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Tax-Induced Trading and the Turn-of-the-Year Anomaly: An Intraday Study

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ABSTRACT

This study tests the tax-induced trading hypothesis as an explanation of the turn-of-the-year anomaly using Canadian and U.S. intraday data. Since the Canadian tax year-end precedes the calendar year-end by five business days, tax effects may be isolated. We find the anomaly is related to the degree of seller- and buyer-initiated trading and depends upon the incidence of the taxation year-end. Seller-initiated transactions (at bid prices) dominate until the tax year-end after which buyer-initiated trades (at ask prices) dominate. The anomaly is a function of bid-ask prices.

THIS STUDY TESTS THE hypothesis that tax-induced trading is an explanation for the turn-of-the-year anomaly. Specifically, we examine directly whether the effective end of the taxation year coincides with a shift from transactions at the bid price to transactions at the ask price. Previous studies (Lakonishok and Smidt (1984), and Keim (1989)) provide indirect evidence of this conjecture. Badrinath and Lewellen (1991) provide evidence of seasonality in the trading of securities that have experienced capital gains and capital losses. We use Canadian and U.S. data which allow for discrimination between tax-motivated and other possible year-end effects. Under Canadian income tax regulations, transactions are deemed consummated on the settlement date which is five trading days after the transaction has been executed, whereas in the U.S. the taxation and calendar year-ends are coincident.[1] Hence, all trades a resident Canadian investor wants to include in the current tax year must take place at least five trading days prior to the calendar year-end.

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[1] Interpretation Bulletin No. IT–133, paragraph 11(d). In the U.S., a sale of stock through an exchange is generally consummated on the date the contract to sell is entered into, and not when delivery of the stock is made. See, for example, 1987 U.S. Federal Tax Reports paragraph 2831.03.

We find the turn-of-the-year anomaly is related to the degree of seller- and buyer-initiated trading and depends upon the incidence of the taxation year-end. Generally, transactions are seller dominated until the last day in the tax year after which they are buyer dominated. Individual investors not subject to capital gains regulations display identical propensities. We believe our results provide the first broad-based direct link between taxation and stock return seasonality at the turn of the year.

We extend the earlier works by focusing our investigation on the existence of systematic tendencies in the intraday buying and selling behavior of investors and examine its implications on the tax-related explanations. The study proceeds as follows. Section I describes our data set and details our initial examination of tax-induced trading activities including a brief investigation into the implications for the bid-ask spread. Section II outlines the implications of the tax loss selling explanation for the turn-of-the-year anomaly and presents the hypotheses to be tested more directly, along with the methods employed. Section III presents the results of tests examining the role of buyer- and seller-initiated trading as an explanation for the turn-of-the-year anomaly. Here, we also present results based on the last trade of the day to show the consistency of our findings with previous studies which used only closing price data. We then examine the difference between taxing gains and losses on the basis of the ordinary income versus taxation as a capital gain or loss. Section IV closes with our conclusions.

I. Data Description

The data base comprises all date- and time-stamped bid-ask quotes, transaction prices, and volumes for every security listed on the Toronto Stock Exchange (TSE) for the period March 1977 through June 1989. We restrict the analyses in this study to common equities. The TSE is the seventh largest of the world's major stock exchanges. According to its *1989 TSE Official Trading Statistics*, the market value of shares traded in 1988 was $57,163.8 million (U.S.) compared to $31,168.0 million on the (ninth ranked) American Stock Exchange (AMEX). No Canadian data are available for March 31, 1980.

In addition, a second data base comprising similar data for 311 New York Stock Exchange (NYSE) and AMEX securities from January 1984 through June 1989 has been obtained. The U.S. data were obtained from a direct data feed from the NYSE/AMEX employed by the TSE for interexchange monitoring purposes. The 311 securities on the data feed are: 68 Canadian-AMEX interlisted securities, 53 U.S.-based TSE interlisted securities, 33 Canadian-based NYSE interlisted securities, 27 noninterlisted Dow 30 securities (all Dow 30 securities are included), and 130 other U.S.-based securities for TSE monitoring purposes. Only Canadian-NYSE interlisted securities with substantial U.S. trading volume appear on the data feed. U.S. data are unavailable for November 24, 25, and 26, 1986. U.S. data for October 19 and 23, 1987 are only available during the last half-hour of trading. Compared to the

NYSE at the end of December 1988, the NYSE securities that comprise our U.S. sample accounted for 12.5% of the 1681 companies listed, 60.0% of total market value of capitalization, 61.1% of the total market value of common stock capitalization, and 56.6% of the trading volume. *The American Stock Exchange Fact Book '89* reports that in December 1988, the Canadian-based AMEX interlisted securities represent 23.8% of the total AMEX market value. All but two Canadian-based AMEX interlisted securities are on the data feed. Our sample underrepresents low-priced securities and overrepresents high-priced securities relative to the CRSP data base. For example, about 40% of the CRSP securities have prices which are in the same range as our smallest price quintile while approximately 5% of the CRSP securities are in our largest price quintile range. Hence, our U.S. sample is biased against finding a turn-of-the-year anomaly.

The Canadian file also contains detailed information about the transacting brokers, including whether the trade was made for a client account, a registered trader's account, or a nonclient account. Clients (the public sector) are third party investors and may be either individuals or institutions. A registered trader operates on the exchange floor and trades for the company account. A nonclient is deemed to be any employee of a brokerage house and may be trading either on a personal account or as an agent of the brokerage house. The transacting party codes (not available for the U.S. sample) makes it possible to identify the general class of traders on either side of any transaction. The transaction price relative to the bid and ask prices makes it possible to classify the trade as buyer or seller initiated.

We employ a variant of the bid-ask mean test[2] to discriminate between buyer- and seller-initiated trades. We use four exclusion criteria. For thinly traded securities there is often a considerable period between the last recorded bid-ask quotation and subsequent transactions (at times more than 24 hours) for many securities. We choose to limit our sample in the following tests to those with valid same day quotes and that traded at least once per day in any given month.[3] Securities excluded in one month may be included in a subsequent month.

Since we are most concerned with the accuracy of the classification method, rather than the number of observations, we discard all confounding trades

[2] Roll (1984) argues that in markets where transactions are costly to effect, a small region of price (the bid-ask spread) brackets the underlying value of the asset. The difference between the observed price and the underlying value then serves as compensation to the market maker or dealer. The dealer is assumed to set the quotes symmetrically around the underlying value and the profits are a consequence of the random and equally probably arrival of buy and sell orders.

