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INVENTORY RULES, TAXATION AND INSTITUTIONS' TRADING DECISIONS

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Inventory Rules, Taxation and Institutions' Trading Decisions†

by

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This paper examines whether the trading decisions of institutional investors can be explained in part by the effects of taxation on portfolio returns. The trading strategy that maximizes benefits to owners in the absence of taxes on capital gains differs from the optimal strategy in the presence of taxes. In particular, it may be better to hold on to an appreciated security in order to defer the payment of capital gains tax. We find that advisers managing portfolios on behalf of persons who are taxable entities are 26% less likely to sell securities that trigger large capital gains than securities that trigger no capital gains. Also, tax considerations seem to weigh more heavily in trading decisions later in the fiscal year. The decision to sell a particular security appears to depend on the cumulative gain or loss realized by the institution so far in the tax year. Tax-exempt institutional investors (namely, private foundations, universities, and pension funds) do not exhibit these tendencies. Surprisingly, all institutions are less likely to sell securities that would trigger a large loss. The inventory flow assumption adopted for tax purposes affects the size of the gain or loss realized in the sale of a block of stock. Consistent with tax planning, a HIFO (highest in first out) inventory rule is most significant for taxable institutions; a FIFO inventory rule is most significant for non-taxable institutions. We provide some evidence on the effect on realized gains of the two different inventory methods.

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1. Introduction

Taxation has an important effect on investor returns. Some estimates indicate the after-tax proceeds to a taxable mutual fund investor over a ten-year period are as much as 55% less than the pretax proceeds implied by the raw (tax-free) returns published in newspaper advertisements.[1] The tax cost associated with holding stock can be reduced by reducing the turnover of appreciated securities in a portfolio. Slowing the turnover of appreciated stockholdings has the effect of deferring the payment of capital gains. Tax costs can also be reduced by realizing capital losses to offset capital gains.

We examine whether institutions differ in their propensity to sell stock according to their tax status, their current tax position, and the time remaining until the tax year-end. Unlike earlier research, where the dependent variable is aggregate sales from each investor's portfolio, our study examines the decision to sell individual securities within a portfolio. We are therefore able to examine whether trading decisions by institutional investors are influenced by differences in capital gains triggered per dollar of stock sold. Further, we are able to calibrate the importance of tax factors against other variables, namely past returns and earnings announcements, that have been shown elsewhere to influence trading decisions.[2] Tax factors have incremental explanatory power after controlling for unexpected earnings and unexpected returns.

Despite the broad acceptance of the importance of taxes to investment trading strategies, there is little systematic documentation of the effects of taxation on the stock trading decisions of institutional investors.[3] In part, the lack of evidence is due to the difficulty

[1] Dickson and Shoven (1993a).

[2] Little is known about the trading behavior of institutional investors. Recent research in this area includes Lakonishok et al. (1991) who study the trading behavior of a set of pension funds. They document a weak positive correlation between changes in pension fund holdings in a security and the returns of that security over the prior year. They attribute this observation to "window dressing" by fund managers who wish to avoid the appearance of having held stock that underperformed the market. Lakonishok et al. (1992) investigate whether pension fund managers engage in herding or positive feedback trading (i.e., buying past winners and selling past losers). They find little evidence in support of either hypothesis. In a more comprehensive study, Lang and McNichols (1992) examine whether institutional investors trade in response to short-term earnings and returns realized by the firms they hold. They find that institutions, on average, sell (buy) the stock of firms that have experienced negative (positive) quarterly earnings forecast errors in the past year. They also find that institutions, on average, sell (buy) the stock of firms that have experienced negative (positive) excess returns in the past year.

[3] Indirect evidence is available from studies of stock price movements and trading volume at year-end (e.g., Roll 1983 and Lakonishok and Smidt 1984), across past-winners and past-losers (e.g., Lakonishok and Smidt 1986 and 1989), and around ex-dividend dates (e.g., Michaely 1991). These studies show that

of knowing the tax consequences of a trade on an investor. The tax effect of the sale of a security is idiosyncratic to each institution since tax is due on the difference between the price on the date of sale and the price on the date of purchase. If investors purchase their holdings on different dates, the tax effect of a sale will differ across investors. Tests that presume all recent winners give rise to capital gains may lack the power necessary to detect tax-motivated behavior. The trading tests in this paper are more powerful than those previously employed because we estimate the basis (or cost for tax purposes) of each security held by each institution. Consequently, we capture the idiosyncratic tax effect of different purchase prices for each stock held by an institution.

Anecdotal evidence on the significance of taxation in trading decisions is inconsistent. One investment adviser we consulted stated that although tax effects existed, they did not greatly affect the trading decisions of his investment advisory practice because (i) the investment adviser's compensation is based on pretax performance relative to an index that is not tax-adjusted, (ii) the clients who invested in the mutual funds managed by the adviser undoubtedly faced different marginal rates of tax, and (iii) the marginal rates of tax were in any case unknown to the adviser.[4] On the other hand, promotional literature for one mutual fund contains the following statement:

> Mutual funds generate positive returns by selling stocks when their prices are high and reinvesting the proceeds. Shareholders, however, must pay capital gains taxes on the gains produced by this practice, regardless of the overall value of the fund's shares. The Schwab 1000 Fund's portfolio managers will attempt to offset taxable gains with losses realized on underperforming stocks. The goal of this strategy is to minimize the capital gains tax liability to shareholders and increase their after-tax returns.[5]

winners have higher abnormal volume than losers. This evidence is inconsistent with tax-based predictions of stock trading. On the other hand, there is seasonal variation in trading volume (abnormally high sales of losers in December and abnormally high sales of winners in January) that is consistent with tax-motivated trading. Griffiths and White (1993) find that the turn-of-the-year anomaly is related to the degree of seller-initiated trading at the fiscal year-end and the consequent shift from trades at the bid to trades at the ask. All these studies examine the aggregate response of stock market participants at moments of time when taxation plausibly may affect trading decisions. The behavior of institutional investors as a whole, much less the behavior of specific subsets of institutional investors, cannot be identified from market data.

[4] It may be that mechanisms are at work which cause some fund managers to pay attention to taxes and others to ignore them. For instance, investors may sort themselves into tax clienteles according to the trading reputation of the fund. Low turnover funds (e.g., some growth funds) may attract high marginal tax rate taxpayers because those funds are most likely to postpone the recognition of capital gains. Similarly, funds with high turnover may be more attractive to taxpayers who face low marginal rates of tax.

[5] Pamphlet, "Schwab 100 Fund," Charles Schwab & Co., Inc., 1993.

Thus, it is uncertain *ex ante* whether institutional trading behavior is importantly affected by tax factors.

Most research examining the effects of capital gains taxation on investor behavior has examined individual investors rather than institutions.[6] The results are mixed. Feldstein and Yitzhaki (1978) and Feldstein et al. (1980) study the effect of capital gains taxation on the turnover of corporate stock in individual portfolios. They document a strong negative relationship between stock sales as a fraction of the value of the portfolio and estimates of the marginal rate of tax faced by the investor. Poterba (1987) and Seyhun and Skinner (1994) examine the capital gains and losses reported in samples of individual tax returns. Poterba finds evidence that a large fraction of realized capital gains are taxed at non-zero marginal rates. His evidence suggests the majority of individual investors do not realize gains and losses in a manner consistent with a strategy of tax minimization. Seyhun and Skinner's evidence suggests most individual investors buy and hold stocks, thereby deferring the realization of capital gains, but do not engage in more complex strategies to reduce taxes. Badrinath and Lewellen (1991) examine the common stock investment records of individual investors. They find that loss-taking trades are concentrated late in the year.

To test tax hypotheses, it is necessary to know (or infer) the tax cost of assets held, the proceeds for which they are sold, and the rate of tax that applies to the sale for a sample of taxpayers. No investor is required to disclose publicly these values. To conduct our tests, we estimate the tax cost and proceeds of assets sold by 673 large institutional investors from the quarterly 13-F reports they filed with the Securities and Exchange Commission for the years 1988, 1989, and 1990. Our procedure assumes all taxpayers use the same inventory flow assumption in accounting for additions and dispositions of their inventory of stock. Additionally, our method estimates the proceeds from the sale of securities at an average price for the quarter in which the disposition occurs since the data set contains neither the date of sale nor the sale price. Despite the noise these assumptions and estimations produce, our tax variable assumes the predicted sign and is strongly significant for taxable institutions.

