day price changes from exceeding the dividend per share, by *shortselling* around the ex-dividend day. Thus, in both countries, *all parties involved have equal incentives to trade when* ΔP

[6] There are some other key differences in personal taxation of investment income between the two countries.

(i) Capital losses in the U.S. can be offset in full against other capital gains and against up to $2,000 of other income (in 1966). Any unused losses can be carried forward indefinitely. In Canada the provisions are similar, limiting the deductibility of capital losses against other income to $1,000 (in 1972).

(ii) Canada allows a deduction of up to $1,000 of interest, dividend, and capital gain income. In the U.S. taxpayers may deduct $100 of dividends.

$> D$. On the other hand, incentives to trade (buying before and selling after) when $\Delta P < D$ are not as strong in Canada as in the U.S. for incorporated (and in 1972 also individual) members of the exchange (compare Columns 3 and 5 of Tables III and I). Admittedly, in 1971, for individual Canadian members of the exchange (who could claim business losses) potential trading profits were 20 to 30 percent higher than for their U.S. counterparts (compare columns 3 and 5 of Table III; see also Table IV, Column 4). Nevertheless, this relative advantage was still more than 55% below the potential trading profit of the incorporated U.S. members of the exchange (see the third column of Tables III and V). So overall *we expect that in Canada, in 1971 and 1972, incentives to exploit price drops which are less than the dividend per share are lower than in the U.S.* Note that these incentives are the ones that ensure that ΔP will not fall below D. Thus, given price changes above or below D (for *whatever* reason), the asymmetric trading incentives outlined above lead us to expect, on the average, $\Delta P/D$ to be smaller in Canada than in the U.S.[7]

(ii) We expect $\Delta P/D$ in 1972 to be smaller than in 1971. The reason is as follows: the main impact of the 1971 tax reform was to reduce trading profits (from buying cum- and selling ex-) for individual members of the exchange (compare Column 4 with columns 7, 8, and 9 in Table IV) and to a lesser extent for incorporated members and corporations (compare Columns 4 of Tables III and V). Recall that this trading incentive ensures that ΔP does not fall below D. At the same time incentives to prevent ΔP from exceeding D (via shortselling) were left unchanged.

(iii) Finally, similar to the prediction of the tax clientele hypothesis, we expect $\Delta P/D$ to be positively related to dividend yield. This prediction is conditional upon the fundamental assumption that on the average prices fall by less than the dividend per share.[8] (The assumption that prices fall by less than the dividend is consistent with all the empirical evidence.) This assumption can be justified in two different ways. First, for reasons

[7] It is interesting to note that because different traders are taxed differently, no stable equilibrium may exist. A price drop greater than the dividend would offer trading profits by shortselling on the ex-dividend day but U.S. corporate investors would trade as long as the drop-off is smaller than 1.85 (see Column 3 of Tables III and V). Even if transactions costs may limit profit opportunities (and thus induce stability), once we allow for special accounts at brokerage houses and for the formation of intermediaries (e.g., a mutual fund for corporate investors which will funnel short-term capital gains into dividends to take advantage of the 85% exclusion (see Fisher Black [2]) it may well be that transaction costs are not a severe limitation to short-term trading. However, the fact that the observed prices will not be equilibrium prices does not affect the crux of our argument: the larger the incentive for short-term traders to wipe out incomplete drop-offs, the larger the "disequilibrium" drop-offs will be.

[8] An explanation why stock prices would fall less than the dividend per share *after* allowing for short-term trading is provided by Kalay: in the U.S., traders can offset a maximum of $3,000 per year of short-term capital losses against ordinary income. So potential gains from buying cum dividend and benefiting from a capital loss deduction (by selling on ex-dividend days) are limited, while profits from short sales are not. This explanation is not applicable to Canada. It is true that, similar to the U.S., individual traders can offset a maximum of $1,000 (in 1972) per year of capital losses against ordinary income. But as shown in the Appendix, the Canadian trader-member of the exchange would prefer not to have a capital loss at all (because of Section 112 (4)).

Table III

Profits before Transaction Costs from Buying Cum Dividend (at P_B) and Selling Ex-Dividend (at P_A) in 1971[a]

Trader Type	United States (Profits)	$(P_B - P_A)/D$ for Zero Profits	Canada (Profits)	$(P_B - P_A)/D$ for Zero Profits
Ordinary Investor	$-P_B + P_A + D(1 - T_p) + (P_B - P_A)T_P$	1	$-P_B + P_A + D(1.144 - 0.72T_f)$	$1.14 - 0.72T_f$
Individual Exchange Member				
a) Capital Loss	Same as above,	1	Same as above.	$1.144 - 0.72T_f$
b) Business Loss	Same as above.	1	$-P_B + P_A + D(1.144 - 0.72T_f) + (P_B - P_A)0.72T_f$	$\frac{1.144 - 0.72T_f}{1 - 0.72T_f}$
Incorporate Traders	$-P_B + P_A + D(1 - 0.15T_c) + (P_B - P_A)T_c$	$\frac{1 - 0.15T_c}{1 - T_c}$	Optional: $-P_B + P_A + D$ $-P_B + P_A + D(1 - T_c) + (P_B - P_A)T_c$	1 1
Tax Exempt Institution	$-P_B + P_A + D$	1	$-P_B + P_A + D$	1
Corporations	Same as Incorporated Dealers	$\frac{1 - 0.15T_c}{1 - T_c}$	$-P_B + P_A + D$	1

[a] **Notes:** T_p = ordinary income tax rate (US); T_c = corporate income tax rate; T_f = federal personal tax rate for Canadian investors.

