Measuring Tax-Sensitive Institutional Investor Ownership

Forthcoming in *The Accounting Review*

Jennifer Blouin
The Wharton School, University of Pennsylvania
blouin@wharton.upenn.edu

Brian J. Bushee
The Wharton School, University of Pennsylvania
bushee@wharton.upenn.edu

Stephanie Sikes[¥]
The Wharton School, University of Pennsylvania
ssikes@wharton.upenn.edu

January 30, 2017

Abstract

We classify all institutional investors that file Form 13F over the period 1995–2013 as either "tax-sensitive" or "tax-insensitive" based on their trading behavior and portfolio characteristics. We examine tests of the effects of investor tax-sensitivity on portfolio rebalancing, price pressure, and fund performance, and compare our measure of tax-sensitive institutional investor ownership to three measures used in prior studies. We show that our measure of tax-sensitive investors dominates other measures in the portfolio rebalancing and price pressure tests. In the fund performance test, our measure of tax-sensitivity is the only one that finds that tax-sensitive investors have significantly lower returns on their portfolio stocks, which is a new result in the literature.

JEL Classification: G11; G20; H24

Keywords: institutional investors; tax-sensitivity; capital gains taxes; portfolio performance

We appreciate helpful comments from Kirsten Cook, Todd Gormley, John Robinson, Dan Taylor, and workshop participants at the University of Rochester, North Carolina State University, and the AAA Annual Meeting, and we thank Vikas Agarwal, Wei Jiang, Yuehua Tang, and Baozhong Yang for sharing their list of hedge funds with us.

[¥] Corresponding Author. Address: The Wharton School, University of Pennsylvania, 1300 Steinberg Hall-Dietrich Hall, 3620 Locust Walk, Philadelphia, PA 19104-6365; Phone: 215-898-7783

I. INTRODUCTION

We develop a new measure of tax-sensitive institutional investor ownership based on each investor's revealed preferences for tax-motivated portfolio management. There is an extensive prior literature examining the effect of tax-sensitivity on investor behavior and stock prices, but the definition of a "tax-sensitive" investor varies greatly across papers. Moreover, these definitions have important drawbacks such as the inability to identify heterogeneous tax-sensitivity among institutional investors, inconsistencies in assumptions about how legal type affects tax-sensitivity, and small sample sizes. For example, the measure "one minus institutional ownership" implicitly assumes that all institutional investors are *tax-insensitive*, whereas other measures treat almost 90% of institutional investors as *tax-sensitive*. Our approach relies on the actual trading behavior and portfolio characteristics of institutional investors to classify them as either tax-sensitive or tax-insensitive. In doing so, we develop a classification of tax-sensitive institutional investors that has the potential to be less noisy and more powerful than existing measures. We examine tests of the effects of investor tax-sensitivity on portfolio rebalancing, price pressure, and fund performance. We show that our measure of tax-sensitive investors dominates other measures based on investors' legal types in the portfolio rebalancing and price pressure tests. In the fund performance test, our measure of tax-sensitivity is the only one that finds that tax-sensitive investors have significantly lower returns on their portfolio stocks, which is a new result in the literature.

Prior literature proposes a number of different methods for classifying investors as tax-sensitive. A commonly used measure is individual investor ownership, which is estimated as one minus the percent of shares owned by institutional investors (e.g., Ayers, Lefanowicz, and Robinson 2003; Dhaliwal, Li, and Trezevant 2003; among many others). We do not examine this measure in our paper because it does not identify specific investors as tax-sensitive, which is

necessary for portfolio tests. Instead, we examine three definitions of tax-sensitive institutional investor ownership. The first approach, *TSII_GM,* follows Grinstein and Michaely (2005) to classify insurance companies, investment companies, and investment advisers as tax-sensitive; and banks, pensions, and endowments as tax-insensitive. The second approach, *TSII_CL*, follows Chyz and Li (2012) by modifying *TSII_GM* to omit banks and classify insurance companies as tax-insensitive. The third approach, *TSII_IAPD,* follows Jin (2006) and Sikes (2014) in using the SEC's Investment Adviser Public Disclosure (IAPD) database to classify tax-sensitive ownership based on the clienteles of investment advisers that file a Form ADV. Investment advisers whose majority clientele consists of high net-worth individuals are classified as tax-sensitive; and pensions, endowments, and investment advisers whose majority clientele consists of tax-exempt entities are classified as tax-insensitive. This classification omits around 80% of institutional investors, including banks, insurance companies, miscellaneous institutions, and all investment advisers without majority tax-sensitive or tax-exempt clienteles.