[6] Relative to individual investors, the connection between tax factors and institutions' trading decisions is complicated by the agency relationship between investment advisers and investors.

Our evidence suggests that there is a relationship between trading decisions made by institutional investors and our estimate of the tax consequences of the trade. The relationship exists only for institutions that are taxable or that pass on the tax consequences of their trading to taxable entities. Also, the relationship is strongest in the fourth quarter of the year, suggesting that institutions weigh tax concerns most heavily just before they must close their books for tax purposes.

There are several alternative inventory flow assumptions for stockholdings that may be used by institutional investors. We investigate HIFO (highest in first out) because this method minimizes taxes currently payable and FIFO because practitioners tell us this method is commonly used by managers who do not care about taxes. The paper documents the effect of HIFO and FIFO inventory methods on the realizations of capital gains. Although the burden of keeping HIFO records is greater than the burden of FIFO records, the opportunity HIFO presents to postpone payment of capital gains tax may justify its use. This assertion is reinforced by the fact that the tax coefficients are strongly significant for taxable institutions under a HIFO assumption but insignificant under a FIFO assumption. This implies that institutional investors who care about taxes use HIFO.

The remainder of this paper is organized as follows. Section 2 motivates our tax hypotheses. In section 3, we consider the tax status of the institutions in our sample. Section 3 also explains the calculation of unrealized capital gains and other variables. The results of our tests are in section 4. Section 5 concludes the paper.

2. Hypothesis Development

There are many reasons why an institutional investor may trade. One reason is that the funds available for investment may increase (for example, because a pension plan pays out less in benefits to employees than it receives in new contributions) or decrease (for example, because the plan pays out more in benefits to employees than it receives in new contributions). Another reason is that the investment manager may trade in order to profit from information he receives about the returns distribution of securities in coming periods. A third reason is that trading may serve as a signalling mechanism: the manager may trade simply to signal to potential users of his portfolio management services that

he receives valuable private information (Huddart 1993). In making trading decisions, the manager considers not only the tax cost associated with selling an appreciated security (as in Constantinides 1984), but also the benefits enumerated above arising from the trade. In some cases, the tax cost may exceed the benefit derived from the sale of a stock.[7] We seek to document the impact of taxation on trading strategy. We expect taxation to be a significant factor in decisions to buy or sell individual securities, but it will certainly not be the only factor.

The return to an investor from selling an appreciated security to buy another stock that is expected to perform better over the remaining investment horizon is decreasing in both the tax rate on capital gains faced by the investor and the amount of the gains that would be triggered per dollar of stock sold. If the tax rate is high and the gain is large in relation to the incremental pretax return offered by the alternative stock, the trade may not be worthwhile. Assuming the information a manager receives about the forthcoming returns of various securities is independent of the unrealized gain or loss associated with any security the manager presently holds, then we expect the probability a taxable institution sells a security is decreasing in the amount of capital gain triggered per dollar of the stock sold.

Suppose now that the manager must sell part of the institution's portfolio for liquidity reasons. Assume the manager believes all stocks in the portfolio offer the same pretax expected return. Selling the stocks that trigger the least capital gains per dollar sold leaves the maximum possible funds invested in coming periods, and we may expect managers who face positive tax rates to adopt this strategy. As above, we expect the probability a taxable institution sells a security is decreasing in the amount of capital gain triggered per dollar of the stock sold. These observations lead us to the following hypothesis:

Hypothesis 1: For tax-paying institutions, the likelihood of sale of an appreciated security is decreasing in the capital gain triggered per dollar sold.

A second hypothesis concerns the sensitivity of trading decisions to tax factors over the course of the fiscal year. Taxable institutions owe tax on the net capital gains realized

[7] We ignore the possibility that institutional investors follow tax avoidance strategies that involve either shorting against the box or swap contracts, in which an investor exchanges the return on one security for the return on another. Both of these techniques have the effect of reducing the investor's net position in stock to zero without triggering any capital gains. There are no net short positions in our data.

each year in excess of available capital losses. Realizing incremental capital gains will not result in an increase in taxes payable for the year if these gains are offset by losses. The manager has greater flexibility early in the year to offset the effects of a trade that triggers a large gain by realizing losses elsewhere in the portfolio. Therefore the likelihood of sale of an appreciated security may be higher earlier in the year.

Hypothesis 2: Relative to a security whose cost for tax purposes equals its present market value, the likelihood of sale of an appreciated security by a tax-paying institution is lower later in the fiscal year.

3. Calculation of Variables

3.1 Sample

Our data consists of the end-of-quarter holdings of U.S. equities of large institutional investors from March 31, 1988 through December 31, 1990. Institutional investment managers exercising discretion over accounts with combined equity assets exceeding $100 million are required to file quarterly reports on form 13-F with the Securities Exchange Commission.[8] Our data come from these filings. The data file records the shareholdings (adjusted for splits and stock dividends) of 1,080 institutions in 9,917 firms.

We delete institutions that had investments in fewer than 10 firms since we want to consider only institutions holding a well-diversified portfolio of stock. This reduces the number of institutions by 24. Of the remaining 1,056 institutions, 383 were dropped from the sample because we did not have a complete panel of 12 quarterly filings.[9]

Closing monthly prices from January 1988 to December 1990 were available on NASDAQ and CRSP tapes for 4,028 of the 9,917 stocks.[10] We were able to obtain earnings and return data from Compustat to estimate unexpected earnings and unexpected returns for 2,776 of these firms. Each stock position of an institution is an observation.

[8] Equity holdings below 10,000 shares and less than $200,000 are exempted.

[9] Reasons for the disappearance of an institution from our sample include the winding up of the institution, the merger of the institution with another organization, and the cessation of quarterly reporting by the institution to the SEC. Only managers of portfolios having a market value in excess of $100 million are required to file form 13-F, although smaller institutions may supply the information voluntarily.

[10] Of the 4,028 firms, the share prices of 1,331 firms were obtained from CRSP tapes.

The intersection of the restrictions on stocks and the restrictions on institutions yields 163,434 observations in the fourth quarter of 1990.

3.2 Taxation of Institutions

The institutions in our sample fall into one of the following categories: foundations and universities, public and private pensions, insurance companies, investment companies, investment advisers, banks, and miscellaneous. We summarize the tax treatment of capital gains for each type of institution below. We assume institutions in our data set and recipients of taxable distributions from these institutions all have December 31 tax year-ends.

Foundations, universities, and pension plans comprise the non-taxable institutions in our sample. The return on investments in U.S. equities earned by foundations and universities is exempt from income tax.[11] Earnings on pension fund investments in U.S. equities are tax-exempt to the pension trust. Contributions to pension plans by employers and employees generally are tax-deductible to the contributor. Most distributions from pension plans are taxable to the recipient as income, but only when disbursed. Since pensions, foundations, and universities pay no taxes, we predict no relation between the probability of sale of a given security and the gain or loss triggered by the sale.

We classify the remaining categories of institutions as taxable. Insurance companies are taxable entities. Special provisions in the tax code that apply only to insurance companies may have the effect of reducing the marginal rate of tax faced by insurance companies below the rate faced by other large corporations.

Investment companies generally are "regulated investment companies" under the Internal Revenue Code. These organizations are commonly known as mutual funds. A mutual fund is not subject to federal income tax to the extent its income is distributed to unitholders. Distributions from the fund paid from long-term capital gains are taxable as such to the recipient.[12] In order for a fund to maintain its tax-exempt status, it must

[11] Sometimes, restrictions attached to gifts or payout rules adopted by the trustees of endowments limit the conditions under which portions of the investment portfolio may be liquidated. For example, rules may require that principal be invested in perpetuity. Only income (i.e., dividends or realized capital gains) may be used to fund current operations. As a result, a foundation or university may be more likely to sell an appreciated security in order to realize capital gains.