Table IV

Equilibrium Expected $\Delta P/D$ in Canada, which would Prevent Individuals from Making Profits from Buying Cum and Selling Ex-Dividend, in 1971 and 1972, for Investors who make more than $15,000 Per Year

		1971: $\Delta P/D$			1972: $\Delta P/D$			
						Exchange Member		
Taxable Income above $15,000 but below:	1971 Marginal Federal Tax Rate	Ordinary Investor (1)	Exchange Member (2)	1972 Marginal Federal Tax Rate	Ordinary Investor (3)	Business Loss (4)	Capital Loss (5)	No Loss Reported (6)
26,000	0.45	0.82	1.21	0.35	0.960	0.521	0.661	0.741
41,000	0.50	0.784	1.225	0.39	0.900	0.332	0.562	0.671
61,000	0.55	0.748	1.238	0.43	0.837	0.090	0.453	0.602
91,000	0.60	0.712	1.254	0.47	0.760	−0.211	0.330	0.532
126,000	0.65	0.672	1.263	0.47	0.768	−0.211	0.330	0.532
400,000	0.75	0.604	1.31	0.47	0.768	−0.211	0.330	0.532

Notes: (1) computed as $1.14 - 0.72T_f$; (2) computed as $(1.144 - 0.72T_f)/(1 - 0.72T_f)$; (3) computed as $(1.35 - 1.74T_f)/(1 - 0.652T_f)$; (4) computed as $(1.35 - 3.045T_f)/(1 - 1.305T_f)$; (5) computed as $(1.35 - 2.393T_f)/(1 - 0.652T_f)$; (6) computed as $1.35 - 1.74\ T_f$; For an explanation of (1) and (2), see Table III. For an explanation of (3), (4), (5), and (6) see Table V.

Table V

Profits before Transaction Costs from Buying Cum Dividend (at P_B) and Selling Ex-Dividend (at P_A) in 1972[a]

Trader Type	United States (Profits)	$(P_B - P_A)/D$ for Zero Profits	Canada (Profits)	$(P_B - P_A)/D$ for Zero Profits
Ordinary Investor	$-P_B + P_A + D(1 - T_p) + (P_B - P_A)T_P$	1	$-P_B + P_A + D(1.35 - 1.74T_f) + 0.652T_f(P_B - P_A)$	$\frac{1.35 - 1.74T_f}{1 - 0.652T_f}$
Individual Exchange Member				
a) Capital Loss	Same as above.	1	$-P_B + P_A + D(1.35 - 1.7T_f) + 0.652T_f(P_B - P_A - D)$	$\frac{1.35 - 2.392T_f}{1 - 0.652T_f}$
b) Business Loss	Same as above.	1	$-P_B + P_A + D(1.35 - 1.74T_f) + 1.305T_f(P_B - P_A - D)$	$\frac{1.35 - 3.045T_f}{1 - 1.305T_f}$
Incorporated Traders	$-P_B + P_A + D(1 - 0.15T_c) + (P_B - P_A)T_c$	$\frac{1 - 0.15T_c}{1 - T_c}$	$-P_B + P_A + D + T_c(P_B - P_A - D)$	1
Tax Exempt Institution	$-P_B + P_A + D$	1	$-P_B + P_A + D$	1
Corporations	Same as Incorporated Dealers	$\frac{1 - 0.15T_c}{1 - T_c}$	$-P_B + P_A + D + \frac{T_c}{2}(P_B - P_A - D)$	1

[a] **Notes:** T_p = ordinary income tax rate (US); T_c = corporate income tax rate; T_f = federal personal tax rate for Canadian investors.

outlined in the tax-clientele hypothesis, on the average the investors who time their transactions in the capital market around ex-dividend days tend to value dividends less than capital gains. Note from Table II that this will be true for all U.S. individual investors (ignoring Miller and Scholes [13] tax shelter arguments) and all Canadian investors whose annual income is more than $14,000. Thus, the typical trading opportunity is created by an individual who is willing to sell on the day before the ex-dividend day, even when he knows that the price drop will be smaller than the dividend per share. Alternatively, one could "explain" why stock prices fall less than the dividend per share as a market inefficiency: uninformed investors may submit limit orders on the ex-day, without incorporating the (publicly available) information that the stock went ex-dividend.

Whatever the reason, given the assumption above, the "typical" short-term trading opportunity involves buying on the day before and selling on the ex-dividend day. By doing this, a tax exempt[9] investor could realize a profit after paying a round-trip transaction cost TC of $-P_B + P_A + D - TC$. No profit opportunity exists if $P_B - P_A \leq D - TC$ or when $(P_B - P_A)/D \leq 1 - \frac{TC}{D}$. Transaction costs are in general proportional to the stock price (usually a percentage, say X, of the stock price); therefore, we can rewrite this nonprofit condition as

$$\frac{P_B - P_A}{D} \leq 1 - X\frac{(P_A + P_B)}{D}$$

Hence, the larger the dividend yield the closer the right-hand side of the above inequality gets to one. To put it differently, for high dividend yield stocks, after transactions cost, incentives to force a full drop-off ($\Delta P/D = 1$) via short-term trading are larger than for low dividend yield stocks. Thus, short-term trading could create a yield effect which looks like a clientele effect.