To devise our classification, we first use the *TSII_IAPD* approach to form a "calibration" sample of institutional investors for which we have detailed information about their investor clientele. We estimate a logistic model that predicts tax-sensitivity in this sample. We find that tax-motivated trading variables (e.g., abnormally high fourth-quarter realized losses and first-quarter realized gains) and portfolio characteristics (e.g., portfolio size, turnover, blockholdings, and risk) significantly explain whether an institution is tax-sensitive or tax-insensitive in this sample. We next apply the model to a "classification" sample, which includes all institutional investors that are <u>not</u> in the calibration sample and that file Form 13F between 1995 and 2013. We use their portfolio characteristics, along with the calibration model parameters, to classify them as either tax-sensitive or tax-insensitive.

We combine the classification and calibration samples to yield our final classification, which we label *TSII_NEW*. Overall, we find that 51.3% of institutional investors are tax-sensitive under our approach, accounting for 12.4% of the yearly total equity managed (which translates to $539.4 billion of equity, on average, managed annually). In contrast, *TSII_GM* (*TSII_CL*) classifies 86.9% (92.4%) of their sample institutions as tax-sensitive, accounting for 76.7% (82.6%) of total equity managed. The *TSII_GM* and *TSII_CL* approaches have such large percentages of tax-sensitive institutions because they classify all investment advisers as tax-sensitive, whereas we estimate that only about 46.1% are tax-sensitive. Similar heterogeneity exists for banks and insurance companies. The *TSII_IAPD* approach classifies 61.0% of sample institutions as tax-sensitive, representing 30.9% of total equity. However, this approach only classifies 7,635 institution-years ($1.0 trillion of total equity), compared to 22,312 institution-years ($4.3 trillion of total equity) classified under our approach. By accounting for heterogeneity within legal type, our approach likely provides a less noisy measure of tax-sensitivity than *TSII_GM* and *TSII_CL*. By expanding the IAPD approach to a larger sample, our approach potentially provides a more powerful measure than *TSII_IAPD*.

To show that our new measure of tax-sensitive investors is preferable to existing measures, we need to either overturn significant results found using the prior measures or find significant results that are not significant using the prior measures. Because our concern with the prior measures is that they are low power, our new measure is unlikely to overturn results using the prior measures; i.e., any significant results found with the lower-power prior measures should still hold with our new measure. However, we do test whether our measure dominates the prior measures in these cases. More importantly, we find a new significant result using our measure that we cannot find using the lower-power prior measures.

We present three sets of empirical tests to compare our measure of tax-sensitive institutions to the measures used in prior research. The first two tests rely on the Taxpayer Relief Act of 1997 (TRA97), which is arguably one of the most powerful settings to capture market activity by tax-sensitive investors relating to capital gains taxes. First, we examine whether tax-sensitive institutions rebalanced their portfolios in response to the capital gains tax rate reduction enacted in TRA97. Second, we examine whether tax-sensitive institutions "unlocked" their unrealized gains following the announcement of the 1997 capital gains tax rate cut, resulting in downward price pressure in stocks with a high percentage of tax-sensitive ownership. In our third test, we examine whether tax-sensitive investors experience lower pre-tax returns on portfolio stocks due to the constraints placed on their portfolio management by their need to minimize their clients' tax exposure and maximize their after-tax returns. In the first two tests, prior work has found evidence of tax-sensitive ownership effects. However, no prior work has found evidence that institutional investor tax-sensitivity affects the returns earned on portfolio stocks.

Overall, the evidence from these three tests suggests that our measure of tax-sensitivity, *TSII_NEW*, provides more power to detect tax-sensitivity than prior measures. The broadest classification using legal type, *TSII_GM,* only detects tax-sensitivity in the price pressure test, but our measure dominates it when we include both in the same model. The legal type classification that excludes banks, *TSII_CL,* detects tax-sensitivity in both the portfolio rebalancing and price pressure tests, but again our measure dominates it when we include both. In the fund performance test, both legal type classifications suggest that tax-sensitive institutions *outperform* tax-insensitive institutions, contrary to expectations. This finding suggests that the legal type measures simply reflect short-term return performance differences between investment advisers and pensions.