[12] In addition, the sale of units by a unitholder is a taxable event that may trigger a capital gain or loss. The timing of unit sales is at the discretion of the unitholder, not the fund manager. Accordingly, we assume sales of units have no effect on the fund manager's trading decisions except as they affect the fund's liquidity needs.

distribute yearly a dividend to unitholders equal to the net capital gain realized from the sale of investments in the fund.[13] Banks generally are prohibited from holding stock on their own account.[14] However, banks are allowed to perform investment advisory services for others. In this way, banks manage large portfolios of stocks on behalf of other investors. Investment advisers also provide investment advisory and management services for others. Since at least some of the persons who delegate the administration of their portfolio to banks or investment advisers or who invest in investment companies are taxable entities, we predict the probability of sale of a given security to decrease with the amount of gain triggered per dollar of stock sold.[15]

The above classification of institution types does not allow us to distinguish completely between taxable investors and non-taxable investors. We are confident that the institutions we have identified as non-taxable in fact pay no taxes. However, many tax-exempt investors delegate the management of their assets to investment advisers or banks. Tax-exempt institutions also invest in certain investment companies. Within the institution classes of banks, investment companies, and investment advisers, we expect there to be a mix of taxable and non-taxable beneficial owners. Since we identify all of these institutions as taxable in the tests, the analysis is biased against finding differences between the taxable and non-taxable populations.

Another problem with our data is that the securities reported on a single form 13-F may represent the aggregate holdings of several entities that are distinct for tax purposes. For instance, an investment adviser who simultaneously manages several different mutual funds may file a single form 13-F. Since each mutual fund is a separate entity for tax purposes, each must calculate capital gains and losses based on its own history of securities

[13] To qualify as a regulated investment company under Internal Revenue Code §851, less than thirty percent of the company's gross income can be derived from the sale or disposition of securities held for less than three months. This requirement slows the turnover of securities in the portfolio. As a result, our inferences of portfolio, drawn from quarterly "snapshots" of institutional holdings, may be more accurate. This rule also reduces the turnover of appreciated securities for a tax reason different than those used in development of hypothesis 1.

Investment companies may elect a year-end for purposes of capital gains distributions of either October 31, November 30, or December 31. The election is irrevocable. Uncertainty about the tax year-end complicates testing of our hypothesis that taxes weigh more heavily in investment advisers' decisions immediately before year-end. Since our data only provide us with quarterly snapshots of institutional holdings, we assume all institutions have a December 31 tax year-end.

[14] Savings banks (thrifts) are permitted to invest limited amounts in corporate stock.

[15] We could not place 29 of the institutions in our sample into any of the above categories. We include these institutions in our tests for completeness. We assume these entities are taxable.

purchases and sales. Because we treat each filer as a taxable entity, our estimates of the tax consequences of a sale are muddy. This also biases our tests against our hypotheses.

A third problem with our data is that a single investor may place his funds with several investment advisers. For instance, it is common for pension funds to manage some funds internally and to allocate other funds to outside managers. The internally managed assets of a pension fund typically would be reported on one 13-F. The externally managed funds would be reported on the 13-Fs filed by the outside managers. In each of these reports, the externally managed assets of the pension would be pooled with the other assets under the same management. Because commingled assets appear on a single form 13-F, the power of our tests is further reduced.

There is no requirement for institutional investors to file public reports that aggregate all stock holdings regardless of who manages them. Nor is there a requirement for investment managers to disclose the allocation of the assets they manage among the clients they serve. Thus, the structure of mandated disclosures limits the power of our tests. However, conversations with portfolio managers suggest that managers invest the assets of their clients similarly. If a manager decides a stock is a good buy, he is likely to add some of it to all of his clients' portfolios. Similarly, when a manager decides to sell a particular stock from one portfolio, he often sells from all the portfolios he manages. Since managers tend to execute purchases and sales proportionately in each portfolio, the estimation of unrealized gains from 13-F filings approximates the unrealized gains and losses in the individual client portfolios.

3.3 Estimation of Unrealized Capital Gains

In order to test our hypotheses, it is necessary to estimate the capital gain or loss that would be triggered per dollar of stock sold for each stock from every institution's portfolio. The tax basis of each share of the investee corporation's stock need not be the same. If the fund acquires its position over time, then it may own an "inventory" composed of several "layers" that have different costs for tax purposes. By examining quarter-over-quarter changes in holdings, it is possible to estimate how many shares are in each layer and the basis of the layers.[16]

[16] Offsetting purchases and sales within a quarter cannot be observed with our data.

When shares are sold, the taxpayer must report the tax cost, or basis, of the shares sold. The difference between the selling price and basis gives rise to a capital gain (if positive) or loss (if negative) in the year sold. U.S. tax laws allow some taxpayers to elect among several methods in order to determine the basis of the shares sold. Permissible methods (depending on the taxpayer) include average cost and FIFO. All taxpayers are permitted to use specific identification.

Using specific identification, the taxpayer can receive an outcome that is at least as good as any outcome available using other methods. For instance, when tax rates are constant over time (the case for the period covered by our sample) the lowest tax is payable by selling the most costly shares on hand of a given stock first.

Since specific identification combined with the policy of electing to sell the most costly shares of a given stock first results in the least tax payable currently on the sale of any stock, we assume that all institutions follow this practice.[17] Table 1 provides a simple illustration of this procedure. We call this inventory policy HIFO for highest in first out.

[Table 1]

To implement exactly the inventory costing scheme outlined in table 1 requires the complete trading history of every institution. Our raw data consists of the stockholdings of institutions at the end of every calendar quarter, beginning with March 31, 1988 and ending on December 31, 1990. Accordingly, we assume that if an institution increases its holdings of a particular stock from one quarter to the next, then a single purchase was made at a price equal to the average of the three month-end prices for that quarter. If an institution decreases its holdings from one quarter to the next, we assume that a single sale takes place at a price equal to the average of the three month-end prices for that quarter. We relieve the most costly layers of inventory first. We assume all stock on hand

[17] The optimality of this method relies on the further assumption that capital losses in excess of current capital gains will be offset by past or future net capital gains before the losses expire. Since (i) regulated investment companies (i.e., mutual funds) can carry losses forward eight years (but not back), (ii) corporate taxpayers can carry losses back three years and forward five years, and (iii) individuals can carry losses forward indefinitely (but not back), this assumption seems reasonable. A Big 6 tax partner who advises regulated investment companies (mutual funds) told us he estimates that about half of investment companies employ specific identification and try to avoid triggering gains, consistent with our HIFO assumption. The other half of investment companies use FIFO. Two reasons offered for using FIFO are (i) the record keeping burden is lower, and (ii) paying capital gains dividends to investors is a way of signaling successful trading activities.

at March 31, 1988 has a tax cost equal to the stock price at that date. We apply the algorithm outlined above to the first 11 quarters of data to estimate the cost and quantity of stock on hand in each layer at September 30, 1990.[18]

3.4 Definition of Variables

$\text{LAY}k_{qis}$ is the capital gain or loss that would be triggered per dollar of stock s sold by institution i from layer k in quarter q. The most costly layer (i.e., the layer for which the basis is highest) is layer 1. The next most costly layer is layer 2, etc.

UR_{ts} for $t = -1$ and -2 is the unexpected return during the previous and second previous quarter on each stock.[19] We include UR in our models to distinguish the tax effect from the window dressing effect, which asserts that firms sell stocks that have performed poorly in the recent past and buy (or do not sell) stocks that have performed well. Since stocks that have enjoyed large returns recently are also likely to have large unrealized capital gains, it would not be possible to distinguish between window dressing and the tax hypothesis unless the gain variable has explanatory power in the presence of UR.

UE_{ts} for $t = 0$ and -1 measures the unexpected component of the earnings per share released in the event quarter and the previous quarter. UE is the difference in primary earnings per share before extraordinary items in one quarter less the corresponding figure for the preceding year deflated by the opening stock price for the quarter. We assume earnings for one quarter are released in the following quarter.

CUM_{qi} is the cumulative capital gains realized by institution i since January 1, 1990 up to the end of quarter q, standardized by the average market value of assets of the institution.[20] Average market value is calculated by multiplying the stockholdings of the

[18] It is difficult to quantify the effect of assuming a basis for stock on hand at March 31, 1988 equal to the March 31, 1988 market price. The HIFO (FIFO) algorithm leads us to infer that at September 30, 1990 none of the stock held at March 31, 1988 was still on hand for 43% (47%) of our observations. Across observations, the mean amount of stock held at March 31, 1988 still on hand at September 30, 1990, as a proportion of all stock on hand at that date, is 22% (21%). Since stock prices generally rise over time, this means we are overstating the basis of securities and understating the tax cost of selling an appreciated security. In turn, this biases our tests against finding a significant relationship between capital gains and the likelihood of sale.