One final comment: the short-term trading hypothesis does not preclude the possibility that investors time their transactions (as the tax-clientele hypothesis suggests) and does not imply that *all* transactions are executed by short-term traders. It merely adds an additional complication to the more traditional tax-clientele interpretation of ex-dividend day behavior and argues that this complication has an important effect on observed price behavior.

II. Sample Design and Methodology

Closing and opening prices on the ex-dividend day, and closing prices on the preceding day were collected for all Canadian firms on the TSE which paid dividends in 1971 and 1972. In order to avoid problems with "thinly" traded securities, events for which one or more prices were missing were omitted. The final sample contained 555 observations in 1971 and 671 observations in 1972.

[9] We assume a tax exempt investor for illustrative reasons. The argument holds for any short-term trader.

All the data were obtained from the Toronto Stock Exchange Daily Record. In each case, prices represent actual transaction prices.

The use of closing prices on the ex-dividend day raises the possibility of bias, since part of the price movements may be due to market wide returns. Therefore, closing prices on the ex-dividend day were adjusted for market-wide events using the Toronto Stock Exchange (TSE) 300 Index as a proxy for the market.

A. *Test Statistics and Their Properties*

We present results based on two statistics; each corresponds to a different investment strategy and makes different assumptions about the distribution of price changes.

Assume that the price change for security i, $\tilde{\Delta}P_i$, is a random variable which can be written as

$$\tilde{\Delta}P_i = \alpha D_i + \tilde{\epsilon}_i \tag{5}$$

where α measures the value of a dollar of dividends relative to a dollar of capital gains, D_i is the dividend per share, $\tilde{\epsilon}_i$ is a random price change with $E(\tilde{\epsilon}_i) = 0$, and $\text{Var}(\tilde{\epsilon}_i) = P_i^2\sigma^2$. The assumption that the standard deviation of the price change is proportional to the share price or constant in rate of return terms is a standard assumption in finance literature.

Following the analysis of Elton and Gruber [6], the average price drop on the ex-dividend day relative to the dividend is

$$d = \frac{1}{N}\sum_{i=1}^{N}\frac{\Delta P_i}{D_i} \tag{6}$$

where N is the number of observations. d may be estimated as the intercept of the regression

$$\frac{\Delta\tilde{P}_i}{D_i} = \alpha\frac{D_i}{D_i} + \frac{\tilde{e}_i}{D_i} = \alpha + \frac{\tilde{e}_i}{D_i} \tag{7}$$

d is the O.L.S. estimate of the intercept α; assuming homoscedasticity the variance of the estimate is[10]

$$\sigma^2(\tilde{d}) = \frac{1}{N}\sigma^2\left(\frac{\tilde{\Delta}P}{D}\right) = \frac{1}{N}\sigma^2\left(\frac{\tilde{\epsilon}}{D}\right) \tag{8}$$

However, the regression in (7) suffers from heteroscedastic errors and therefore the O.L.S. estimate is not efficient; the error is proportional to the price and not to the dividend.

d represents the expected price drop relative to the dividend per share if an investor would randomly pick a stock out of the population of all available securities. This corresponds to a portfolio investment strategy in which the portfolio weights are such that the investor will receive the same amount of

[10] An assumption is made that $\tilde{\epsilon}_i/D_i$ are independent. Of course, some clustering of events may be present, but for market adjusted daily returns the effect on the value of the t-statistic will be trivial (for some simulation evidence see Brown and Warner [4]).

dividends from each of the securities. Hence, a security that pays \$.05 of dividends receives 20 times as much weight in the portfolio as a security paying \$1 of dividends. Such a portfolio strategy is not very reasonable.

We propose in this paper an alternative statistic to assess the ex-dividend day behavior, one which relates the average price drop to the average dividend yield. It has an appealing portfolio interpretation: it corresponds to an equal dollar amount invested in each of the securities. Specifically, the portfolio statistic p is defined as[11]

$$p = \frac{\sum_{i=1}^{N} \frac{\Delta P_i}{P_{B,i}}}{\sum_{i=1}^{N} \frac{D_i}{P_{B,i}}} = \frac{\left(\overline{\frac{\Delta P}{P_B}}\right)}{\left(\frac{\overline{D}}{P_B}\right)} \tag{9}$$

where $P_{B,i}$ is the closing price per share on the day before the ex-dividend day for firm i and the "bar" denotes average value. The numerator represents (minus) the capital loss on an equally weighted portfolio through the ex-dividend day. The denominator represents the dividend return on the same portfolio. This statistic can be related to the abnormal return on the ex-dividend day. It can be shown that the abnormal return, AB, from investing an equal amount in all companies going ex-dividend is

$$AB = \left(\frac{\overline{D}}{P_B}\right) - \left(\overline{\frac{\Delta P}{P_B}}\right) = (1 - p)\left(\frac{\overline{D}}{P_B}\right) \tag{10}$$

If p is less than one, a positive abnormal return will be observed on the ex-dividend day. The statistic p is adjusted for heteroscedasticity of the disturbance term in (5) since the change in price of each security is scaled by its price. The variance of p is estimated as[12,13]

$$\sigma^2(\tilde{p}) = \frac{1}{N} \frac{1}{\left(\frac{\overline{D}}{P_B}\right)^2} \sigma^2\left(\frac{\Delta P}{P_B}\right) \tag{11}$$

[11] The statistic p has essentially the same properties as the statistic used by Black and Scholes [3] in their study about the behavior of securities around ex-dividend days. (They used abnormal returns.)