[3] Early research on thin trading in Canada was performed by Fowler, Rorke, and Jog (1979, 1980). These authors analyzed the trading history for all securities listed on the TSE during the period January 1, 1970 through December 31, 1979. A number of indicators of thin trading were devised, but the single measure which best indicated the severity of the problem was: of the 1800 securities continuously listed for at least 12 months, 1043 or 58% were not traded for one or more months.

between the bid and ask prices.[4] We note however, that our results do not change materially when all the observations are included. Finally, there are many cases where securities have bid and ask spreads that are equal to the minimum price change ("tick")—for example, one-eighth for securities trading over five dollars. If prices were continuous, the actual transaction price may have been between the bid and ask prices. However, discreteness forces the trades to be at the bid or ask prices. In these instances, it is not clear who initiates the trade: the investor(s) who submits the limit order(s), or the investor(s) whose market order(s) executes at the outstanding bid or ask.[5] This problem is not resolvable given the available data. However, we attempt to minimize the problem by eliminating all transactions with quotes at the minimum tick.

In both the U.S. and Canadian data, approximately 1.5% of all trades occur above the ask price and a similar number occurs below the bid price. On average, these are the largest of all transactions both in terms of market value and the number of shares traded. We include all such trades in our analyses.

Robinson and White (1992) employ this modified bid-ask mean test in a microstructure study of Canadian block trading. To assess the accuracy of the test, they analyze 89 known seller-initiated block trades and 105 known buyer-initiated block trades. The test correctly identified 26 of 27 (96%) of the selling trades and 28 of 30 (93%) of the buying trades.

In summary, after limiting the analysis to common equities, four exclusion criteria were devised to ensure the accuracy of the bid-ask mean test and thus, identification of the initiator of the trade. The exclusion criteria were:

1. No bid-ask quotes recorded for the day,
2. transaction price falls between the most recent ask and bid prices,
3. the security does not trade at least once per day in any given month, and,
4. the bid-ask spread is at minimum tick.

For the Canadian securities, the effect of the first two criteria is to reduce the number of transactions from 27,901,359 to 14,883,468. The next two criteria further reduce the number of transactions to 1,124,492. When applied to the U.S. data, the exclusion criteria reduce the initial sample of 11,851,142 transactions to 2,426,591 transactions.

[4] Lee and Ready (1991) investigate and discuss two potential problems in classifying trades as buys or sells by comparing the trade price to the quote price (the unadjusted bid-ask mean test) at the time of the trade using a sample of 150 NYSE securities and all AMEX equities listed during 1988. They report that quotes may be recorded ahead of the trades that triggered them and that trades inside the spread are not readily classifiable. Their analysis suggests that only 59.3% of NYSE quotes are recorded ahead of the trade and 72.4% of AMEX quotes are recorded in advance of the related transaction. They conjecture that the substantial proportion of timing errors results in the quotation prices straddling the trade price.

[5] For a comparison of the operation of Canadian and U.S. equity markets, see Tinic and West (1974).

A. Initial Tests of Tax-Induced Trading

We commence our investigation by examining two hypotheses. First, we examine whether the turn-of-the-year anomaly is advanced by five trading days in Canada to accommodate the settlement day regulation. Second, we test whether the turn-of-the-taxation-year dummy variables are a proxy for variables representing buying and selling pressure—i.e., patterns of transactions at or above the ask and transactions at or below the bid. We then examine whether realized returns are correlated with the degree of excess buying pressure. We also repeat the initial analyses using daily bid-to-bid returns as an additional test of Ritter's (1988) parking-the-proceeds hypothesis. Finally, we examine bid-to-bid returns prior to the taxation year-end and ask-to-ask returns after the year-end to investigate changes in trading behavior and changes in bid and ask prices.

Securities were allocated to quintiles based upon November month-end closing prices to allow comparison of portfolio results in the following December and January.[6] The portfolio rates of return for each quintile are an equally weighted average of the logarithm of the price relatives of the component securities, using daily closing prices. Given our hypotheses, a Blume and Stambaugh (1983) type adjustment to the return calculation is not appropriate.

To facilitate our initial analysis, we restrict our data base to securities that traded on every day for the 40 trading days surrounding the turn of the calendar year. This results in an average of 20 securities in each of the five Canadian quintiles (maximum 31 (1986), minimum 8 (1977)) and an average of 20 securities (maximum 24 (1988), minimum 18 (1986–1987)) in each of the U.S. quintiles. This trading restriction is relaxed in subsequent analyses.

The Canadian quintiles have mean prices ranging from \$2.47 to \$31.74 as compared to the U.S. portfolio means which range from \$8.49 to \$72.46. The securities in the lowest price U.S. portfolio would fall into the second or third Canadian portfolio while the second largest price U.S. portfolio having a midpoint of \$40.98 would include the securities in the largest price TSE portfolio.

In Table I, Panels A and B, we provide a U.S. versus Canada comparison of the explanatory power of dummy variables designed to capture the effect of the tax year-end. We arbitrarily choose a 40-day turn-of-year period. The requirement that the securities have valid quote data and trade on every day during this period minimizes stale data problems and eliminates statistical difficulties due to nonexistent observations. We use dummy variables, CDNDUM and USDUM, to test for abnormal returns on the five trading days at the turn of the taxation year in each country. The dummy variables have a value of one for the five trading days commencing the day prior to the turn of the tax year (day -1 in the U.S., day -6 in Canada) and zero otherwise. This is one January trading day less than in previous studies (see Keim (1983))

[6] Bhardwaj and Brooks (1992) show the January anomaly to be primarily a low price effect and less so a market value effect.

Table I

Regression Results of Closing Transaction Returns on Canadian and U.S. Tax Year Dummy Variables

This table reports the OLS regression results for a pooled time series of Canadian and U.S. portfolio returns. The equation estimated is:

$$R_{pt} = a_{p0} + a_{p1}\text{CDNDUM}_t + a_{p2}\text{USDUM}_t + e_{pt}$$

where R_{pt} is the equally weighted logarithmic portfolio return on portfolio p on day t based on closing transaction prices. CDNDUM and USDUM are orthogonal dummy variables with a value of 1 for each of the 5 trading days commencing one day prior to the turn of the tax year (day -1 in the U.S. and day -6 in Canada) and zero otherwise. There is an average of 20 securities in each Canadian and U.S. quintile meeting the requirement of trading on each day throughout the 40-day period surrounding the calendar year-end. The data were obtained from the TSE/WESTERN database. U.S. returns were obtained from CRSP. t-Statistics are presented in parentheses.