[19] Return is calculated as $(P_1 + d_1)/P_0 - 1$, where P_1 is the closing share price at the end of the quarter, d_1 is the dividend per share paid in that quarter, and P_0 is the closing share price at the end of the previous quarter. The unexpected return is the realized return less $R_f + \beta(R_m - R_f)$, where R_f is the return on a 90 day treasury bill and R_m is the equally weighted return on the S&P 500 index.

[20] In unreported tests, we included an estimate of losses carried forward in our calculation of the tax position of each institution. The results when carryforwards were included were generally no more significant than those in which we omitted carryforwards. It is probable that 11 quarters is too short a time period over which to estimate carryforwards accurately.

institution at quarter's end by the average of month-end prices in the subsequent quarter. Our estimates of CUM are based on the 2,776 stocks for which we had complete price information although the institutions in our data set held positions in 9,917 different stocks. Nevertheless, we believe the measurement error introduced in CUM by the large number of stocks for which we could not obtain prices is small. This is because the omitted securities have smaller market capitalizations than the included securities. Hence, the securities omitted in calculating CUM are a small portion of the portfolios of institutional investors.[21]

PROP_{qi} is a measure of the selling pressure faced by an institution caused, for example, by liquidity needs. PROP is the ratio of the number of stocks sold by the institution in the quarter to the number of stocks held in the portfolio at the beginning of the quarter. Thus, for an institution that had 100 different securities in its portfolio at the beginning of the quarter and reduced its position in 30 of these during the quarter, PROP is equal to 0.3.

3.5 Descriptive Statistics

Table 2 provides descriptive statistics on the variables. On average, each institution has 243 stocks in its portfolio for which we have the complete record of month-end prices, returns, and earnings from 1988 to 1990. The LAY variable is left skewed because the capital gain per dollar sold on an appreciated stock can be no more than one, but if the stock price has fallen sharply, the capital loss per dollar sold can be many times greater than 1. In less costly layers of inventory, the gain is larger (or the loss is smaller). That is, $\text{LAY}k_{qis} < \text{LAY}(k+1)_{qis}$ by construction. Thus the distribution of $\text{LAY}(k+1)$ is shifted to the right relative to the distribution of $\text{LAY}k$. For more than half of the institutions in our sample, the net of realized gains and losses in the first three quarters of 1990 is a loss.

The PROP variable indicates that there is a high incidence of stock sales in the sample. Over the course of the quarter, an institution will sell at least some of its position in about one-third of the stocks in its portfolio, on average. Also, there is considerable variation across institutions in this propensity to sell. For one-quarter of the institutions

[21] It is not possible to compare the market capitalization of the two groups because we cannot get prices or shares outstanding for the omitted securities.

in our sample, the number of stocks sold as a fraction of stocks held is less than 21.7%; for another quarter of the institutions, it is above 41.5%.

The CUM variable indicates that under the HIFO assumption, more than half of the institutions in our sample had realized net losses in the year up to September 30, 1990. The mean loss realized by institutions as a percentage of the market value of the portfolio is 2.5%.

[Tables 2 and 3]

If an institution's entire holdings of a particular company's stock were purchased in a single quarter, then every inventory method yields the same cost for tax purposes. Only if an institution accumulates its position in a security over several quarters will the tax cost associated with the sale of that stock vary with the choice of inventory method. It is well to ask how frequently institutional investors accumulate and draw down positions in securities over several quarters before examining whether the choice of inventory method matters.

Table 3 provides a breakdown of the distribution of inventory layers and sales of stock. A firm that increased its holdings of a particular stock in each of the 11 preceding quarters would have 11 layers of stock on hand if it paid a different price in each quarter. In fact, there are few observations with more than 5 layers. For about three-quarters of the observations, stockholdings at the beginning of the fourth quarter of 1990 were accumulated over two or more quarters. When an observation has multiple layers of inventory, sales into deeper layers are common. Thus this table suggests opportunities exist to alter the realization of capital gains to reduce taxes currently payable through a judicious choice of inventory method.

4. Empirical Results

4.1 Analysis of Layer 1 – Test of Hypothesis 1

Figure 1 shows the relationship between the gain or loss associated with selling a security and sale of the security, broken down between taxable and non-taxable institutions. The frequency of sales as a percent of (institution, stock) pairs is higher for taxable institutions than for non-taxable institutions. A higher overall frequency of trade for taxable institutions is at odds with the notion that taxation is a friction that makes tax-paying investors more reluctant to trade than tax-exempt investors. One plausible non-tax reason why the propensity to sell may differ across these groups is that internally managed funds may be managed less aggressively.

[Figure 1]

Figure 1 also shows that the frequency of sale of gain securities by taxable institutions decreases monotonically in the magnitude of the gain. The frequency of sale in the first quintile of gain observations is 33.9%. In the fifth quintile, it is 25.0%, a decrease of 26%. Since there are about 7,500 observations in each gain quintile, the hypothesis that the probability of sale is the same in the first and fifth quintiles is overwhelmingly rejected ($\chi^2 = 149$).

Surprisingly, the frequency of sale in the first quintile of loss is significantly lower than in the fifth quintile of losses ($\chi^2 = 371$). This result is puzzling—it cannot be explained by tax factors in the absence of a binding limitation on the availability of loss carryforwards. There are several behavioral explanations for the reluctance of decision makers to realize losses: prospect theory, mental accounting, avoiding regret, and lack of self-control (Shefrin and Statman 1985).[22] These behavioral theories defy the assumptions underlying the economic model of utility maximization. Nevertheless, figure 1 presents the first strong evidence of which we are aware that some investors loathe realizing losses.

The frequency of sale by non-taxable institutions increases somewhat in the magnitude of the gain and decreases somewhat in the magnitude of the loss, but the relationship is

[22] These theories also predict decision makers realize gains "too often." Our data contradict this prediction.

not monotonic. The hypothesis that the probability of sale is the same in both the first and fifth gain (loss) quintiles is rejected with marginal significance with $\chi^2 = 4.66$ ($\chi^2 = 4.15$).

Taken together, these observations on figure 1 suggest there are significant differences in the responses of taxable and non-taxable institutions to a HIFO measure of the gain triggered on sale of a security. To examine these differences more carefully, we represent the decision whether to sell a security in a quarter as a dichotomous choice model. Define $\text{GAIN}_{isq} = \text{LAY1}_{isq}$. Further suppose that y^*_{is} is a linear function of the independent variables, i.e.,

$$y^*_{is} = \beta_0 + \beta_1 \text{GAIN}_{is} + \beta_2 \text{PROP}_i + \beta_3 \text{UR}_{-1s} + \beta_4 \text{UR}_{-2s} + \beta_5 \text{UE}_{0s} + \beta_6 \text{UE}_{-1s} + \tilde{\epsilon}_{is}$$

where the $\tilde{\epsilon}_{is}$ are independent and identically distributed error terms. We observe the variable, y_{is}, where

$$y_{is} = \begin{cases} 1 & \text{if a sale takes place (i.e., } y^*_{is} > 0); \\ 0 & \text{otherwise.} \end{cases}$$

In table 4, we report the maximum likelihood estimates of the coefficients β and their significance levels assuming ϵ is normally distributed (i.e., a normit analysis). The only observations included in the analysis are the stocks of institutions which, if sold, would trigger a capital gain (i.e., the GAIN variable is positive).

[Table 4]

The coefficient on the gain variable has a negative sign and is significantly different from zero for tax-paying institutions. Consistent with hypothesis 1, this indicates that the probability of sale of an appreciated security by an institution that has net capital gains decreases in the capital gain per dollar of the stock sold. The gain variable is not significantly different from zero for non-taxable institutions.[23] These results accord with the irrelevance of capital gains to these institutions.

[23] In normit regressions, OLS regressions, and rank regressions by institution type not reported in this paper, the coefficient on gain is negative and significantly different from zero for all types of taxable institutions. The gain variable is negative for foundations and universities and positive for both private and public pension funds, but is not significant in any case. In other regressions not reported in this paper, the inclusion of additional lags of UE and UR did not increase explanatory power. The coefficients on the additional lags were not significantly different from zero.