The *TSII_IAPD* approach of hand-collecting clientele information for a small set of investment advisers, and adding pensions and endowments, works very well in the portfolio rebalancing and price pressure tests. However, this measure lacks the power to find significant differences in fund performance due to tax-sensitivity after controlling for fund characteristics. This lack of power is likely due to the smaller sample size and limited variation in fund characteristics for the institutions classified by this method. Our method, *TSII_NEW*, is able to detect significant effects of tax-sensitivity in all three tests, including providing the first evidence that we are aware of that tax-sensitive fund management is associated with lower pre-tax fund performance.

Our paper makes several contributions to the literature. First, we develop a classification of tax-sensitive investors that reliably measures tax-sensitivity based on observed trading behavior and classifies a large sample of institutional investors. Our method has the advantages of being able to account for heterogeneity in tax-sensitivity within legal types (unlike *TSII_GM* and *TSII_CL*) and to classify a larger number of institutions than the *TSII_IAPD* approach. Second, we find that our measure of tax-sensitive investors dominates measures based on legal type in analyses where capital gains taxes are salient. Our measure explains more variation in portfolio rebalancing and firm-level price pressure surrounding TRA97. This evidence suggests that our measure of tax-sensitive institutions provides more power to detect tax-sensitivity than prior measures.

Third, we find that tax-efficient management of assets, the goal of which is to maximize after-tax returns, constrains investment activity, resulting in tax-sensitive institutions holding stocks that generate lower pre-tax returns. Although much attention has been placed on tax-efficient management of mutual funds (e.g., Bergstresser and Poterba 2002; Sialm and Starks 2012; among many others), no prior study finds evidence that tax-efficient management of assets affects institutions' performance. In terms of economic magnitude, we find that tax-sensitive portfolio

management results in a -0.35% lower pre-tax return than tax-insensitive portfolio management. As far as we are aware, we are the first to document that there are significant costs to tax-efficient portfolio management. When studying factors that affect an institution's fund performance, our results suggest that researchers should control for whether an institution's clients are tax-sensitive.

In Section II, we describe prior approaches to measuring tax-sensitive investors. Section III describes the methodology that we use to classify institutional investors as either tax-sensitive or tax-insensitive. In Section IV, we examine the effectiveness of our classification and the prior measures of tax-sensitive investors in tests of the effects of tax-sensitivity on portfolio rebalancing, price pressure, and fund performance. We offer concluding remarks in Section V.

II. PRIOR APPROACHES TO MEASURING TAX-SENSITIVE INVESTORS

Individual Investors

Prior literature has not followed a consistent approach to identify ownership by tax-sensitive investors. A commonly used measure is individual investor ownership, which is estimated as one minus the percent of shares owned by institutional investors (e.g., Ayers et al. 2003; Dhaliwal et al. 2003; Dai, Maydew, Shackelford, and Zhang 2008; among many others). This measure treats all institutional investors as tax-insensitive and assumes that all other investors are tax-sensitive individual investors. Although easy to compute, this measure is a very noisy proxy of tax-sensitive ownership (Hanlon and Heitzman 2010). Chetty and Saez (2005) argue that this measure is not valid because some institutional investors are tax-sensitive. Moreover, this approach does not allow for tests of the effect of tax-sensitivity on portfolio holdings or portfolio returns because it does not identify the tax-sensitivity of specific investors. As one of our goals is to develop a measure than can be used to study investor behavior in addition to price effects, we do not examine this measure in our study.

Institutional Investor Legal Type Classifications

The Form 13F database of institutional investors identifies five legal types: banks, insurance companies, investment companies, independent investment advisers, and "other," which includes pensions, endowments, and "miscellaneous" institutions. Prior work explores the tax heterogeneity among institutional investors by classifying these legal types as either tax-sensitive or tax-insensitive. However, these classifications are not consistent across studies. Several prior studies classify all investment companies (i.e., mutual fund managers) and investment advisers as tax-sensitive (Grinstein and Michaely 2005; Moser 2007; Moser and Puckett 2009; and Chyz and Li 2012). However, Jin (2006) excludes investment companies, arguing that they are heterogeneous with respect to tax-sensitivity. There is also inconsistent treatment of insurance companies: Chyz and Li (2012) classify them as tax-insensitive, whereas other studies classify them as tax-sensitive (Grinstein and Michaely 2005; Jin 2006; Moser 2007; Moser and Puckett 2009).[1] Finally, papers that focus on tax-sensitivity with respect to dividend income treat banks as tax-insensitive, arguing that many banks are corporations and thus receive a dividend-received deduction (Strickland 1996; Grinstein and Michaely 2005; Moser 2007; Moser and Puckett 2009).[2] In contrast, Jin (2006) and Chyz and Li (2012), both of which focus on sensitivity to capital gains taxes, exclude banks because they are unable to distinguish which tax attribute dominates; some bank holdings are tax-sensitive (e.g., those held for their own account or for trust customers) whereas others are not (e.g., those held in retirement accounts). Desai and Jin (2011) assume that banks and investment companies have the same percentage of institutions that are averse to dividend taxes as the

[1] Jin (2006) notes that insurance companies are difficult to classify because they consist of life insurance and property insurance companies, which have different tax treatments, and because their portfolios are a mix of their own taxable investments and the funds invested on behalf of tax-advantaged clients. Desai and Jin (2011) classify insurance companies as insensitive to dividend taxes because they are corporations.