Price Portfolio	a_{p0}	a_{p1}	a_{p2}	Adjusted R^2	F-Statistic	p-Value
Panel A: Canadian Results for December 1977 to January 1989						
Smallest	−0.0002	0.0129	0.0046	0.0344	9.533	0.0001
	(−0.194)	(4.272)	(1.505)			
2	0.0004	0.0067	0.0028	0.0192	5.677	0.0037
	(0.484)	(3.244)	(1.367)			
3	0.0005	0.0035	0.0013	0.0054	2.305	0.1008
	(0.882)	(2.090)	(0.787)			
4	0.0008	0.0026	0.0009	0.0030	1.720	0.1801
	(1.454)	(1.815)	(0.636)			
Largest	0.0002	0.0016	0.0015	0.0017	1.397	0.2483
	(0.483)	(1.302)	(1.224)			
Panel B: U.S. Results for December 1984 to January 1989						
Smallest	−0.0001	−0.0015	0.0118	0.0754	9.117	0.0002
	(−0.053)	(−0.520)	(4.121)			
2	0.0012	−0.0024	0.0029	0.0048	1.476	0.2310
	(1.329)	(−1.017)	(1.226)			
3	0.0015	−0.0014	0.0044	0.0082	1.821	0.1645
	(1.581)	(−0.549)	(1.731)			
4	0.0019	−0.0033	0.0035	0.0110	2.111	0.1238
	(2.043)	(−1.321)	(1.369)			
Largest	0.0014	−0.0014	0.0023	−0.0034	0.662	0.5171
	(1.465)	(−0.568)	(0.909)			

but is done to ensure that the CDNDUM and USDUM variables are orthogonal.

Table I, Panel A presents the results for the Canadian data. Here, CDNDUM, which captures the increased returns attributable to days 2 through 6 prior to the calendar year-end, displays the classical turn-of-the-year anomaly with both the size and significance of the coefficient decreasing

monotonically with portfolio price. CDNDUM is statistically significant at the 1% level for the three smallest price portfolios. These results are comparable to previously reported U.S. results. These findings imply that rational American investors holding Canadian stocks should sell these securities during the last five days of December when the Canadian investors exhibit a higher probability of initiating buy orders. As will be shown in Table V, the probability of buyer-initiated trading in Canadian equities over the turn of the Canadian taxation year (days -5 through -2) is lower (45.5%) than the days at the turn of the U.S. taxation year-end (48.2%).

Results for U.S. data are presented in Table I, Panel B. As in previous studies, the level and significance of the USDUM coefficients generally decrease as price increases. The statistical significance of the CDNDUM coefficients in the Canadian data regression and their statistical insignificance in the U.S. regression strongly support the hypothesis that the Canadian turn-of-the-year anomaly is shifted forward five trading days as a result of the settlement day taxation regulation.[7]

Keim (1989) argues that returns computed with closing bid or ask prices may not represent "true" prices. Patterns in portfolio returns can result from bid or ask prices, if investor buying and selling behaviors follow systematic patterns.[8] Using closing bid, ask, and transactions prices from the National Market System for trading in over-the-counter shares, he finds systematic tendencies for closing prices to be recorded at the bid in December and at the ask in early January. Further, he determines that after controlling for changing bid and ask prices, this pattern results in large portfolio returns on the two trading days surrounding the end of the year, especially for low-priced securities.

To examine the role of the bid-ask spread as an explanatory variable in the turn-of-the-year anomaly, we perform two direct tests. First, in Table II, Panels A and B, we compare the explanatory power of the standard dummy variable regression with a model utilizing a P[Buy] variable that measures the proportion of the portfolio's closing prices taking place at or above the ask price. Excluding the trading day prior to and the five trading days following the turn of the taxation year both CDNDUM2, which has one more January trading day than CDNDUM, and P[Buy] take the value of zero.

Ideally, to test whether the turn-of-the-year dummy variables proxy for increased selling pressure we would like to include both CDNDUM2 and P[Buy] in the same regression equation. However, these variables are highly correlated (the correlation coefficient is approximately 0.9) and thus, we

[7] In contrast to the Canadian results and other reported U.S. results, the dummy variable coefficients in our U.S. results do not decrease monotonically. To test whether this result is due to the sample period, we analyzed Canadian data over the shorter U.S. time frame. Our results were again qualitatively similar to the U.S. data results. Thus, we conclude that the coefficient on USDUM not decreasing monotonically as the mean portfolio price increases as found in earlier studies, is a function of time period analyzed. The results are also robust over the length of the turn-of-the-year period chosen for both periods.

[8] See Blume and Stambaugh (1983) for a detailed discussion of the biases in computed returns.

Table II

OLS Regression Results of Closing Transaction Returns on Canadian Tax Year Dummy Variables (Panel A) and on a P[Buy] Variable (Panel B)

In Panel A, the equation estimated is:

$$R_{pt} = a_{p0} + a_{p1}\text{CDNDUM2}_t + e_{pt}$$

where R_{pt} is the equally weighted logarithmic portfolio return on portfolio p on day t based on closing transaction prices. CDNDUM2 has a value of 1 for each of the 6 trading days commencing one day prior to the turn of the tax year and zero otherwise. In Panel B, the equation estimated is:

$$R_{pt} = a_{p0} + a_{p1}\text{P[Buy]}_t + e_{pt}$$

where P[Buy] measures the proportion of portfolio closing transactions taking place at or above the ask price for each of 6 trading days commencing one trading day prior to the turn of the tax year and zero otherwise. There are an average of 20 securities in each quintile meeting the requirement of trading on each day throughout the 40-day period surrounding the calendar year-end from December 1977 through January 1989. The data were obtained from the TSE/WESTERN database and are restricted to common equities based on the following exclusion criteria (i) no bid-ask quote recorded on day t, (ii) the transaction price falls between the most recent ask and bid prices, (iii) the bid-ask spread is at a minimum tick. t-Statistics are presented in parentheses.

Price Portfolio	a_{p0}	a_{p1}	Adjusted R^2	F-Statistic	p-Value
Panel A: Regression Results from Dummy Variable Regression					
Smallest	0.000 (0.066)	0.013 (4.561)	0.0397	20.806	0.0001
2	0.000 (0.825)	0.006 (3.398)	0.0215	11.545	0.0007
3	0.000 (0.934)	0.004 (2.646)	0.0124	7.004	0.0084
4	0.001 (1.502)	0.003 (2.367)	0.0095	5.604	0.0183
Largest	0.000 (0.736)	0.002 (1.727)	0.0041	2.983	0.0848
Panel B: Regression Results from P[Buy] Variable Regression					
Smallest	0.000 (0.418)	0.026 (4.264)	0.0346	18.186	0.0001
2	0.001 (1.137)	0.012 (3.049)	0.0170	9.295	0.0024
3	0.001 (1.209)	0.008 (2.306)	0.0089	5.317	0.0215
4	0.001 (1.783)	0.006 (2.004)	0.0063	4.016	0.0456
Largest	0.001 (0.951)	0.004 (1.435)	0.0022	2.058	0.1521

choose to employ two separate equations. The results indicate that both variables are of roughly equal explanatory value. Therefore, we conclude that dummy variables employed in earlier studies are a proxy for the P[Buy] variable.