Table 4 also shows that the gain variable is significant in the presence of the unexpected return variable, UR, and the unexpected earnings variable, UE. Thus, tax factors have explanatory power for institutional investors' trading decisions beyond previously documented earnings and returns effects (Lang and McNichols 1992). These results are robust over the usual estimation methods. Similar coefficient estimates and significance levels obtain for all variables in OLS regressions applied to either the variables or the ranks of the variables (not reported). For a taxable institution, the coefficient on GAIN in the OLS regression suggests an increase of ten cents in the gain triggered per dollar of stock sold reduces the likelihood of sale of that security by 2%.

4.2 Analysis over Time – Test of Hypothesis 2

It is also interesting to know whether taxes play a greater role in institutional trading decisions later in the fiscal year than earlier. We expect taxpaying institutions to be less likely to trigger a large gain in the fourth quarter of the year than in earlier quarters. This is because gains realized early in the year may be offset by losses realized later in the year.

[Figure 2]

Figure 2 presents a comparison of the frequencies with which taxable institutions sell gain and loss securities in the second, third, and fourth quarters of 1990. The topmost line in figure 2 corresponds to the fourth quarter. Except for a horizontal shift to standardize the frequency of sale in the fifth gain quartile to zero, it is identical to the line for taxable institutions in figure 1. The two other lines in figure 2 present the standardized frequency of sale for like magnitudes of gain (and loss) in the second and third quarters. While the likelihood of sale as function of the gain or loss that would be triggered on sale is distinctly hump-shaped in the fourth quarter, it is less so in earlier quarters. It is remarkable that the standardized point estimates for the frequency of sale in quarter 3 (quarter 2) all lie below the standardized point estimates for quarter 4 (quarter 3). That is, it appears the magnitude of gain triggered per dollar of stock sold is less important in determining the likelihood of sale earlier in the year. We turn now to a more formal test of hypothesis 2.

[Table 5]

Like table 4, table 5 presents a normit regression applied to a dummy variable that takes the value 1 if the stock is sold in the current quarter and zero otherwise. The results are broken down between taxable and tax-exempt institutions. The explanatory variables of interest are the amount of capital gain triggered per dollar of stock sold in quarter q, GAIN_q. The analyses also include the unexpected returns over the previous two quarters, UR, and the unexpected earnings announced in the event quarter and the previous quarter, UE. To avoid problems associated with fitting a line though a hump-shaped function, the tests include only those observations for which GAIN is positive for the quarter.

Consistent with hypothesis 2, tax factors appear to be most important to taxable institutions just before the end of the year. The GAIN variable is more negative for observations in the fourth quarter than in the third quarter and more negative in the third quarter than in the second quarter. The difference in the GAIN coefficient between the second and third quarter and the third and fourth quarters is highly significant. While the coefficient on GAIN is more negative in the first quarter than in the second, it is not possible to reject the hypothesis that the coefficients are equal. The coefficient on GAIN is not significantly different from zero for non-taxable institutions in any quarter.

It seems difficult to attribute the evidence in favor of hypotheses 1 and 2 to a force other than taxation because the HIFO inventory assumption is peculiarly motivated by tax considerations and, as the next section shows, it is essential to the results we obtain.

4.3 HIFO versus FIFO

This section compares the effects of using HIFO and FIFO inventory procedures on the tax position of the institution over the course of the year. We also examine whether FIFO or HIFO has more power in explaining trading behavior.

[Table 6]

Table 6 compares the tax position at the end of each quarter of 1990 under HIFO and FIFO. The cumulative gain under HIFO is, of course, less than under FIFO. Under the HIFO method, the median taxable and non-taxable institutions have net realized losses at the end of the year. The loss is larger for taxable than for non-taxable institutions. Under the FIFO method, the median taxable and non-taxable institutions have net realized gains

at the end of the year. The gain is larger for taxable than for non-taxable institutions. Also under either method, there are large unrealized gains (on the order of 10% of the market value of the portfolio) and losses (on the order of 20%) in the portfolios throughout the year. These results suggest that there is considerable scope for an institution to reduce its tax bill by selling loss positions. Simply by using a HIFO inventory policy for stock transactions, the median taxable institution changes a net gain at year's end for tax purposes of .40% of the market value of the portfolio to a loss of 4.48% of the market value of the portfolio.

[Figure 3]

Figure 3 depicts the frequency of sale of securities broken down according to the magnitude of the gain or loss under a FIFO assumption. In contrast to figure 1, there is no sharp, monotonic decrease in the likelihood of sale by taxable institutions as the size of the gain increases. Nevertheless, it is possible to reject the hypothesis that the probabilities of sale in the first (33.9%) and fifth (32.5%) gain quintiles are the same ($\chi^2 = 4.783$). In common with figure 1, figure 3 shows that the likelihood of sale by taxable institutions decreases sharply as the size of loss grows large. For non-taxable institutions, the difference in the likelihood of sale between the first and fifth gain quintiles is negligible ($\chi^2 = 0.006$). Non-taxable institutions, too, are less likely to sell loss securities in quintile 1 than quintile 5 ($\chi^2 = 3.698$). Comparison of figure 1 and figure 2 suggests that the choice of inventory flow assumption is crucial to the examination of trading behavior.

[Table 7]

Table 7 presents normit regressions similar to those in table 5 except the gain variable has been replaced by either or both HIFOGAIN and FIFOGAIN. HIFOGAIN is identical to the GAIN variable used earlier in the paper. FIFOGAIN is similar to the GAIN variable, but a FIFO inventory assumption is used in calculating the cost of various layers of stock. The third and sixth columns of table 7 are comparable to table 4 except that table 4 includes all observations for which GAIN is positive, while table 7 includes all observations for which both HIFOGAIN and FIFOGAIN are positive.

The coefficient on HIFOGAIN is not significantly different from zero for non-taxable institutions. The coefficient on FIFOGAIN is significant and positive for non-taxable institutions, however. It may that some of these institutions prepare historical cost financial

reports under a FIFO assumption and like to show gains in the reports. For taxable institutions on the other hand, the coefficient on FIFOGAIN is not significant in the absence of HIFOGAIN while the coefficient on HIFOGAIN is significantly negative in the presence and absence of FIFOGAIN. This suggests that institutions that care about taxes use HIFO rather than FIFO for tax purposes.

It is puzzling that the coefficient on FIFOGAIN becomes significantly positive in the presence of HIFOGAIN. This relationship could be caused by the mixing of tax-paying and tax-exempt institutions within the taxable category. It also could be that after controlling for taxes with HIFOGAIN, taxable institutions and non-taxable institutions alike have a preference for reporting gains in historic cost financial reports.

5. Conclusions

In contrast to earlier studies of the effects of taxation on institutional trading practices, we find strong evidence in support of our hypotheses linking taxation to trading behavior. We argue that the trading decisions of taxpaying institutional investors (or institutions that invest on behalf of taxpaying investors) should be influenced by the amount of unrealized capital gains that would be triggered if the stock were sold. We present evidence consistent with the hypothesis that advisers managing portfolios on behalf of persons who are taxable entities are less likely to sell securities that trigger large capital gains per dollar sold than securities that trigger small capital gains. In the fourth quarter of 1990, the likelihood of sale of an appreciated security by a taxable institution was 26% less than the likelihood of sale of a security trading at cost. Non-taxable institutional investors do not exhibit these tendencies. Our evidence also indicates that tax factors affect trading decisions more strongly near the fiscal year-end. We are also surprised to find that all institutions seem loath to sell stocks that would trigger large losses.

Earlier studies document the relationship between unexpected returns and unexpected earnings on the change in holdings of institutional investors in aggregate. Institutions as a group seem to buy stocks that have performed well in the past, and sell stocks that have performed poorly in the past. We believe that taxes, in part, explain this observation. Selling appreciated securities triggers capital gains. On average, taxable entities hold

appreciated securities to postpone payment of capital gains taxes. Decisions to purchase stock are unaffected. Because of the drag capital gains tax imposes on institutional stock sales, tax considerations may cause institutions as a group to increase their holdings of appreciated securities. This is not the whole story, though. In our tests, unexpected returns exhibit explanatory power in the presence of the capital gains variable. Generally, our results suggest that taxes are a factor in determining institutional trading behavior that is no less important than the effects of earnings announcements and stock returns.

Relative to FIFO, the HIFO inventory method reduces net realized capital gains of the median taxable institutions in 1990 by about five percent of the portfolio market value. In comparing alternative inventory assumptions, we find that FIFO has less explanatory power than HIFO for taxable institutions. This suggests that managers who care about taxes use HIFO rather than FIFO. Taxable institutions are less likely to sell securities that trigger large gains under a HIFO inventory assumption; non-taxable institutions are more likely to sell securities that trigger large gains under a FIFO inventory assumption.