[12] Without knowing the drop in price relative to the dividend paid (α in (5)) we cannot derive $\sigma^2(\tilde{\epsilon}/P_B)$. Therefore, in the statistical tests, we shall assume that $\sigma^2(\tilde{\epsilon}/P_B) = \sigma^2(\tilde{\Delta P}/P_B)$ so that the true variance of p is overstated.

[13] The estimate that we are using is different from an O.L.S. estimate of (5) adjusted for heteroscedasticity. An O.L.S. estimate in this case, gives to each observation on the dependent variable ($\Delta P/P$) a weight which is proportional to the size of the dependent variable (D/P). In terms of portfolio interpretation of such a measure, the implied strategy is that the portfolio weights are a function of the dividend yield. Hence, the virtue of such a strategy is not immediately apparent.

In addition to our measure p, we also computed the O.L.S. measure and the results were qualitatively the same. This similarity is not unexpected because the variability of the independent variable, D/P, is relatively low. Therefore, the observations on the dependent variable are receiving relatively similar weights.

B. *Price Movement Discontinuity and Opening Versus Closing Prices*

Stock prices cannot drop by the full amount of the dividend if the dividend is not divisible by 0.125. Kalay [10] argues that this will induce a downward bias in the price drop for all the stocks with a dividend smaller than 12.5 cents.[14] In order to assess the magnitude of this bias, we also report "adjusted" results obtained by rounding all dividends to the nearest 0.125. The results based on rounded dividends are indicated with superscript "R".

In addition, to examine the sensitivity of the results to the selection of the ex-dividend price, closing (adjusted for the market) as well as opening prices are utilized.

III. Empirical Results

A. *Tax-clientele Versus Short-term Trading Hypotheses*

Table VI compares the values of the two relative price change statistics, the Elton-Gruber statistic (d) and the portfolio measure (p) in 1971 and 1972, for four different specifications of ΔP (using closing- to-closing prices, closing- to-opening prices, rounded and unadjusted dividends). Contrary to the predictions of the tax-clientele hypothesis, but consistent with the short-term trading hypothesis, in seven out of the eight cases considered the average relative price drop is smaller in 1972 than in 1971. In four cases, the difference is statistically significant at the 10% significance level and ranges between 0.21 and 0.28. (The F-test in Table VI shows that for three out of the four "significant" differences, it is impossible to reject the hypothesis that the variances are equal.) The difference in the price drop was probably not caused by a "yield effect": the average dividend yield was only marginally different in the two years (1.07 percent in 1971 and 1.13 percent in 1972).

Table VI shows that the portfolio statistic is more robust and statistically superior to the traditional statistic: the variance of the Elton-Gruber statistic is always larger than the corresponding (overstated) variance of the portfolio statistic. Also, rounding makes little difference in the portfolio statistic, while rounding causes large fluctuations when the traditional computation method is used. Note that to a certain extent, rounding alleviates the problem with Elton and Gruber's statistic: all dividends smaller than 12.5 cents are eliminated. Thus, a case for rounding can be made for a different reason than the one proposed by Kalay [10].

[14] Kalay's reasoning goes as follows: assume dividends are uniformly distributed between 0 and 12.5 cents and that ΔP is only influenced by D. In this case, if the dividend is less than 6.25 cents, $\Delta P = 0$ and $\Delta P/D = 0$. For dividends between 6.25 cents and 12.5 cents, $2 \leq \Delta P/D \geq 1$. Therefore, the average $\Delta P/D$ will be smaller than 1 for dividends between 0 and 12.5 cents. However, this reasoning breaks down if ΔP is no longer determined solely by D. For example, if $D = 5$ cents, it may well be that $\Delta P = 7$ cents (which is "rounded" to 12.5 by the exchange), even if the *expected* value of $\Delta P/D = 1$. So Kalay's argument for rounding is rather weak. However, by rounding, all dividends smaller than 12.5 cents are eliminated. As the Elton-Gruber measure is very sensitive to noise from low dividend paying stocks (see supra) an argument for rounding can be made for "pure" statistical reasons.

Table VI

Comparison of Ex-dividend Day Behavior on TSE in 1971 and 1972[a] (Mean Values with Standard Deviations in Parentheses)

		Elton-Gruber Statistics (d)			Portfolio Statistics (p)			
Variables	$[\Delta P/D]_{co}$	$[\Delta P/D]_{cc}$	$[\Delta P/D]^R_{co}$	$[\Delta P/D]^R_{cc}$	$\left[\frac{\overline{\Delta P}}{P}\Big/\frac{\overline{D}}{P}\right]_{co}$	$\left[\frac{\overline{\Delta P}}{P}\Big/\frac{\overline{D}}{P}\right]_{co}$	$\left[\frac{\overline{\Delta P}}{P}\Big/\frac{\overline{D}}{P}\right]^R_{co}$	$\left[\frac{\overline{\Delta P}}{P}\Big/\frac{\overline{D}}{P}\right]^R_{cc}$
1971	0.2638	0.2712	0.4558	0.4505	0.3858	0.4606	0.4072	0.4814
	(2.55)	(3.01)	(1.82)	(2.25)	(1.89)	(2.24)	(1.69)	(2.03)
1972	0.3256	0.0666	0.2266	0.1851	0.2825	0.2096	0.2741	0.2657
	(3.30)	(4.62)	(1.66)	(2.23)	(1.89)	(2.32)	(1.55)	(1.98)
Difference 1972 − 1971	+0.0618	−0.2046	−0.2292	−0.2754	−0.1033	−0.2510	−0.1331	−0.2157
t-Statistic	.36	−0.90	−2.15**	−1.93*	−0.95	−1.91*	−1.34	−1.75*
F-Statistic	1.68***	2.3***	1.20**	1.01	1.00	1.06	1.19**	1.08