Second, to isolate the effects of a possible shift in the size of the relative bid-ask spread at the turn of the taxation year, we regress the portfolio returns on a relative bid-ask spread {SPRD = [(ASK − BID)/CLOSING PRICE]} variable. To test whether the relative bid-ask spread changes systematically at the turn of the year, we set SPRD to zero for all trading days except the five trading days at the turn of the taxation year. This variable is statistically indistinguishable from zero at all reasonable confidence levels. Another test was then performed. We regressed portfolio returns on the change in the relative spread {RSPD = (ASK − BID)/[(ASK + BID)/2]} between each of the 40 days at the turn of the year and the average spread during or closest to the previous June. This results in a variable with little variation which has no explanatory power (results are not presented). These findings are consistent with Clark, McConnell, and Singh (1992) who find no evidence of a significant correlation between changes in turn-of-the-year spreads and January returns.

However, under Ritter's (1988) parking-the-proceeds hypothesis the bid-ask prices may shift downward prior to the taxation year-end due to selling pressure and then upward with the turn of the new taxation year due to buying pressure. To examine the price pressure effects associated with tax year-end trading, we test the hypothesis that daily returns of the small firms' stocks are positively related to the excess of buyer-initiated trading over seller-initiated trading volume standardized by the total number of shares outstanding. We present the Canadian results in Table III, Panel A. The buying pressure coefficient is positive and statistically significant providing strong initial support for the parking-the-proceeds hypothesis.[9] We provide more direct support for this hypothesis in the following section.

Further evidence of a shift in the level of bid and ask prices may be obtained by regressing returns based on closing bid and ask prices on the dummy variables used previously. Assuming a constant spread, under the price pressure hypothesis both the bid and ask prices should shift downward toward the end of the taxation year and shift upward at the beginning of the taxation year. Using closing bid-to-bid returns, the coefficient on the smallest portfolio should remain positive but less than 0.013 (see Table II, Panel A).[10]

[9] Portfolio 2 contains the largest range of shares outstanding as well as the smallest means and variances for buyer- and seller-initiated volumes.

[10] Although closing bid-to-bid returns are consistent with the actions of an investor purchasing with a limit buy order and selling with a market order, we do not consider this to be a test of potential arbitrage profits for several reasons. First, the regressions are performed on a pooled time series. Second, search, taxes, and other transactions costs are not considered. Finally, one must avoid the implicit assumption that any volume may be purchased at the prevailing prices. We note that while the portfolio containing the lowest priced Canadian shares has the greatest average daily volume, the average number of shares traded at the turn of the taxation year is approximately 58.5% of the average daily volume (167,634 shares) for the 15 days prior to the end of the taxation year.

Table III

OLS Regression Results (Panel A) of Closing Transaction-Based Returns on a Buying Pressure Variable and Regression Results (Panel B) of Canadian Bid-to-Bid Returns on Canadian and U.S. Tax Dummies

In Panel A, the equation estimated is:

$$R_{pt} = a_{p0} + a_{p1}\text{B-PRESSURE}_t + e_{pt}$$

where R_{pt} is the equally weighted logarithmic portfolio return on portfolio p on day t based on closing transaction prices. B-PRESSURE is the average excess buyer-initiated shares ratio for each day for each portfolio. The variable is calculated daily on an individual security basis as: B-PRESSURE = {BUYER-INITIATED SHARES − SELLER-INITIATED SHARES}/TOTAL SHARES OUTSTANDING. In Panel B the equation estimated is

$$R_{pt} = a_{p0} + a_{p1}\text{CDNDUM}_t + a_{p2}\text{USDUM}_t + e_{pt}$$

where the equally weighted logarithmic portfolio return on portfolio p on day t is based on closing bid prices. CDNDUM and USDUM are orthogonal dummy variables with a value of 1 for each of the 5 trading days commencing one day prior to the turn of the tax year (day −1 in the U.S. and day −6 in Canada) and zero otherwise. There is an average of 20 securities in each Canadian and U.S. quintile meeting the requirement of trading on each day throughout the 40-day period surrounding the calendar year-end from December 1977 through January 1989. The data were obtained from the TSE/WESTERN database and are restricted to common equities based on the following exclusion criteria (i) no bid-ask quote recorded on day t, (ii) the transaction price falls between the most recent ask and bid prices, (iii) the bid-ask spread is at a minimum tick. t-Statistics are presented in parentheses.

Price Portfolio	a_{p0}	a_{p1}	a_{p2}	Adjusted R^2	F-Statistic	p-Value
Panel A: Regression of Canadian Transaction Based Returns on a B-Pressure Variable						
Smallest	0.004	11.911		0.1211	67.016	0.0001
	(3.747)	(8.186)				
2	0.002	2.386		0.0067	4.209	0.0407
	(2.570)	(2.052)				
3	0.002	7.695		0.0324	17.035	0.0001
	(3.002)	(4.127)				
4	0.001	4.187		0.0071	4.439	0.0356
	(2.998)	(2.107)				
Largest	0.001	3.635		0.0049	3.367	0.0671
	(1.845)	(1.835)				
Panel B: Regression of Canadian Bid-to-Bid Returns on Canadian and U.S. Tax Year Dummies						
Smallest	−0.0002	0.0094	0.0040	0.0220	6.384	0.0018
	(−0.182)	(3.431)	(1.478)			
2	0.0006	0.0058	0.0028	0.0152	4.698	0.0095
	(0.762)	(2.905)	(1.382)			
3	0.0006	0.0032	0.0016	0.0049	2.168	0.1115
	(0.910)	(1.958)	(0.983)			
4	0.0008	0.0026	0.0013	0.0030	1.730	0.1784
	(1.465)	(1.748)	(0.880)			
Largest	0.0002	0.0016	0.0016	0.0019	1.468	0.2315
	(0.554)	(1.311)	(1.279)			

Table IV

OLS Regression Results of Quotation-Based Returns on Canadian Tax Year Dummy Variables

In this table, the equation estimated is:

$$R_{pt} = a_{p0} + a_{p1}\text{CDNDUM2}_t + e_{pt}$$

where R_{pt} is the equally weighted logarithmic portfolio return on portfolio p on day t. The returns are calculated on bid prices prior to the taxation year-end, from the bid to the ask price on the last day of the taxation year and on ask prices for the remainder of each 40-day period. CDNDUM2 has a value of 1 for each of the 6 trading days commencing one day prior to the turn of the tax year and zero otherwise. There is an average of 20 securities in each quintile meeting the requirement of trading on each day throughout the 40-day period surrounding the calendar year-end from December 1977 through January 1989. The data were obtained from the TSE/WESTERN database. t-Statistics are presented in parentheses.