[2] Note that our classification only applies to sensitivity to capital gains taxes. We discuss dividend taxes in Appendix C.

remaining institutional investors since the data on the clients of banks and mutual funds is unavailable. Thus, there is little consensus on how legal type affects the tax-sensitivity of institutional investors.

We examine two common definitions of tax-sensitive institutional investor ownership. First, we classify insurance companies, investment companies, and investment advisers as tax-sensitive; and banks, pensions, and endowments as tax-insensitive (following the approach in Grinstein and Michaely 2005). We label this classification as *TSII_GM*. Second, following Chyz and Li (2012), we modify *TSII_GM* to omit banks and to classify insurance companies as tax-insensitive rather than as tax-sensitive. In this classification, which we label as *TSII_CL*, we classify investment companies and investment advisers as tax-sensitive; and insurance companies, pensions, and endowments as tax-insensitive.[3]

Investment Advisers Classification using IAPD data

Some studies use the SEC's Investment Adviser Public Disclosure (IAPD) database to classify tax-sensitive ownership based on the clienteles of investment advisers listed on their Form ADV filings.[4] All registered investment advisers must file a Form ADV to provide information on ten client types.[5] Investment advisers provide the approximate percentage of their business represented by each client type: none; up to ten percent; 11–25 percent; 26–50 percent; 51–75

[3] These studies do not mention whether their legal type classifications come from the Thomson database or from another source. According to the WRDS Overview of Thomson Reuters Mutual Fund and Investment Company Data (https://wrds-web.wharton.upenn.edu/wrds/support/Data/index.cfm), "The TYPECODE variable is not reliable from 1998 and beyond…Many of these institutions were and are still improperly classified as TYPE=5 (endowments and others)." We use the legal type classifications in Bushee and Goodman (2007) (http://www.iiclassifications.com). These classifications use hand collected data to fix the Thomson error and also divide the "other" group into separate groups for pensions, endowments, and miscellaneous.

[4] This data starts in 2001 and is found at http://www.adviserinfo.sec.gov/IAPD/Content/IapdMain/iapd_SiteMap.aspx

[5] The ten clients types are: high net-worth individuals; other individuals; banking or thrift institutions; investment companies (including mutual funds); pension and profit-sharing plans (other than plan participants); other pooled investment vehicles (e.g., hedge funds); charitable organizations; corporations or other businesses not listed above; state or municipal government entities; and "others" such as non-U.S. government entities

percent; more than 75 percent.[6] Prior work uses this data to classify investment advisers whose majority clientele are high net-worth individuals as tax-sensitive (Jin 2006; Jin and Kothari 2008; Desai and Jin 2011; Sikes 2014). While this measure provides a plausible measure of tax-sensitivity, it only captures a small percentage of institutional investors.

We label this measure of tax-sensitive ownership as *TSII_IAPD*. Using the IAPD data, we match Form ADV filers to the Thomson Reuters data to collect the advisers' quarterly holdings.[7,8] Our conversations with investment advisers confirm that their majority clientele's type generally does not change over time. Thus, we match an investment adviser's majority clientele type collected from the IAPD database in 2006 to the respective investment adviser's quarterly holdings in earlier and later years. We classify investment advisers whose majority (> 50%) clientele consists of high net-worth individuals as tax-sensitive (Sikes 2014).[9] We classify investment advisers whose majority clientele consists of tax-exempt entities (e.g., state and local governments, charitable organizations, and pensions and endowments) as tax-insensitive and also add pensions and endowments to the tax-insensitive group (Jin 2006; Sikes 2014). The classification omits banks, insurance companies, miscellaneous institutions, and any investment adviser for which a Form ADV is not available.