[a] **Notes:** ΔP represents the change in price per share around the ex-dividend day; D the dividend per share; the subscripts co and cc refer to price changes computed from closing to opening prices and closing to closing prices (adjusted for market-wide events), respectively. The superscript R means that the dividends were rounded to the nearest ⅛. The statistics in the first four columns correspond to d in Equation (6). The statistics in the last four columns correspond to the portfolio statistic p (see Equation (9)). Number of observations in 1971: 555 when dividends are not rounded; 507 when dividends are rounded. Number of observations in 1972: 671 when dividends are not rounded; 563 when dividends are rounded, * = significant at the 10% significance level, ** = significant at the 5% significance level, *** = significant at the 1% significance level.

Table VI shows, that especially for the traditional statistic, results differ for opening and closing prices. It is easy to verify that none of the differences is statistically significant, however.

As predicted by the short-term trading hypothesis, the percentage price change in Canadian stocks on ex-dividend days turns out to be significantly smaller than reported in similar studies which use U.S. data. For example, for a 1966 NYSE sample, Kalay [10] reports an average value of $\Delta P/D$ (using closing prices, rounded and adjusted for the market) of 0.83 which is 38 percent and 65 percent higher than the corresponding (see Table VI, column 4) Canadian values in 1971 and 1972, respectively. Considering the less favorable taxation of U.S. dividends relative to capital gains, the 1972 figure is clearly inconsistent with the predictions of the tax-clientele hypothesis.[15]

B. *The dividend yield clientele effect*

In Table VII and Table VIII the sample is split into deciles by dividend yield for 1971 and 1972, respectively. The statistics are the same as the ones reported in Table VI, except that inferences on the basis of opening prices are ignored. Note that there exists no strong theoretical justification for using opening rather than closing prices: first, opening prices are not adjusted and do not reflect overnight market returns caused by news released after the closing of the exchange on the day before the ex-dividend day. Second, the opening prices may not represent an "equilibrium" price. While such noise may wash out when we analyze the total sample, it may seriously affect the results for individual deciles. Recall that the results for the total sample were independent of whether we used opening or closing prices.

Performing an F-test, we are unable to reject the hypothesis (at the 10% significance level) that the mean price changes across dividend yield classes are identical. This is true for all price change statistics, both in 1971 and 1972. However, a casual look at the tables reveals that the underlying assumption of normal distributions with the same variance is not met: the low dividend yield deciles tend to have significantly larger standard deviations. This is particularly true for the first decile, which in some cases has a standard deviation ten times as large as the standard deviation of the highest yield decile. Therefore, we performed two nonparametric tests.

First, a median test[16] shows that, except for the traditional statistic in 1971, medians are significantly different (at the 10% significance level or lower) across dividend yield deciles. This result is obtained only when dividends are not rounded, however, A similar conslusion is reached by looking at the Spearman-

[15] An alternative explanation for the differences may be the lower trading volume on the TSE, which may well reduce expected trading profits. The difference between 1971 and 1972 cannot be explained by differences in trading volume itself, however; in 1971 the average daily trading volume for the 555 stocks in our sample was equal to 676,000 shares. The corresponding number in 1972 is 786,000.

[16] The median test examines whether the medians are significantly different across yield deciles. It assumes identical, but not normal, distributions and is less sensitive to outliers than a mean or Kruskall-Wallis test (see Neter and Wasserman [15], pp. 521–2).

Table VII

Relationship between Dividend Yield and Ex-dividend Day Behavior in 1971[a] (standard deviations in parentheses)

Deciles	Mean D/P	Elton-Gruber Statistics $[\Delta P/D]_{cc}$		Elton-Gruber Statistics $[\Delta P/D]^R_{cc}$		Portfolio Statistics $\left[\frac{\overline{\Delta P}}{P} \Big/ \frac{\overline{D}}{P}\right]_{cc}$		Portfolio Statistics $\left[\frac{\overline{\Delta P}}{P} \Big/ \frac{\overline{D}}{P}\right]^R_{cc}$	
1	0.0034	−.7079	(6.39)	0.7060	(4.27)	−.3851	(6.19)	0.6112	(4.39)
2	0.0056	−.3335	(3.91)	0.2129	(2.31)	−.2955	(3.88)	0.2161	(2.31)
3	0.0071	.3597	(2.26)	0.4531	(2.18)	.3583	(2.25)	0.4606	(2.21)
4	0.0080	.6796	(2.84)	0.4775	(2.11)	.6955	(2.90)	0.4697	(2.09)
5	0.0089	.4780	(2.38)	0.8237	(1.80)	.4766	(2.38)	0.8214	(1.80)
6	0.0099	.3100	(1.99)	0.1306	(1.84)	.2989	(1.94)	0.1268	(1.82)
7	0.0111	.3309	(1.75)	0.4895	(2.03)	.3329	(1.74)	0.4996	(2.07)
8	0.0128	.4594	(2.17)	0.2437	(1.28)	.4556	(2.16)	0.2521	(1.29)
9	0.0156	.5168	(1.34)	0.4266	(2.10)	.5195	(1.35)	0.4310	(2.04)
10	0.0305	.6123	(1.53)	0.5417	(1.22)	.7184	(1.47)	0.6543	(1.35)
F Statistic		1.19		0.88		0.46		0.43	
Median Statistic		9.29		7.08		14.59*		15.23*	
Spearman Rank Correlation Coefficient		0.467*		0.021		0.511**		0.067	