Price Portfolio	a_{p0}	a_{p1}	Adjusted R^2	F-Statistic	p-Value
Smallest	0.001	0.015	0.1153	63.418	0.0001
	(0.744)	(7.964)			
2	0.000	0.013	0.1631	94.345	0.0001
	(0.317)	(9.713)			
3	0.001	0.007	0.0898	48.230	0.0001
	(1.315)	(6.945)			
4	0.001	0.006	0.0993	53.833	0.0001
	(1.863)	(7.337)			
Largest	−0.000	0.004	0.0978	52.906	0.0001
	(−0.151)	(7.274)			

As shown in Table III, Panel B, the Canadian results from regressing bid returns on dummy variables remain essentially the same although the size of CDNDUM falls by approximately 27% for the smallest portfolio. The results are comparable to Keim and Stambaugh (1984).

Using closing bid returns prior to the last day for tax purposes, closing bid-to-ask returns at the turn of the taxation year-end and closing ask returns subsequent to the taxation year-end, the coefficient on the dummy variable for the smallest portfolio should be equal to 0.013. The results in Table IV show that the coefficient is now 0.015 with a standard error of 0.002. These findings support both the parking-the-proceeds hypothesis and tax-induced trading as an explanation for the turn-of-the-year anomaly.

II. Testable Hypotheses and Methods

Under the parking-the-proceeds hypothesis investors do not immediately reinvest all funds from one tax year's sales, but park them until the subsequent tax year. We now test the validity of this hypothesis by examining the incidence of seller- versus buyer-initiated trading on a daily basis using intraday data.

Using small transaction value (less than $100,000) to proxy for the trades of individual investors[11] as an example, we base our analysis on the following testable tax loss selling hypotheses:

1. The tax loss selling hypothesis predicts that the probability of a seller-initiated trade exceeds the probability of a buyer-initiated trade for small transactions towards the end of the taxation year.
2. The parking-the-proceeds extension of the tax loss selling hypothesis also predicts that the probability of a buyer-initiated trade exceeds the probability of a seller-initiated trade for small transactions after the turn of the taxation year.

The null hypothesis is that on any given day the ratio of the number of buyer-initiated trades to the number of seller-initiated trades is constant. This suggests a nonparametric approach to analyzing the number of trades in each category. We estimate the binomial probability statistic:

$$\text{P[Sell]} = \text{sample mean}^{12}$$

The probability is estimated for days relative to the turn of the year, based on the number of cases—pooled across time—calculated as the number of seller-initiated trades divided by the aggregate number of trades.[13] We use P[Sell} in the remainder of this study to aid in the exposition, since the sign of the test statistic will be consistent with investor cash flows with trades at the bid price (positive) shifting to trades at the ask (negative) price.

Significance tests are based on the binomial Z-statistic:

$$Z = (p - \bar{p})/\sqrt{(\bar{p})(1 - \bar{p})/n}$$

[11] In the U.S., the NYSE and AMEX classify any stock transaction of at least 10,000 shares as a block trade. In Canada, the TSE considers any stock transaction with a value of at least $100,000 as a block trade. This designation is purely arbitrary. Due to both the thinness of TSE trading and the relatively low share prices, no other transaction value was deemed more appropriate.

[12] Our method implicitly assumes that trades occur (instantaneously) as a result of new information, since we rely on market bid and ask prices to discern the initiator of the trade. However, not all transactions are market orders. Many investors consciously choose to acquire securities by placing limit bid orders, trading off the gain associated with the possibility of trading at a more favorable price with the possibility of not trading at all. Cohen, Maier, Schwartz, and Whitcomb (1986, p. 106) suggest a model of investor order placement in which "there would be a clustering of limit orders near P_t^{MB} (the market bid price)." Since a limit order will not be executed unless a market sell order is received, statistical tests of our hypotheses are unaffected provided we employ the observed sample mean as the expected value when the determining the value of the t-statistics. We have no data on the amount or incidence of limit orders versus market orders.

[13] An alternate specification would be to analyze the dollar value of the buyer- versus seller-initiated transactions, that is, market value weights rather than equal value weights. This analysis (not presented in the interest of brevity) yields qualitatively similar results to those reported in the following sections. The use of value weighted rather than equally weighted observations has questionable validity with respect to the binomial test statistic and its interpretation.

where:

p = the observed proportion of seller-initiated transactions.
$\bar{p}$ = the mean proportion of seller-initiated transactions over the entire sample period.
n = the total number of buyer- and seller-initiated transactions.

An important issue that arises when analyzing intraday data centers on the interpretation of levels of significance when dealing with large numbers of observations. Because the large sample drives the standard errors of the estimates towards zero and produces large t-statistics, interpretation difficulties arise if no prior for the coefficient exists and one judges the significance of a variable only by its t-statistic. In this case, the large sample is more likely to generate a spurious significant result. Consequently, a substantial risk of type I error exists. We follow Neal, Malmquist, and Jarrell (1986) in employing a posterior odds ratio test as an alternate method of determining critical t-values.[14] In general, this Bayesian approach rejects the null hypothesis in instances where the t-statistic is in excess of the classical critical t-value at the 1% level. In the interest of brevity, we do not present the posterior odds ratio, but do indicate in the tables (with a # sign) and where appropriate in the text the Bayesian interpretation of our test results.

III. Descriptive Results

A. Intraday Results

To identify turn-of-the-year tax-related behavior,[15] we determine the probability of a seller-initiated transaction using intraday data for each of the 40 trading days surrounding the turn of the year.[16] That is, we pool intraday

[14] As described in Zellner (1984), the large sample posterior odds ratio, as a function of the sample size and the t-statistic, can be approximated by:

$$K_{12}\text{value} = \sqrt{\pi^*(\text{d.f.})/2}\,^*\exp[-(t^2/2)]$$

where: K_{12} value is the posterior odds ratio, d.f. is the degrees of freedom, and t is the t-statistic. For example, in Table V for the 14,237 observations for the U.S. day -1 equity listings, a t-statistic of 4.00 is needed to generate a posterior odds ratio of 20:1. The posterior odds ratio evaluates the odds against the null hypothesis being true as a function of the data. We interpret large posterior odds ratios as recommended in Jeffreys (1967, pp. 396–397); see also Zellner (1984).

[15] Throughout this paper, U.S., results for the 1984 to 1989 period are presented along with Canadian results for the period 1977 to 1989 for comparison purposes. Shortening the Canadian sample to match the 1984 to 1989 period was not deemed appropriate for several reasons. First, the power of the test is provided by the length and breadth of the Canadian data set. Second, the U.S. data set is not exhaustive and underrepresents both low-priced and thinly traded securities. Finally, the U.S. data serve merely to confirm the Canadian results and to show that they should not be considered anomalous.