This paper suggests other interesting avenues of research. One is to model the effects on trading strategy of the incentives imposed on an institutional fund manager by his compensation contract. As we noted at the outset, it is not clear whether managers face appropriate incentives to internalize the tax consequences of their trading behavior on the beneficial owners of fund assets. Another avenue to investigate is the mechanisms used by an investor to identify fund managers who employ trading strategies that are appropriate for his tax rate. We speculate that within the (undifferentiated, in our data set) class of investment advisers, managers tailor their trading strategies to particular investor tax clienteles.

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Date	*Trading History*				*Basis of Shares Sold*			*Inventory*			
	Purchase or Sale	Share Price	Quantity	Proceeds	Share Price	Quantity	Tax Cost	Layer	Share Price	Quantity	Capital Gain (Loss)
1	*p*	5	100					1	5	100	
2	*p*	10	50					1	10	50	
								2	5	100	
3	*p*	8	100					1	10	50	
								2	8	100	
								3	5	100	
					10	50	500				
					8	10	80				
4	*s*	9	60	540			580	1	8	90	(40)
								2	5	100	

Table 1. This table illustrates the calculation of capital gain or loss and layers of inventory of stock assuming specific identification is combined with the policy of selling first the most costly stock held. Call this policy HIFO, for highest in first out. The underlying transactions are: (i) a purchase of 100 shares at $5 per share on date 1; (ii) a purchase of 50 shares at $10 per share on date 2; (iii) a purchase of 100 shares at $8 per share on date 3; and (iv) a sale of 60 shares at $9 per share on date 4. The loss of $40 is equal to the proceeds of $540 less the tax cost of the shares sold, $580. Even though the stock price is on average moving up, use of HIFO results in a loss for tax purposes. Under a FIFO inventory assumption, a gain of $240 would be triggered by the sale on date 4.

	N	mean	25%	median	75%	standard deviation
LAY1	163,434	−.804	−.745	−.254	−.011	6.366
LAY2	16,040	−.580	−.589	−.193	−.022	3.805
LAY3	6,302	−.548	−.566	−.173	.049	2.840
LAY4	2,599	−.570	−.547	−.168	.059	2.991
PROP_i	673	.329	.217	.319	.415	.155
UR	2,776	−.058	−.183	−.072	.024	.396
UE	2,776	−.0041	−.0107	.0004	.0065	.176
CUM	673	−.025	−.048	−.015	.007	.114

Table 2. Descriptive statistics of variables for the fourth quarter of 1990.

$\text{LAY}k_{is}$ *The capital gains triggered when a dollar of stock s is sold by institution i from layer k (layer 1 is the costliest layer, layer 2 is second most costly layer, etc.) in the fourth quarter of 1990.*

PROP_i *The number of security positions that were reduced by institution i during the fourth quarter of 1990 divided by the number of security positions held by institution i at the beginning of the fourth quarter of 1990.*

UR_s *UR is the unexpected return during the past quarter on each stock. Return is calculated as* $(P_1 + d_1)/P_0 - 1$ *where* P_1 *is the closing share price at the end of the previous quarter,* d_1 *is the dividend per share paid in that quarter and* P_0 *is the closing share price at the end of the second previous quarter. The unexpected return is the realized return less* $R_f + \beta(R_m - R_f)$*, where* R_f *is the return on a long government bond and* R_m *is the equally weighted return on the S&P 500 index.*

UE_s *UE measures the unexpected component of the quarterly earnings per share number released in the fourth quarter of 1990. UE is defined as the difference between primary earnings per share before extraordinary items for the third quarter of 1990 and the third quarter of 1989 deflated by the stock price at the beginning of the third quarter of 1990.*

CUM_i *Capital gains realized since January 1, 1990 up to the end of September 30, 1990 of institution i, standardized by the market value of assets of institution i. Market value is calculated by multiplying the stockholdings of institution i at September 30, 1990 by the average of month-end prices in the fourth quarter of 1990.*

Number of Inventory Layers	*No Sale*	*Sale Into Layer* 1	2	3	4	≥ 5	*Total*
1	33,770	13,219					46,989
2	30,568	7,140	4,085				41,793
3	18,129	5,440	1,898	1,649			27,116
4	11,741	3,868	1,405	734	720		18,468
≥ 5	18,086	5,433	2,350	1,320	770	1,109	29,068
Total	112,294	35,100	9,738	3,703	1,490	1,109	163,434

Table 3. For 163,434 (institution, stock) observations at the beginning of the fourth quarter of 1990, the rows in this table detail the number of observations for which there were 1, 2, 3, 4, and 5 or more layers of stock on hand in the inventory of the institution holding that stock. For the same observations, the columns of this table detail whether the institution sold some of the stock it held. If there was a sale, the table also indicates the layer from which the last share sold came. A layer of stock is created whenever stock is purchased. The cost of the stock in the layer is its basis for tax purposes. A HIFO (highest in first out) inventory assumption is assumed for all stock sales. Layers are ordered from most costly (layer 1) to least costly.

For example, an additional observation that institution XYZ, which had four layers of stock ABC on hand at the beginning of the quarter, sold all of the stock in the first layer and some of the stock in the second layer during the quarter would increase the number in the fourth row and the column for sale into layer 2 from 1,405 to 1,406.

Independent Variables	*Dependent Variable: 1 if sale, 0 if no sale*	
	coefficient P-value	
	Non-taxable	Taxable
Intercept	-1.6034 0.0001	-1.3604 0.0001
GAIN	0.0922 0.6765	-0.6979 0.0001
PROP	3.5272 0.0001	2.8003 0.0001
UR-1	0.1194 0.6154	0.2728 0.0001
UR-2	0.0224 0.9089	0.1467 0.0019
UE-0	1.4412 0.0528	0.0999 0.5096
UE-1	-1.3121 0.2047	0.5266 0.0354
Gamma	0.536	0.349

Table 4. This table shows the estimation results for the normit regression procedure applied to a dummy variable that takes the value 1 if the stock was sold by the institution and 0 otherwise. The results are presented in aggregate and broken down by institution type. The explanatory variable of interest is the amount of capital gain triggered per dollar of stock sold, GAIN. The models also include controls for unexpected returns over the previous quarter UR, and the unexpected earnings announced in the event quarter, UE. P values are presented below the coefficients. The tests include only those observations for which GAIN is positive. All test statistics are two-sided. For taxable (non-taxable) institutions, the total number of observations is 36,373 (2,832) and the number of observations for which there was a sale is 11,280 (631). There are 634 taxable and 39 non-taxable institutions.

Independent Variables	*Dependent Variable: 1 if sale, 0 if no sale* Taxable	Non-taxable
Intercept	-2.4072	-2.7859
	.0001	.0001
Gain4	-1.1517	.0700
	.0001	.8565
Gain3	-.5156	-.0965
	.0001	.7875
Gain2	-.2178	.0871
	.0019	.7521
Gain1	-.3905	-.4695
	.0001	.1115
Q4	.1246	.0901
	.0001	.3716
Q3	.0959	.1268
	.0001	.2012
Q2	.0362	.0849
	.0867	.3227
PROP	4.7784	5.9663
	.0001	.0001
UR-1	.3137	.5765
	.0001	.0002
UR-2	.1624	.1178
	.0001	.3807
UE-0	-.0384	.1167
	.7213	.8523
UE-1	-.0723	-.0845
	.2954	.8062
observations		
y = 0	129,824	12,899
y = 1	57,771	3,122
Gamma	0.3480	0.4990

Table 5. This table presents a normit regression applied to a dummy variable that takes the value 1 if the stock is sold in the current quarter and zero otherwise. The results are broken down between taxable and tax-exempt institutions. The explanatory variable of interest is the amount of capital gain triggered per dollar of stock sold, GAIN. The analysis includes controls for (i) institution-specific selling pressure in the quarter, PROP; (ii) unexpected returns in the two quarters prior to the event quarter, UR; and, (iii) unexpected earnings announced in the event quarter and the previous quarter, UE. The regressions include only those observations for which GAIN is positive. For each (institution, stock) pair, GAIN is a measure of the capital gain triggered per dollar of stock sold by the institution. The variable Q for $i = 2, 3, 4$ is equal to one if the observation is from quarter i and zero otherwise. In the data matrix, only the gain term corresponding to the quarter in which the observation occurs is non-zero. For example, if the observation is in the fourth quarter, then GAIN3 = GAIN2 = GAIN1 = 0. Consistent with the hypothesis that tax factors are most important to taxable institutions just before the end of the year, the GAIN variable is most negative in the fourth quarter for taxable institutions. For taxable institutions, the GAIN variable is significantly more negative ($t = 4.93$) in quarter 4 than in quarter 3. The gain variable is significantly more negative in quarter 3 than in quarter 2 ($t = 2.69$). It is not possible to reject the hypothesis GAIN1 = GAIN2 ($t = 1.67$). The hypotheses that GAIN4, GAIN3, GAIN2, and GAIN1 are equal to zero cannot be rejected for non-taxable institutions ($t = 0.18, 0.27, 0.32$, and 1.59, respectively). All p-values are two-sided.