[a] **Notes:** ΔP measures te change in price per share around the ex-dividend day; D measures the dividend per share; the subscripts *co* and *cc* refer to price changes computed from closing to opening prices and closing to closing prices (adjusted to market-wide events), respectively. The superscript "R" means that the dividends were rounded to the nearest ⅛. The mean dividend yield in the first column is computed on the basis of "unrounded" dividends. * = significant at the 10% significance level; ** = significant at the 5% significance level.

Table VIII

Relationship between Dividend Yield and Ex-dividend Day Behavior in 1972[a] (standard deviations in parentheses)

Yield Deciles	Mean D/P	Elton-Gruber Statistics $[\Delta P/D]_{cc}$		Elton-Gruber Statistics $[\Delta P/D]^R_{cc}$		Portfolio Statistics $\left[\frac{\overline{\Delta P}}{P} \Big/ \frac{\overline{D}}{P}\right]_{cc}$		Portfolio Statistics $\left[\frac{\overline{\Delta P}}{P} \Big/ \frac{\overline{D}}{P}\right]^R_{cc}$	
1	0.0026	−.1866	(12.53)	−.1377	(3.07)	−.6945	(9.56)	−.1741	(3.02)
2	0.0043	−.4562	(3.73)	0.1067	(2.99)	−.4060	(3.66)	0.1409	(2.99)
3	0.0055	.0136	(2.93)	−.0698	(3.31)	.0216	(2.84)	−.0849	(3.30)
4	0.0068	−.1707	(3.71)	0.2937	(1.93)	−.2203	(3.71)	0.2966	(1.98)
5	0.0078	.0621	(2.42)	0.5026	(1.73)	.0546	(2.43)	0.5118	(1.73)
6	0.0090	.3325	(2.94)	0.0452	(1.87)	.3375	(1.71)	0.0443	(1.88)
7	0.0100	.1288	(2.54)	0.1276	(2.33)	.1231	(2.50)	0.1224	(2.38)
8	0.0114	.1153	(1.77)	0.3933	(1.34)	.1166	(1.77)	0.3897	(1.35)
9	0.0140	.3866	(1.53)	0.1607	(1.49)	.3943	(1.52)	0.1513	(1.50)
10	0.0350	.4356	(1.24)	0.4214	(1.08)	.435	(1.31)	0.4326	(1.24)
F Statistic		0.24		0.51		.597		0.56	
Median Statistic		17.57**		12.04		17.59**		9.649	
Spearman Rank Correlation Coefficient		0.468*		0.378		0.511**		0.378	

[a] **Notes:** ΔP measures the change in price per share around the ex-dividend day; D measures the dividend per share; the subscripts *co* and *cc* refer to price changes computed from closing to opening prices and closing to closing prices (adjusted to market-wide events), respectively. The superscript "R" means that the dividends were rounded to the nearest ⅛. The mean dividend yield in the first column is computed on the basis of "unrounded" dividends. * = significant at the 10% significance level; ** = significant at the 5% significance level.

rank correlations between mean dividend yield and average price changes: all correlations are significantly positive at the 10 percent significance level, again provided dividends are not rounded. This result is similar to the one reported by Kalay, and also observes that rank correlations become insignificant when dividends are rounded. Casual inspection of the tables shows that this "rounding" effect is caused by the dramatic swings in the low dividend yield deciles. The results obtained by rounding dividends should be interpreted with caution: the prices of securities with very low dividend yields are less likely to be set by short-term traders, because of the trivial trading returns involved. Moreover, once we consider only the largest five dividend yield deciles, it becomes apparent that in 1971, for all four statistics, the sixth decile always experiences the smallest price change, while the largest price change is always observed in the tenth decile. A similar effect is observed in 1972, for the rounded dividends. So it is probably safe to conclude that some yield effect is present, although less pronounced (especially for the low dividend yield deciles) than that reported by Elton-Gruber and Kalay with U.S. data (both studies report rank order correlations larger than 0.80, using unadjusted dividends). This international difference cannot be explained by a dividend yield effect in itself: in both countries the median dividend yields are roughly equal (approximately 0.9 percent).