[16] We also determined the probability of a seller-initiated transaction for every calendar month. In general, buyer-initiated trading dominates the first eight months and seller-initiated trading dominates the last four months of the year at the 1% level. Market value results are also similar and statistically significant at the 1% level. January and February are buyer dominated and September through December are seller dominated. Bayesian analysis confirms this pattern.

Table V

Probability of an Identified Seller-Initiated Transaction for the 20 Trading Days Surrounding the Calendar Year-End for U.S. and Canadian Equity Listings

This table reports the value and significance of P[Sell] for the 20 trading days surrounding the calendar year-end from December 1977 through January 1989. Days −10 through −1 are the last 10 trading days of December. Days 1 through 10 refer to the first 10 trading days of January. P[Sell] = {Total Sells/(Total Buys + Total Sells)}*100. The data were obtained from the TSE/WESTERN database and are restricted to common equities based on the following exclusion criteria (i) no bid-ask quote recorded on day t, (ii) the transaction price falls between the most recent ask and bid prices, (iii) the security does not trade at least once per day in any given month, and (iv) the bid-ask spread is at a minimum tick.

	U.S. Equity Listings[a]				Canadian Equity Listings[b]			
T-Day Relative to Year End	Total Buys	Total Sells	P[Sell]	t-Statistic	Total Buys	Total Sells	P[Sell]	t-Statistic
−10	5414	7875	59.3	24.82**#	1656	2880	63.5	8.05**#
−9	7807	7456	48.9	0.87	1536	2628	63.1	7.13**#
−8	6626	7954	54.6	14.63**#	1632	2892	63.9	8.59**#
−7	5916	7927	57.3	20.63**#	1752	3084	63.7	8.61**#
−6	5951	9505	61.5	32.33**#	1668	2712	61.9	5.75**#
−5	3225	4857	60.1	20.86**#	1212	1392	53.5	−4.21**#
−4	2816	5686	66.9	33.91**#	804	996	55.2	−2.05*
−3	3860	7325	65.5	35.95**#	1068	1320	55.2	−2.33*
−2	4935	8224	62.5	32.13**#	1200	1428	54.2	−3.56**#
−1	5006	9231	64.8	39.01**#	1284	1320	50.7	−7.14**#

Table V—*Continued*

T-Day Relative to Year End	U.S. Equity Listings[a]				Canadian Equity Listings[b]			
	Total Buys	Total Sells	P[Sell]	*t*-Statistic	Total Buys	Total Sells	P[Sell]	*t*-Statistic
1	6767	5739	45.9	−5.84**#	1637	1882	53.5	−4.94**#
2	8970	5679	38.8	−23.57**#	2365	2617	52.5	−7.24**#
3	7113	5662	44.3	−9.45**#	2425	2498	50.7	−9.74**#
4	8441	5684	40.2	−19.64**#	2546	3217	55.8	−2.73**
5	7958	9798	55.2	17.81**#	2496	3214	56.3	−2.01*
6	8466	9763	53.6	13.66**#	2352	3341	58.7	1.66
7	8630	7809	47.5	−2.56**	2216	2870	56.4	−1.69
8	8051	6639	45.2	−8.02**#	2218	2902	56.7	−1.33
9	8034	6646	45.3	−7.83**#	2276	2532	52.7	−6.93**#
10	8869	6587	42.6	−14.63**#	2495	2592	51.0	−9.59**#

[a] The mean of P[Sell] = 55.1% for the last 20 days of December. The mean of P[Sell] = 46.2% for the first 20 days of January. *t*-Statistics are calculated relative to the observed mean of 48.5%.

[b] The mean of P[Sell] = 60.6% for the last 20 days of December. The mean of P[Sell] = 55.6% for the first 20 days of January. *t*-Statistics are calculated relative to the observed mean of 57.6%.

* Significant at the 0.05 level.

** Significant at the 0.01 level.

Bayesian rejection of the null hypothesis based on posterior odds ratio.

transactions data across years for the 20 trading days before and after the calendar year-end. The length of this period is arbitrarily chosen, but generally covers all trading days in both December and January. If tax loss selling is a viable explanation for the turn-of-the-year anomaly, the incidence of seller-initiated trading should dominate up to the last day of the year for tax purposes. If Roll's (1983) conjecture of share prices rebounding to equilibrium values is accurate, the level of seller-initiated January transactions should be statistically indistinguishable from the sample mean. If Ritter's parking-the-proceeds hypothesis has merit, buyer-initiated trading should dominate in January.

Table V presents the results for the 20 trading days surrounding the calendar year-end.[17] Days -10 through -1 are the last 10 trading days of December. Similarly, days 1 through 10 refer to the first 10 trading days of January.

For U.S. securities, only day -9 is statistically insignificant.[18] All other days up to and including the day immediately prior to the turn of the year are seller dominated. On each of the last six days, the observed intraday probability of a sell transaction is 60% or greater. This result is unexpected since Roll (1983)[19] reports that the day immediately prior to the year-end experiences significant excess returns. However, Roll used daily data. If the closing trades on the day prior to the year-end tend to be buyer initiated,[20] excess returns calculated on a daily basis are not inconsistent with seller-dominated trading on average throughout the day. We present this analysis in the following section.

Reinforcing these findings are the Canadian results. Up to and including day -6 (the last day of the year for tax purposes), all activity is significantly seller initiated in excess of the 1% level. Commencing on day -5 and continuing through the first five days of January, Canadian transactions are generally significantly buyer initiated at least at the 0.05 level. Of these days, the first day of the new taxation year (day -5), and the five consecutive trading days commencing two days prior to the calendar year-end and extending through the third trading day of the new calendar year are all significant, well in excess of the 1% level. Similarly, significant levels of buyer-dominated trading are observed in the U.S. sample throughout the first 10 trading days of the new calendar-taxation year. These buyer-dominated results over several trading days are consistent with the initial results in Table III, Panel A and the parking-the-proceeds hypothesis that

[17] For clarity of presentation, the results for the first 10 trading days in December and the last 10 trading days in January are not reported in the tables. However, we do report the mean of each 20-day trading month for comparison purposes.

[18] It is often helpful in interpreting the tables to examine the sign of the t-statistics. A negative value indicates a greater degree of buyer-initiated activity, while a positive value reflects higher levels of seller-initiated trading.

[19] See also, Reinganum (1983) and Keim (1983).

[20] Wood, McInish, and Ord (1985), Harris (1986), and Terry (1986) have all found that higher returns occur at the end of the trading day.

investors do not immediately reinvest all funds from December sales but park them until later in the new taxation year as indicated by the buying pressure taking place over several days.