	Panel A: HIFO Inventory Assumption								Panel B: FIFO Inventory Assumption							
	Taxable Institutions				Non-taxable Institutions				Taxable Institutions				Non-taxable Institutions			
Quarter	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Cumulative realized gain or loss																
75%	0.35%	1.62%	0.58%	-0.90%	0.58%	1.55%	1.48%	0.70%	0.54%	0.61%	1.08%	2.01%	0.77%	0.88%	3.21%	3.36%
Median	0.00%	0.00%	-1.53%	-4.48%	0.10%	0.11%	-0.57%	-2.97%	0.02%	-0.01%	0.03%	0.40%	0.38%	0.28%	-0.11%	0.31%
25%	-0.34%	-1.53%	-4.84%	-9.53%	-0.22%	-1.18%	-3.55%	-7.57%	-0.24%	-0.62%	-0.75%	-0.58%	-0.14%	-0.34%	-1.24%	-0.62%
Unrealized Gain																
75%	16.30%	11.72%	9.62%	11.12%	16.85%	12.39%	9.75%	10.62%	15.44%	11.03%	8.78%	10.21%	16.48%	11.89%	9.30%	10.39%
Median	13.88%	9.75%	7.98%	9.32%	14.98%	10.69%	8.23%	9.57%	13.03%	8.97%	7.15%	8.35%	14.95%	10.56%	8.05%	9.48%
25%	11.65%	7.94%	6.45%	7.86%	13.44%	9.19%	7.10%	8.29%	10.94%	7.16%	5.76%	6.96%	12.99%	8.62%	6.49%	7.24%
Unrealized Loss																
75%	-8.81%	-16.86%	-20.40%	-15.38%	-10.07%	-18.87%	-23.11%	-18.52%	-9.49%	-17.90%	-21.95%	-17.34%	-10.49%	-19.31%	-23.93%	-19.47%
Median	-11.17%	-20.14%	-24.37%	-18.62%	-11.68%	-20.35%	-25.51%	-20.40%	-11.96%	-21.29%	-26.47%	-21.11%	-12.19%	-20.96%	-26.39%	-21.56%
25%	-13.69%	-23.70%	-29.46%	-23.18%	-13.77%	-24.78%	-29.75%	-23.00%	-15.30%	-25.69%	-32.13%	-26.12%	-16.32%	-25.74%	-30.76%	-25.77%

Table 6. This table presents summary statistics on the estimated tax position of institutions throughout the year 1990. Two sets of estimates are presented. Panel A assumes institutions use HIFO. Panel B assumes institutions use FIFO. For each quarter, the net cumulative realized gain (loss), unrealized gain, and unrealized loss are expressed as a percentage of the market value of the portfolio. Taxable and non-taxable institutions are presented separately. Under HIFO, unrealized gains are lower. Also, under HIFO unrealized losses are smaller. The cumulative gain realized under HIFO is less than under FIFO.

Independent Variables	*Dependent Variable: 1 if sale, 0 if no sale*					
	Non-taxable			Taxable		
	coefficient P-value					
Intercept	-1.6906 0.0001	-1.6932 0.0001	-1.6023 0.0001	-1.4394 0.0001	-1.4646 0.0001	-1.3634 0.0001
HIFOGAIN	-0.2850 0.3011		0.1245 0.5776	-1.1321 0.0001		-0.6738 0.0001
FIFOGAIN	0.6226 0.0118	0.4682 0.0194		0.6594 0.0001	0.0233 0.6545	
PROP	3.6542 0.0001	3.6299 0.0001	3.5797 0.0001	2.8673 0.0001	2.8544 0.0001	2.8348 0.0001
UR-1	-0.0057 0.9813	-0.0125 0.9592	0.0776 0.7481	0.2136 0.0001	0.1842 0.0001	0.2568 0.0001
UR-2	-0.1087 0.5961	-0.1211 0.5525	-0.0300 0.8807	0.0616 0.2059	0.0198 0.6820	0.1293 0.0071
UE-0	1.3007 0.0840	1.3024 0.0828	1.3600 0.0683	0.0821 0.5936	0.0807 0.5992	0.0718 0.6408
UE-1	-1.3975 0.1967	-1.4628 0.1754	-1.4019 0.1905	0.5015 0.0475	0.4223 0.0954	0.5445 0.0313
observations						
y = 0		2,152			24,163	
y = 1		625			11,045	
Gamma	0.545	0.545	0.544	0.357	0.343	0.351

Table 7. This table shows the estimation results for a normit regression applied to a dummy variable that takes the value 1 if the stock was sold by the institution and 0 otherwise. This table is similar to table 5. However, the regressions reported here include gain variables calculated under two different inventory assumptions. The results are broken down by institution type. The explanatory variable of interest is the amount of capital gain triggered per dollar of stock sold under the FIFO and HIFO inventory assumptions, FIFOGAIN and HIFOGAIN, respectively. The models also include controls for unexpected returns over the previous two quarters, UR, and the unexpected earnings announced in the event quarter and the previous quarter, UE. P values are presented below the coefficients. The tests include only those observations for which FIFOGAIN and HIFOGAIN are positive. All test statistics are two-sided.

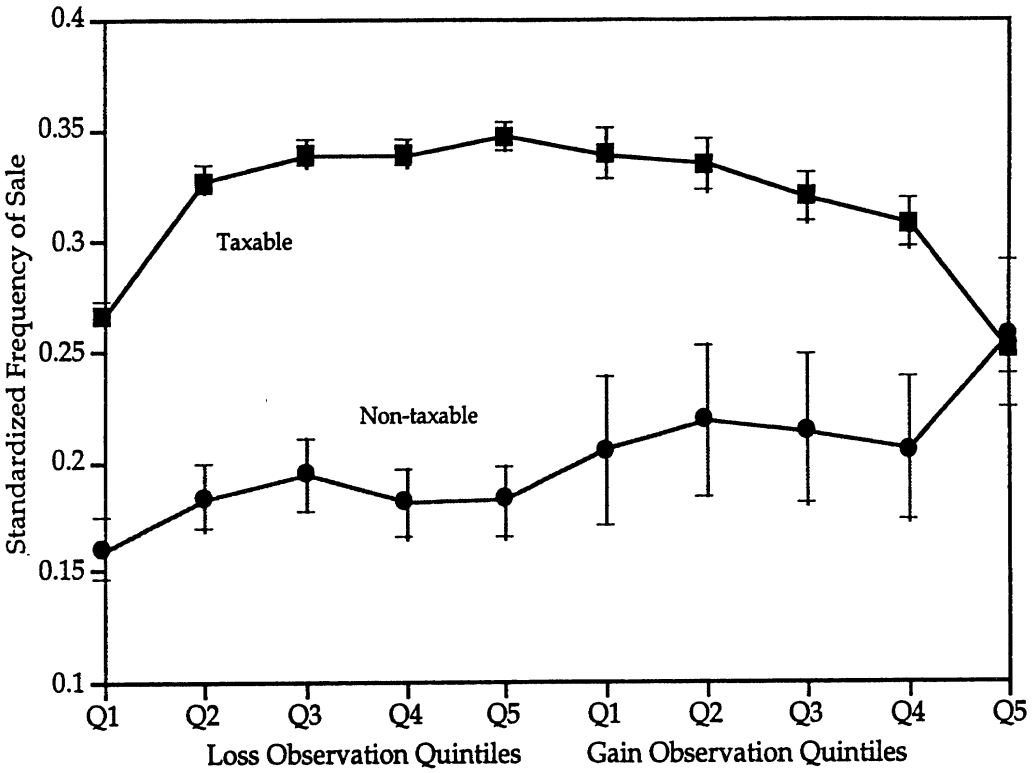

Figure 1. This figure shows the relationship between the gain or loss associated with selling a security and sale of the security. For each security held by each institution, an estimate was made of the gain or loss that would be triggered on the first dollar sold using a HIFO inventory assumption. The observations for which it was estimated a gain would be triggered were divided into quintiles according to the magnitude of the gain. Loss observations were similarly divided into quintiles. The smallest gains (largest losses) are in quintile 1. The observations were then divided into two groups according to whether the institution is classified as taxable or non-taxable. For each class of institution, the number of observations in a quintile for which a sale takes place is divided by the number of observations in the quintile. Whiskers surrounding the point estimates enclose a 95% confidence interval. For taxable (non-taxable) institutions, the figure is based on 162,802 (14,492) (stock, institution) pairs in the fourth quarter of 1990.