[6] The current Form ADV asks investment advisers to list the approximate percentage of clients in each group and the approximate percentage of assets in each group. When we collected the data, the Form ADV only asked for the former.
[7] The Form ADVs were collected in 2006 for investment advisers registered with the SEC in 2006, as well as investment advisers no longer registered with the SEC in 2006 but registered at some point between 2001 and 2006.
[8] Form 13F reports data at the management company level. One management company could file multiple Form ADVs, some of which could be associated with investment advisers that are tax-sensitive while others could be associated with investment advisers that are tax-insensitive. To avoid this problem, we only match a Form ADV to a Form 13F if there is an exact match of the names on the two forms. Thus, multiple Form ADVs cannot be associated with the same 13F institution.
[9] The Form ADV defines a "high net-worth individual" as "an individual with at least $750,000 managed by [the investment adviser], or whose net worth [the investment adviser] reasonably believes exceeds $1,500,000, or who is a 'qualified purchaser' as defined in section 2(a)(51)(A) of the Investment Company Act of 1940. The net worth of an individual may include assets held jointly with his or her spouse."

We compare the three classifications of tax-sensitive institutional investors developed in prior work—*TSII_GM, TSII_CL,* and *TSII_IAPD*—to a new measure that we develop below. The goal of our measure is to improve upon *TSII_GM* and *TSII_CL* by accounting for the heterogeneity that exists within legal types and to improve upon *TSII_IAPD* by classifying a larger number of institutional investors.[10] In this way, our measure has the potential to provide a less noisy and more powerful measure of tax-sensitive investors.

III. CLASSIFICATION OF INSTITUTIONAL INVESTORS

We classify institutional investors as tax-sensitive or tax-insensitive using a two-step approach. First, we use the *TSII_IAPD* approach to create a calibration sample of institutional investors that are likely to be tax-sensitive or tax-insensitive based on detailed information about their investor clientele. Using this sample, we estimate a logistic regression of an indicator for tax-sensitivity on a number of tax-motivated trading variables and other portfolio characteristics to generate a model that predicts tax-sensitivity. Second, we apply the estimated coefficients from this model to the portfolio characteristics of a classification sample, which includes any institutional investor not in our calibration sample. Each institutional investor in the classification sample is classified as tax-sensitive (tax-insensitive) based on whether its predicted probability of being tax-sensitive is above (below) the base-rate percentage of tax-sensitive institutions in the calibration sample.

Calibration Sample

Using the Forms ADV collected in 2006, we identify 337 tax-sensitive investment advisers and 126 tax-insensitive investment advisers. We match these names to the institutional investors

[10] There are three factors that limit the number of institutions that can be classified with IAPD data. First, the IAPD data is not available to identify the tax-sensitivity of any banks, insurance companies, or miscellaneous institutions that do not act in an investment advisory role. Second, the IAPD clientele data is not available for institutions that did not survive to 2001, which would induce a selection-bias in studies that include pre-2001 data. Third, as mentioned in footnote 8, large investment advisers (e.g., Vanguard) generally file multiple Form ADVs, but only one Form 13F. To prevent classification error, it is best to only match a Form ADV to an institution in Thomson Reuters if there is a one-to-one exact name match.

in the Thomson Reuters 13F database and consider all yearly observations for that institutional investor between 1995 and 2013 to be tax-sensitive (4,658) or tax-insensitive (1,851), respectively. We also consider all yearly observations for pensions and endowments (1,126) to be tax-insensitive, which brings the total tax-insensitive group to 2,977. Thus, our calibration group is 61.0% tax-sensitive.

Variables Used to Predict Tax-Sensitivity

In the first-stage, we estimate the following logistic regression of an indicator for tax-sensitive institutions (*TSII_IAPD*) on tax-motivated trading variables and other portfolio characteristics:

$$TSII\_IAPD_j = \beta_0 + \beta_1 ABN(PLR4)_{j,t} + \beta_2 ABN(PGR4)_{j,t} + \beta_3 ABN(PLR1)_{j,t} + \beta_4 ABN(PLG1)_{j,t} + \beta_5 TE_{j,t} + \beta_6 NSTK_{j,t} + \beta_7 PTURN_{j,t} + \beta_8 BLOCK_{j,t} + \beta_9 FSIZE_{j,t} + \beta_{10} PGROW_{j,t} + \beta_{11} VALUE_{j,t} + \beta_{12} FIDUC_{j,t} + \varepsilon_{j,t} \quad (1)$$

where *TSII_IAPD* equals one if the institution is an investment adviser whose primary clientele are high net-worth individuals, and equals zero if the institution is a pension, endowment, or investment adviser whose primary clientele are tax-exempt entities.