Table V also shows that the shift to buyer-initiated activity after the turn of the year discerned by Keim (1989) in closing data prevails throughout the daily trading intervals. For U.S. securities in January, 8 of the first 10 trading days are buyer dominated; the first four days and days 7 through 10 are days of consecutive significant buyer-initiated activity. Elevated levels of Canadian buyer-initiated trading occur generally through the first half of January. This activity is consistent with the larger observed returns over the first few trading days of January reported in Roll (1983) and Ariel (1987).[21]

As noted above, the majority of our sample of U.S. securities is cross-listed. It is possible that the results for these securities are affected by intermarket arbitrage. That is, Canadian-based firms in the U.S. sample may behave like Canadian firms because of arbitrage. To test this conjecture, we repeated our analysis using the 154 U.S. securities not interlisted on the TSE. These results (available upon request) are consistent with the findings reported here.

B. Last Trade Results

We now report the results of our analysis (available upon request) which are consistent with previous studies relying solely on closing price data. This analysis is motivated by the apparent contradiction of Roll's (1983) finding of abnormal returns on the last day of the taxation year. Such a result should imply buyer-dominated trading rather than the observed seller-dominated trading.

Canadian results for the 10 days preceding the turn of the year are significantly seller-dominated at the 1% level for three of the four trading days prior to day -6, the last day of the closing taxation year. P[Sell] is statistically indistinguishable (t-statistic = 1.55) from the sample mean on the last day of the taxation year and remains so on three (days -2, -3, and -5) of the remaining five trading days of the calendar year. Both day -4 and the last day of the calendar year are significantly buyer dominated with t-statistics of -2.71 and -3.49, respectively. U.S. results are significantly seller dominated for the five consecutive trading days preceding the last day of the calendar-taxation year, which with a t-statistic of 1.06 is statistically indistinguishable from the sample mean. The shift in both countries away from seller-dominated trading on the last day of the taxation year is consistent with Roll's (1983) finding of significantly higher returns on the day prior to the turn of the taxation year. We conclude therefore, that Roll's finding is dependent upon the use of closing trade data.

[21] Analysis (not presented here) indicates that the first halves of months are not always significantly buyer initiated.

Table VI

Probability of an Identified Seller-Initiated Transaction for the 20 Trading Days Surrounding the Calendar Year-End by Transaction Size for Canadian Equity Listings

This table reports the value and significance of P[Sell] after restricting for the market value of the trade for the 20 trading days surrounding the calendar year-end from December 1977 through January 1989. Days −10 through −1 are the last 10 trading days of December. Days 1 through 10 refer to the first 10 trading days of January. P[Sell] = {Total Sells/(Total Buys + Total Sells)}*100. The data were obtained from the TSE/WESTERN database and are restricted to Canadian common equities based on the following exclusion criteria (i) no bid-ask quote recorded on day t, (ii) the transaction price falls between the most recent ask and bid prices, (iii) the security does not trade at least once per day in any given month and, (iv) the bid-ask spread is at a minimum tick.

	Transactions ≥ $100,000[a]				Transactions < $100,000[b]			
T-Day Relative to Year End	Total Buys	Total Sells	P[Sell]	t-Statistic	Total Buys	Total Sells	P[Sell]	t-Statistic
−10	21	28	57.1	−0.42	1004	1408	58.4	3.14**#
−9	21	23	52.3	−1.06	880	1304	59.7	4.24**#
−8	11	34	75.6	2.12**#	876	1458	62.5	7.06**#
−7	34	33	49.3	−1.82	936	1553	62.4	7.22**#
−6	14	28	66.7	0.87	899	1371	60.4	4.98**#
−5	7	6	46.2	−1.03	588	680	53.6	−1.13
−4	1	3	75.0	0.61	421	452	51.8	−2.04*
−3	5	11	68.8	0.71	485	622	56.2	0.66
−2	12	14	53.8	−0.65	608	689	53.1	−1.50
−1	3	3	50.0	−0.51	661	667	50.2	−3.65**#

Table VI—*Continued*

T-Day Relative to Year End	Transactions ≥ $100,000[a]				Transactions < $100,000[b]			
	Total Buys	Total Sells	P[Sell]	*t*-Statistic	Total Buys	Total Sells	P[Sell]	*t*-Statistic
1	15	25	62.5	0.31	849	914	51.8	−2.38**#
2	18	27	60.0	−0.01	1279	1293	50.3	−5.03**#
3	29	29	50.0	−1.57	1310	1283	49.5	−5.86**#
4	26	25	49.0	−1.62	1469	1596	52.1	−3.48**#
5	38	50	56.8	−0.63	1453	1595	52.3	−3.19**#
6	28	33	54.1	−0.96	1381	1770	56.2	1.10
7	20	37	64.9	0.74	1305	1485	53.2	−2.10*
8	26	29	52.7	−1.12	1256	1473	54.0	−1.29
9	23	25	52.1	−1.13	1349	1278	48.6	−6.75**#
10	37	36	49.3	−1.88	1446	1317	47.7	−7.96**#

[a] The mean of P[Sell] = 60.8% for the last 20 days of December. The mean of P[Sell] = 56.5% for the first 20 days of January. *t*-Statistics are calculated relative to the observed mean of 60.1%.

[b] The mean of P[Sell] = 58.7% for the last 20 days of December. The mean of P[Sell] = 53.2% for the first 20 days of January. *t*-Statistics are calculated relative to the observed mean of 55.2%.

* Significant at the 0.05 level.

** Significant at the 0.01 level.

Bayesian rejection of the null hypothesis based on posterior odds ratio.

C. Large Block Results

The tax loss selling hypothesis asserts that the January anomaly is caused by the tax optimizing behavior of individual investors. Since institutions specializing in money management are either tax exempt or indifferent to the effects of capital gains regulations, we test the role of capital gains regulations by analyzing trading behavior based on transaction value.

We restrict the analysis to all intraday transactions in which the initiator is coded as a public account. The U.S. data do not contain these broker codes. Hence, the analysis is restricted to the Canadian data base. We then subdivide this group based on the TSE's $100,000 definition of a block transaction to discriminate between individual and institutional investors. Table VI presents the results of this analysis.

For securities in which the transaction value is less than $100,000, the results reported in Table V are confirmed. Significant levels of seller-initiated trading occur up to day −6 after which buyer-initiated trading dominates, particularly on the day immediately preceding the turn of the calendar year. This is not true for transactions valued over $100,000. Levels of buyer- and seller-initiated trading are generally indistinguishable statistically from the sample mean. Assuming these large trades represent institutional activity, these results are generally inconsistent with the Haugen and Lakonishok (1987) conjecture of an institutional cause for the turn-of-the-year anomaly.