Note again the systematically smaller price change in 1972 compared to 1971, for the highest 5 yield deciles: in 16 out of the 20 comparisons, the average price change is smaller in 1972 than 1971. Finally, note the systematically smaller price change, in both years, for the 5 highest yield deciles, compared to U.S. data. e.g., for the highest 5 deciles Kalay reports average relative price changes fluctuating between 0.74 and 1.05 (1.05 is the price change for the tenth decile.) In the Canadian case, we are unable to find any price change larger than .71. So, the general conclusions reported in the previous section are also valid for (the largest) individual deciles, and therefore independent of outliers in the low dividend yield deciles.[17]

It may seem puzzling that in 1971 Canadian individual traders, by claiming business losses, did not by themselves enforce a full drop off, especially in the high dividend yield deciles. However, even for the highest yield decile (e.g., see Table VII), the standard deviation of the mean $\Delta P/D$ is roughly equal to 20 percent, so that the mean $\Delta P/D$ is not (highly) significantly different from 1. Of course, several other explanations are possible: individual traders are risk averse so that it is incorrect to look only at expected values. Moreover, a similar comment can be made with respect to the observed $\Delta P/D$ in the U.S.: although (for some trader categories) the equilibrium $\Delta P/D$ should be equal to 1.85 (ignoring transaction cost), past research has reported values around 0.75. So, even if we do not have a complete explanation for the *level* of the equilibrium $\Delta P/D$ ($\Delta P/D$ seems to be too low) the short-term trading hypothesis is still able to explain the *difference* in $\Delta P/D$ between the U.S. and Canada.

[17] Of course, this does not mean that, in 1972, no traders were active on ex-dividend days in Canada. So we cannot conclude that in 1972 we observe "true" clientele effects. Even if we would like to entertain this hypothesis, note that the largest $\Delta P/D$ in Table V equals 0.51, which is 25 percent below the predicted value for the investors in the highest tax brackets (see Table II).

IV. Conclusions

The main empirical findings of this paper can be summarized as follows. First, on ex-dividend days stock prices fall by a smaller amount in Canada than in the U.S. Second, the relative price change is larger in 1971 than in 1972. Third, a positive relation between dividend yield and relative price changes exists, but it is less pronounced than reported in studies which employ U.S. data. These results are inconsistent with the simple tax interpretation of ex-dividend day behavior proposed by Elton and Gruber [6]. The "representative" marginal holder's valuation of taxable dividends relative to taxable capital gains is clearly not reflected in the price behavior on ex-dividend days. Rather, as suggested by Miller and Scholes [14], short-term traders, who try to benefit from temporary deviations from "equilibrium" prices, may have significant effect on ex-dividend day behavior. However, as pointed out in footnote 7, the short-term trading hypothesis does not lead to a model of market equilibrium which is completely arbitrage free.

One major puzzle remains: we have not explained why the drop-off is so small in Canada. Thus, while we have been more or less successful in explaining the *difference* in price behavior with the U.S. and around the tax reform, we have not provided a satisfactory explanation for the *level* of the price changes on ex-dividend days (why is the average $\Delta P/D$ only 30% in 1972?).

The results should not be interpreted as evidence that stock prices are independent of personal taxes and divident policy. We merely argue that the price behavior on ex-dividend days should not be used to assess the relative valuation (by the "average" investor) of taxable dividends vs. taxable capital gains or the existence of so called "clientele" effects.

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Appendix: Analysis of Short-Term Trading Possibilities

Buying Cum Dividend and Selling Ex

In this case, the "zero-profit" $\Delta P/D$ should be interpreted as a *minimum* boundary: if $\Delta P/D$ is smaller than the "zero-profit" values (derived below), a positive trading profit exists.

Analysis in 1971

Table III compares, for 1971, the net after tax (before transaction costs) profits obtainable by selected Canadian and, for comparison, U.S. traders.

A. *Ordinary Individuals*

A. 1. U.S.: Dividends are taxed as ordinary income, but so are short-term capital gains and losses. Therefore (see Table III), investors could buy at P_B, receive $D(1 - T_P)$, sell at P_A, and receive a full (i.e., at ordinary income rates) capital loss deduction of $(P_B - P_A)T_p$. Or, investors have an incentive to trade until $\Delta P/D = 1$.

A. 2. Canada: Dividends receive a 20% tax credit and a provincial tax credit equal to 28% of the net federal tax is taken (see Table I). There is no capital gains tax, however, so that in this case, in equilibrium, trading profits will be zero when $\Delta P/D$ is equal to $1.144 - 0.72\ T_f$, where T_f is the marginal federal tax bracket of the trader (see Table III). Table IV provides some numerical illustrations of the expected equilibrium $\Delta P/D$ values for investors in the highest tax brackets. For traders who earn more than \$15,000 (taxable income) per year, we expect $\Delta P/D$ to vary between 0.82 and 0.604, compared to a value of 1 in the U.S.

B. *Individual Members of the Exchange (stockbrokers, dealers)*

B. 1. U.S.: Same treatment as ordinary individuals.

B. 2. Canada: An important distinction has to be made with regard to the tax treatment of security losses and gains: the potential arbitrage profits will differ, dependent on whether security losses can be deducted as an ordinary business loss or will be considered as a capital loss. In 1971, the provisions of the taxation of security profits realized by stockholders who were members of the exchange were, to quote Gilmour ([7], pp. 219), "delightfully vague."[18] So, if individual members of the exchange

[18] As Gilmour [7] (pp. 219 points out): "In March 1953, the Taxation division notified stockholders who were members of various Canadian Stock Exchanges that agreements previously made whereby

were treated as ordinary individuals for tax purposes, we expect $\Delta P/D$ to be smaller than 1 (as in the previous case; see Table IV). If, on the other hand, security losses of individual members were deductible from ordinary income, the equilibrium $\Delta P/D$ will tend to be greater than 1; e.g., Table IV (column 2) shows that $\Delta P/D$ will tend to fluctuate between 1.21 and 1.31 for the traders in the highest tax brackets.