Tax-motivated trading variables

A key indicator of tax-sensitive trading is tax-loss-selling around the calendar year-end (Sikes 2014). Thus, we measure an institutional investor's abnormal realized losses and gains for the first and fourth quarters. We begin by estimating the realized and unrealized capital gains and losses for each institutional-investor-stock-quarter observation using quarterly holdings data from Thomson Reuters and monthly stock price data from CRSP (see Appendix A for an illustration of how we estimate gains and losses). We next estimate the proportion of an institutional investor's losses that it realizes each quarter (*PLR*) and the proportion of its gains that it realizes each quarter (*PGR*) (Odean 1998; Barber and Odean 2003; Sikes 2014) as follows:

$$Proportion\ of\ Losses\ Realized\ (PLR)_{j,q} = \frac{Realized\ Losses_{j,q}}{Realized\ Losses_{j,q} + Unrealized\ Losses_{j,q}}$$

$$Proportion\ of\ Gains\ Realized\ (PGR)_{j,q} = \frac{Realized\ Gains_{j,q}}{Realized\ Gains_{j,q} + Unrealized\ Gains_{j,q}}$$

where *Realized Losses* and *Unrealized Losses* are summed for all stocks that institutional investor *j* holds at the beginning of quarter *q*.

We compute the abnormal first- and fourth-quarter levels by subtracting the average of an institution's relevant ratio (*PLR* or *PGR*) over the second and third calendar quarters from the institution's relevant ratio for the first quarter and fourth quarter, respectively. We include abnormal fourth-quarter levels of the proportion of total losses realized (*ABN(PLR4))* and the proportion of total gains realized *(ABN(PGR4))* to measure excess tax-loss-selling and reduced tax-gain-selling in the fourth quarter. We also include the abnormal first-quarter levels of the proportion of total gains realized (*ABN(PGR1*)) and proportion of total losses realized (*ABN(PLR1*)) to capture deferral of tax gains and non-deferral of tax losses to the subsequent year.

Other Portfolio Characteristics

Tax-sensitive portfolio management could also manifest in other trading or investment preferences. For example, tax-sensitive institutions may need their portfolios to be relatively small in order to effectively manage the tax impact of their investment decisions. Thus, we control for an institutional investor's portfolio market value (*TE*) and the number of stocks in an institution's portfolio (*NSTK*). We also include the portfolio turnover (*PTURN*) and blockholding *(BLOCK*) factors derived in Bushee (2001) to measure the effect of tax-sensitivity on trading frequency and the average stake size held by an institution, respectively. To control for any relation between tax-sensitivity and preferences for certain firm characteristics, we include the Abarbanell, Bushee, and

Raedy (2003) factor scores that measure preferences for firm size, growth, and risk. The firm size factor (*FSIZE*) captures preferences for large, mature firms with S&P 500 index membership. The prior growth and risk factor (*PGROW*) measures institutions' preferences for firms with high historical sales and earnings growth and high systematic and idiosyncratic risk. The value factor (*VALUE*) reflects institutional investor preferences for firms with high earnings-to-price ratios, book-to-market ratios, and dividend yield. Finally, the fiduciary factor (*FIDUC*) captures fiduciary incentives, such as preferences for highly-rated stocks, firms with low leverage, and firms with positive earnings.

We use institution-year data to classify the institutions. For the tax variables, we use abnormal first- and fourth-quarter measures for the year. For the portfolio characteristics, we use the average of the quarters during the year. See Appendix B for a description of how we calculate each of these variables as well as the other variables used in the paper.

Logistic Regression in Calibration Sample

Panel A of Table 1 presents the results from estimating the logistic regression (equation (1)). We estimate 23 annual regressions using data from 1991 to 2013.[11] Because we estimate annual regressions, we report the mean coefficients and t-statistics based on Fama-Macbeth standard errors with Newey-West autocorrelation corrections.[12] We also report the number of times each coefficient was positive or negative (as well as significant at the 0.10 level) in the annual regressions. Finally, we report the mean, min, and max number of observations, pseudo R-squared,

[11] We also estimated annual regressions using the prior five years of data. While using five years of data potentially provides more power to detect tax-motivated trading because it covers a range of market conditions, it also assumes the tax-sensitivity parameters are stationary over a five-year period. The model fit is slightly higher for the annual regressions using one year of data, suggesting some non-stationarity in the five-year samples. We estimated all of the tests using the five-year approach and all of the inferences were the same. For parsimony, we only report the one-year approach in the tables.