Examination of the test results for January supports the conjecture that small-sized transactions drive the turn-of-the-year anomaly. Transactions valued less than $100,000 are significantly buyer dominated at the 1% level throughout 7 of the first 10 trading days of January. Large transactions are generally statistically indistinguishable from the sample mean. The increased volume in the number of transactions at month-end, coupled with the increased probability of buyer-initiated trading, is consistent with earlier studies by Berges, McConnell, and Schlarbaum (1984) and Tinic, Barone-Adesi, and West (1987) who found evidence of a January anomaly for Canadian stocks using monthly data.

D. Professional Trader Results

To test whether there is a profitable trading opportunity, we examine the transactions of registered traders[22] since, given their physical location and low transactions costs, they are best situated to exploit any mispricing due to tax loss selling. In particular, we investigate transactions involving registered traders under the assumption that the trade will only be initiated by the trader if a net gain can be realized. That is, the pattern of registered trader transactions would be opposite to that reported in Table V.

[22] The trading activity of registered traders accounts for approximately 37% of all trades on the TSE. Above average levels of registered trader activity occur in the first four months of the year. December experiences the lowest level of activity.

Table VII

Probability of an Identified Seller-Initiated Transaction for the 20 Trading Days Surrounding the Calendar Year-End for Trades Initiated by Registered Traders of Canadian Equity Listings[a]

This table reports the value and significance of P[Sell] after restricting to transactions initiated by registered traders for the 20 trading days surrounding the calendar year-end from December 1977 through January 1989. Days −10 through −1 are the last 10 trading days of December. Days 1 through 10 refer to the first 10 trading days of January. P[Sell] = {Total sells/(Total Buys + Total Sells)}*100. The data were obtained from the TSE/WESTERN database and are restricted to Canadian common equities based on the following exclusion criteria (i) no bid-ask quote recorded on day t, (ii) the transaction price falls between the most recent ask and bid prices, (iii) the security does not trade at least once per day in any given month and, (iv) the bid-ask spread is at a minimum tick.

T-Day Relative to Year-End	Total Buys	Total Sells	P[Sell]	t-Statistic
−10	550	1259	69.6	7.25**#
−9	556	1156	67.5	5.29**#
−8	655	1259	65.8	4.02**#
−7	686	1316	65.7	4.07**#
−6	614	1175	65.7	3.80**#
−5	530	651	55.1	−4.36**#
−4	330	482	59.4	−1.14
−3	516	609	54.1	−4.94**#
−2	493	659	57.2	−2.85**#
−1	513	587	53.4	−5.40**#
1	658	837	56.0	−4.22**#
2	916	1170	56.1	−4.89**#
3	898	1081	54.6	−6.10**#
4	901	1385	60.6	−0.70
5	828	1385	62.6	1.24
6	786	1310	62.5	1.13
7	743	1198	61.7	0.38
8	801	1249	60.9	−0.35
9	711	1077	60.2	−0.93
10	832	1065	56.1	−4.61**#

[a] The mean of P[Sell] = 0.599 for the last 20 days of December and 0.572 for the first 20 days of January. t-Statistics are calculated relative to the subgroup mean for registered trader-initiated transactions of 61.3%.

** Significant at the 0.01 level.

Bayesian rejection of the null hypothesis based on posterior odds ratio.

In Table VII, we present the results based on an analysis of the 20 days prior to and following the turn of the calendar year. From day −10 through day −6 (the last day for tax purposes) all transactions are significantly seller initiated from both a classical and Bayesian viewpoint. From the first day of the new taxation year (day −5) through the third trading day of January excluding day −4, transactions are significantly buyer initiated in excess of the 1% level. Note that this is the same pattern as evidenced for the market

as a whole and for small investors. We conclude that the turn of the year is a period of substantial tax-related trading and is not arbitrageable. Thus, we indirectly support Bhardwaj and Brooks (1992) who find the January anomaly is not likely to be exploitable.

Tinic, Barone-Adesi, and West (1987) detect a turn-of-the-year seasonal in Canadian data prior to the 1972 introduction of a capital gains tax. If the pre-1972 behavior of registered traders was similar to the post-1977 behavior and assuming the fiscal and calendar year-ends for registered traders are coincident, our findings provide a tax-induced explanation for the seasonal prior to the introduction of capital gains legislation. That is, the turn-of-the-year trading activity is generally tax related and is not restricted solely to the realization of capital gains and losses.

IV. Conclusions

We examine intraday transactions at and above the ask price and at and below the bid price to determine the initiator of the trade. The implications of the tax loss selling hypothesis are tested by determining the probability of a seller-initiated transaction at appropriate points in the calendar and taxation year. We find:

1. Dummy variables proxy for the probability of buyer-initiated trading in turn-of-the-year regression analyses.
2. Turn-of-the-year returns are significantly positively related to the standardized excess of buyer-initiated trading over seller-initiated trading.
3. The level of the bid-ask prices changes at the turn of the year resulting in the appearance of a potential arbitrage opportunity as measured by bid-to-bid returns before considering transactions costs.
4. Last trade of the day results are not representative of intraday results on the last day of the taxation year.
5. Assuming that block transactions are attributable to institutional investors, there is no indication that institutional investors engage in any seasonal buying or selling activity at the turn of the calendar year.
6. Public sector seller-initiated trading activity in Canada switches dramatically to buyer initiated on day -5, the first day of the new taxation year. In contrast, the U.S. seller-initiated trading continues through to day -1, in accordance with the U.S. taxation year-end.

Based on these findings, we conclude that:

1. The turn-of-the-year anomaly is driven by a systematic shift from transactions at the bid price to transactions at the ask price.
2. The turn-of-the-year anomaly is associated with the taxation and *not* the calendar year-end.
3. Assuming that small transactions are initiated by individual investors, then in combination with findings 5 and 6 above, we conclude that the tax loss selling hypothesis is strongly supported. However, analysis of

transactions initiated by registered traders suggests that turn-of-the-year investment activity is tax related in general and not restricted to the realization of capital gains and losses.

4. The positive relation between small firm returns and buying pressure combined with the finding of significant levels of buyer-initiated trading over several days into the new taxation year is indirect support for the parking-the-proceeds hypothesis.
5. The existence of significant levels of seller-initiated trading prior to the effective taxation year-end is consistent with the theoretical arguments of Constantinides (1984) that loss realization should not be confined to the last trading day of the taxation year.

We believe the results presented in this paper also highlight the caution that must be exercised when employing rates of return in empirical analysis. We show that the tendency demonstrated by Keim (1989) for securities to shift systematically from transactions at the bid price to transactions at the ask price over the turn of the taxation year is widespread on major stock exchanges. Our results demonstrate that the higher turn-of-the-year returns are likely attributable to this seasonal, tax-induced, shift in investor trading behavior.

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