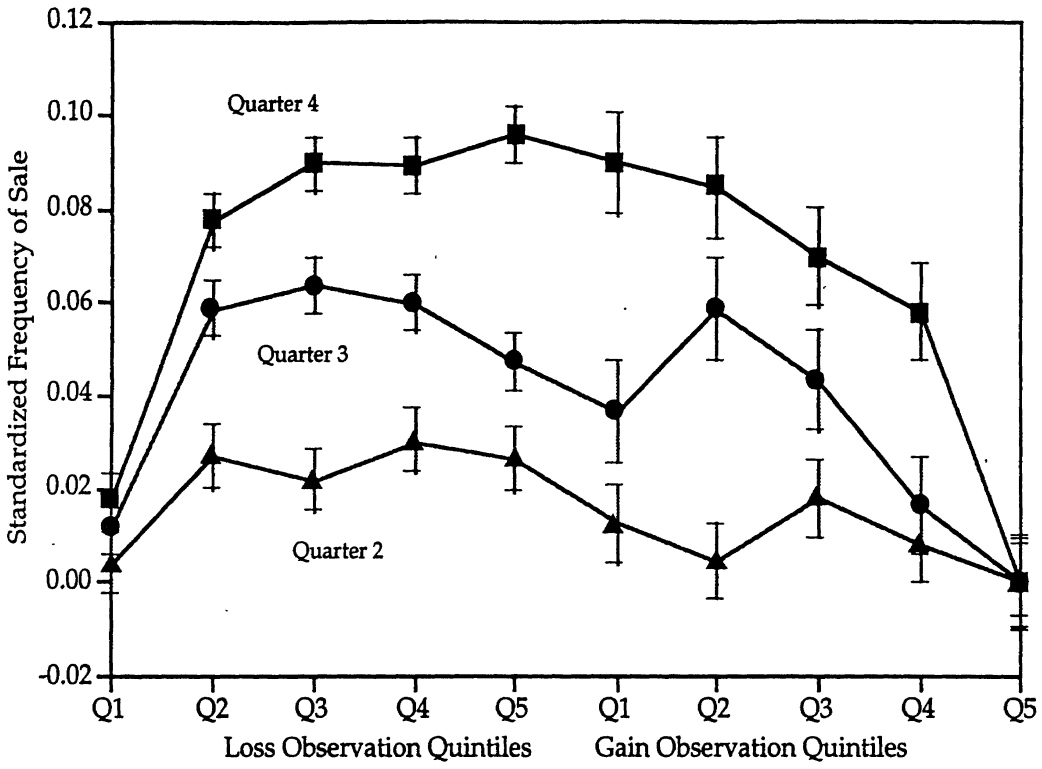

Figure 2. This figure shows the relationship between the gain or loss associated with selling a security and the sale of the security by a taxable institution at various times in the year. For each security held by each taxable institution at the beginning of the second, third, and fourth quarters of 1990, an estimate was made of the gain or loss that would be triggered the first dollar sold under a HIFO inventory assumption. The fourth quarter observations for which it was estimated a gain would be triggered were divided into quintiles according to the magnitude of the gain; loss observations were similarly divided into quintiles. Observations in the second and third quarters were divided into conforming groups. For each quarter, the number of observations in a group for which a sale takes place is divided by the number of observations in the group. The resulting frequency of sale is a number between zero and one. These frequencies were then standardized by subtracting the frequency in the fifth gain group of the corresponding quarter. Whiskers surrounding the point estimates enclose a 95% confidence interval. The figure is based on 156,064, 161,369, and 162,802 (institution, stock) pairs in the second, third, and fourth quarters of 1990, respectively.

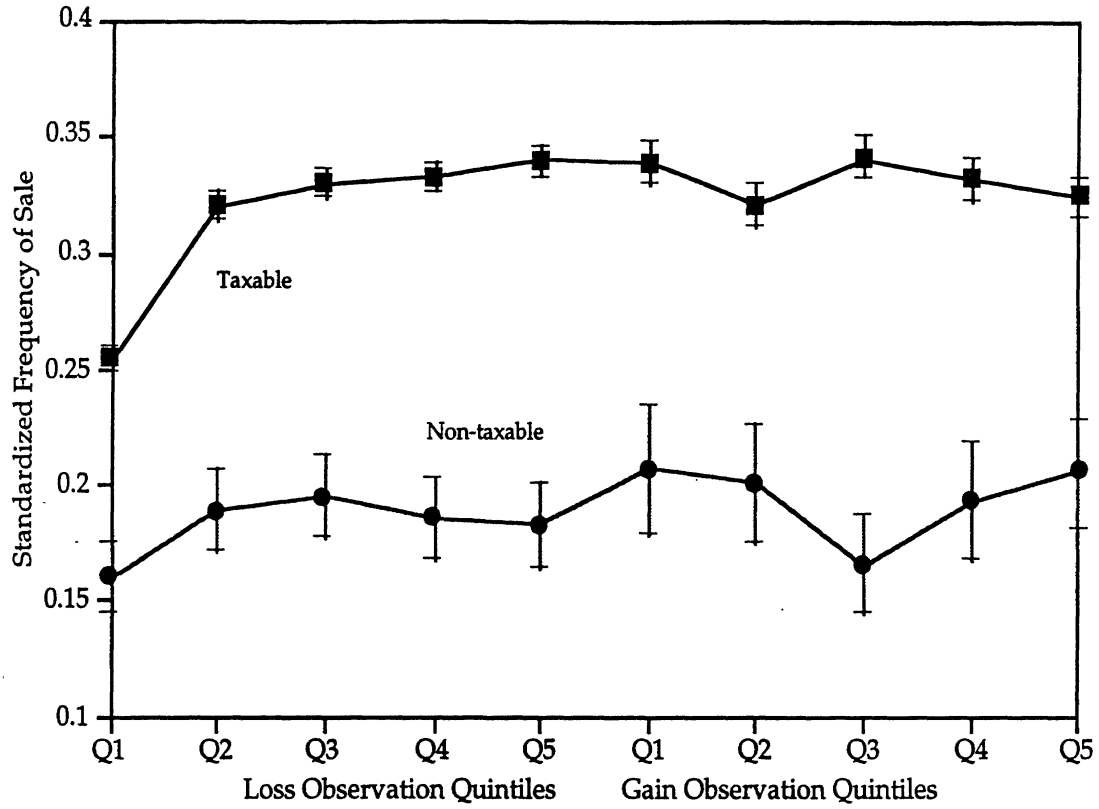

Figure 3. This figure shows the relationship between the gain or loss associated with selling a security and sale of the security. For each security held by each institution, an estimate was made of the gain or loss that would be triggered on the first dollar sold using a FIFO inventory assumption. The observations for which it was estimated a gain would be triggered were divided into quintiles according to the magnitude of the gain. Loss observations were similarly divided into quintiles. The smallest gains (largest losses) are in quintile 1. The observations were then divided into two groups according to whether the institution is classified as taxable or non-taxable. For each class of institution, the number of observations in a quintile for which a sale takes place is divided by the number of observations in the quintile. Whiskers surrounding the point estimates enclose a 95% confidence interval. For taxable (non-taxable) institutions, the figure is based on 162,802 (14,492) (stock, institution) pairs in the fourth quarter of 1990.