[12] We also estimated equation (1) using a pooled sample with standard errors clustered by institutional investor and by year. There are no differences in inferences under this approach.

and Area under the Curve (AUC) of the annual regressions.

The annual regression models correctly classify between 75% and 82% of the observations within sample based on the predicted probabilities from the estimated coefficients. Under both approaches, the coefficients on *ABN(PLR4)* and on *ABN(PGR1)* are positive and significant, consistent with tax-sensitive institutions realizing a greater percentage of their losses (gains) in the fourth (first) calendar quarter. The coefficients on *ABN(PLR1)* and *ABN(PGR4)* are both negative and significant, indicating that tax-sensitive institutions realize fewer gains in the fourth quarter and fewer losses in the first quarter. These results suggest that tax-loss-selling around the calendar year-end is a significant determinant of whether an institution is tax-sensitive.

Among the portfolio characteristics, tax-sensitive institutions manage significantly smaller portfolios *(TE)* and hold marginally fewer stocks (*NSTK*), consistent with the expected higher costs of managing a large portfolio in a tax-sensitive manner. Tax-sensitive institutions also turn over their portfolios less frequently *(PTURN)* and hold larger positions in stocks (*BLOCK*), indicating that tax-sensitivity constrains institutions' ability to trade and leads to larger positions (consistent with a reluctance to sell stocks with large gains). Tax-sensitive institutions also exhibit preferences for firms with lower prior growth and risk (*PGROW*), lower value (*VALUE*) characteristics, and higher fiduciary (*FIDUC*) characteristics. Thus, tax-sensitive institutions are also significantly different from tax-insensitive institutions in terms of other portfolio preferences, some of which reflect tax-sensitive motivations (e.g., lower dividend yield, lower portfolio turnover), whereas others indicate that, in addition to being tax-sensitive, the institutions' clientele have preferences for "safer" stocks (e.g., lower risk, higher rating).

Classification of Tax-Sensitive Institutions in the Classification Sample

Next, we apply the estimated coefficients from the logistic regression to the portfolio characteristics of institutions in the classification sample to generate predicted probabilities of being tax-sensitive. For each institution-year, we initially classify any institution with a predicted probability above (below) the base rate in the calibration sample as tax-sensitive (tax-insensitive).[13] Then, we obtain the final classification using the modal value of the five years leading up to and including year *t* (see Figure 1).[14] Because of the requirement for five years of data, we only classify institutions between 1995 and 2013.

Panel B of Table 1 shows the total number of institution-years classified as tax-sensitive. We find that 6,785 of the 14,677 institution-years in the classification sample (46.2%) are classified as tax-sensitive. Reflecting the smaller size of tax-sensitive institutions, they represent 6.2% of the average yearly total equity managed by institutions in the classification sample.[15]

The last four columns of Panel B report the percentage of institutions in a given year that maintain or change their tax-sensitive classification five and ten years later. While we expect that some tax-sensitive institutions would become tax-insensitive as they become larger, we do not have any reason to expect a substantial number of tax-insensitive institutions to become tax-sensitive. Thus, the percentage of changes from tax-insensitive to tax-sensitive can be viewed as a Type I error rate for the classification approach. We find that the percent of tax-sensitive institutions that are classified as tax-insensitive five (ten) years later is 22.1% (34.9%), suggesting

[13] The base rate is the percentage of institutions that are tax-sensitive in the calibration sample in a given year.

[14] The advantage of using five years of data is that it provides a less noisy classification by requiring that an institution appear to be tax-sensitive in at least three of the five years. The disadvantage of using five years of data is that it reduces the number of institutions that we can classify due to the restriction of five years of data. We also examined classifications using only one year of classification data. The classifications using only one year of data exhibit much higher rates of reclassification over five and ten year windows, indicating a greater amount of noise in those classifications. For that reason, we use the five-year modal approach for our classification.

[15] To calculate the average yearly total equity, we sum up the total market value of all stocks owned by a group of institutions in a given year, and then take the average of this yearly total equity over the sample period.

that about one-third of tax-sensitive institutions that survive for ten years become tax-insensitive. In contrast, only 9.2% – 9.6% of tax-insensitive institution-years are classified as tax-sensitive five and ten years later, respectively. Thus, our classification approach has a Type I error rate that is less than 10%.

Panel C of Table 1 compares means of the portfolio characteristics in the calibration sample to means in the classification sample. The panel shows that the significant differences in portfolio characteristics in the calibration sample are generally preserved in the classification sample. Thus, the logistic regression approach effectively identifies tax-sensitive institutions in the classification sample that are similar to those in the calibration sample.