C. *Incorporated Members of the Exchange*

C. 1. U.S.: 85% of the intercorporate dividends are tax deductible, while the resulting short-term capital loss is deductible at full ordinary corporate tax rates. This implies that, in equilibrium, prices should be set such that $\Delta P/D > 1$. Specifically, for a 50% corporate tax rate, the equilibrium relative price change should be equal to 1.85.

C. 2. Canada: As Gilmour ([7], pp. 511) points out, a corporation which is in the business of buying and selling securities has two options. First, according to Section 28(1), it can treat the dividend as tax exempt (such as regular corporations) but then cannot claim a business loss deduction. Or, alternatively, according to Section 28(11), it can treat the dividend received as ordinary income and claim a deduction at the corporate tax rate. As shown in Table III, whatever the treatment chosen by the firm, the equilibrium relative price drop $\Delta P/D$ should be equal to 1.

Analysis in 1972 (Canadian short-term traders).

Table V summarizes, for 1972, the net after-tax (before transactions costs) profit obtainable by the same selected Canadian short-term traders.

A. *Ordinary Individuals*

From the analysis of Table V (see also Table I) it follows that the equilibrium $\Delta P/D$ should be equal to $(1.35 - 1.74\ T_f)/(1 - 0.652\ T_f)$. Note that in Canada there exists no distinction between long-term and short-term capital gains. Table IV shows that for individuals with taxable income above \$15,000 $\Delta P/D$ should range between 0.960 and 0.768. Note also that the government abolished the provincial tax credit, but reduced marginal federal tax rates.

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profits realized in certain firm and personal trading accounts were not subject to tax would no longer be recognized. Instead, future profits would be scrutinized to determine whether the circumstances justified the inclusion of profit in income. Since that time (i.e., in the next 17 years) it has been observed that the taxation division are attempting to levy tax on profits realized from intensive *firm* trading operations, where these profits form a substantial part of the total profit of the business, particularly where brokerage operations are carried out on a small scale." In the case Graham, Jr. versus the Minister of National Revenue (1964, Dominion Tax Case 409) the court held that "a stockbroker can act on his own account as a private and personal investor. Where profit was realized as a transaction, the true nature of which was that as an investment the stockholder realized a capital gain." So while, in general, there is little doubt that incorporated brokers will be taxed as ordinary income, it seems that the law (at least in 1971) tended to consider profits on some individual transactions as capital gains. Of course, whether this provision would have applied to cum-ex trading, we can't establish for certain.

B. *Individual Members of the Exchange*

When the dividend tax credit and capital gains tax were introduced, the Canadian tax authorities apparently realized the potential increase in short-term dealer-broker trading profits: it added Section 112(4) to the tax law which, for the first time, made explicit reference to *individual* dealers and traders (i.e., members of the exchange). The law explicitly states: "The amount of any loss of a trader or dealer in securites (whether incorporated or otherwise) arising from transactions with reference to any share on which an amount in respect of a dividend has been received by him shall (unless the security is held more than 365 days) be deemed to be the amount of that loss minus the accrual of all amounts received by him in respect of taxable dividends on that share".

The effect of this provision on short-term trading profits depends on the assumptions we are willing to make about the tax treatment of the decline in stock price on the ex-dividend day. If the loss is taxed as a business loss, Table IV and V show that, by subtracting the dividend, the equilibrium $\Delta P/D$ should fall dramatically to -0.211 for investors in the highest tax brackets. If the loss is taxed as a capital loss, Table IV shows that $\Delta P/D$ should fall (relative to 1971) to 0.330 for investors in the highest tax brackets. Finally, if the traders decide not to report the loss (see the last column of Table IV) $\Delta P/D$ has to be higher than or equal to 0.532, in order to prevent short-term trading profits. The message from this analysis is clear: in general, we expect trading profits to decline, relative to 1971, for all individual members of the exchange. This decline will be more pronounced for traders for which security profits in 1971 were taxed as ordinary income. (Recall that, in 1971, for these traders, the equilibrium $\Delta P/D$ should be larger than 1.)

C. *Incorporated Exchange Members*

Intercorporate dividends are tax deductible, but the same provisions as under B applies: incorporated exchange members have to deduct dividends from business losses. As shown in Table V, the equilibrium $\Delta P/D$ should be equal to 1. However, as long as the corporation reports the loss, the dollar profits are smaller than in 1971.

D. *Tax Exempt Investors*

The tax treatment was not altered by the reform and remains the same as in 1971.

E. *Corporations in General*

Section 112(3) was added to the tax law: dividends are tax exempt, but the dividend has to be subtracted from the capital loss. Therefore (see Table V), $\Delta P/D$ should be equal to 1.

Shortselling Around the Ex-dividend Day

Our analysis above applies to profits made from buying cum dividend and selling ex. An alternative profit opportunity may exist (when stock prices fall by

an amount *larger* than the dividend per share) by shortselling the security around the ex-dividend day. The analysis of short sales is straightforward: when the shortseller sells at P_B, buys back the security at P_A and pays the lender the dividend D, the profit of the transaction, $(P_B - P_A - D)$, will generally be taxed differently from different traders and countries, but the zero profit equilibrium $\Delta P/D$ is always equal to 1. Note that in this case the "zero profit" $\Delta P/D$ should be interpreted as a *maximum* limit: if $\Delta P/D$ is greater than one, a positive trading profit exists.