Panel D of Table 1 shows the percent of institution-year observations that we classify as either tax-sensitive or tax-insensitive within each legal type. This breakdown reveals significant heterogeneity within each type. Bank trusts have the highest proportion of observations classified as tax-sensitive at 62.8%, followed by "miscellaneous" institutions (59.4%), investment advisers (which includes investment companies) (46.1%), hedge funds (29.0%), and insurance companies (24.6%).[16] This panel shows that approaches that classify all institutions within a given legal type as either tax-sensitive or tax-insensitive potentially induce significant error into the classification due to the heterogeneity in tax-sensitivity *within* each institutional investor legal type.[17]

[16] The "miscellaneous" group consists of employee stock ownership plans, partnerships, law firms, and individuals that manage enough money that they are required to file Form 13F. The "investment adviser" group includes both "investment companies" and "independent investment advisers," which prior research finds face a similar legal environment (Abarbanell et al. 2003). The investment adviser group excludes institutions classified as hedge funds or IAPD filers. The institutions labeled "hedge funds" are institutions that Agarwal, Jiang, Tang, and Yang (2013) identify as being hedge funds. We thank these authors for sharing their classification with us.

[17] One potential concern with our classification scheme is that we must classify an entire institutional investor as either tax-sensitive or tax-insensitive even though, in the case of a mutual fund family, tax-sensitivity across its funds could vary. In Appendix C, we use mutual fund family data to verify our classification of investment advisers.

Comparison of Different Classifications of Tax-Sensitive Investors

Our measure of tax-sensitive ownership, *TSII_NEW*, combines both the calibration and classification samples, yielding 51.3% of institution-years classified as tax-sensitive. Tax-sensitive institutions manage 12.4% of average yearly total equity, which translates to $539.4 billion of equity managed annually. In Panel E of Table 1, we compare our classification to the three other methods using institution-years from 1995 to 2013 with non-missing data. The first set of columns shows that *TSII_GM* classifies almost 87% of institution-years as tax-sensitive, accounting for 77% of total equity managed by institutions (the only institutions omitted are 1,775 miscellaneous institution-years). The second set shows *TSII_CL*, which modifies *TSII_GM* by dropping banks and switching the classification of insurance companies. This approach classifies 92.4% of sample institution-years as tax-sensitive. It is interesting to note that the literature using the "one minus institutional ownership" measure of tax-sensitivity implicitly assumes that all institutional investors are tax-insensitive; in contrast, the papers classifying institutions based on legal type implicitly assume that virtually all institutional investors are tax-sensitive.

The third set of columns in Panel E shows *TSII_IAPD*, which only classifies investment advisers filing Form ADV, pensions, and endowments. This measure classifies 61.0% of sample institution-years as tax-sensitive, representing about 30.9% of sample total equity. However, this measure only classifies 7,635 institution-years ($1.0 trillion of total equity), compared to 31,561 ($5.0 trillion) for *TSII_GM*. Thus, this approach omits almost 80% of institution-years and total equity managed when identifying tax-sensitive investors, potentially limiting the power of this measure to detect the impact of tax-sensitive investors.

The final columns provide our measure, *TSII_NEW*, which classifies 22,312 institution-years, compared to 31,561 for *TSII_GM*. The loss of observations is due to the requirement of five years

of data for each year classified. However, the lost observations are mainly smaller institutions. Our measure classifies institution-years managing a total of $4.3 trillion of equity holdings, which is 86% of the amount classified by *TSII_GM,* and actually higher than the amount classified by *TSII_CL* (which omits banks that account for $0.74 trillion of equity). Thus, our measure accounts for heterogeneity among legal types, producing an arguably more reasonable level of tax-sensitive ownership, and classifies the vast majority of institution-years as tax-sensitive or tax-insensitive.[18]

IV. EMPIRICAL TESTS

There are two possible ways to show that our new measure of tax-sensitive investors is preferable to measures used in prior research. First, results using the new measure could overturn significant results found using the prior measures. Second, the new measure could find significant results that are not significant using the prior measures. Our concern with the prior measures is that they do not account for heterogeneity within legal types or only classify a small subsample of the universe of institutional investors, which adds noise and reduces power of the prior measures. For this reason, our new measure is unlikely to overturn results using the prior measures; i.e., any significant results found with the lower-power prior measures should still hold with our new measure. However, we do test whether our measure dominates the prior measures in these settings. The more promising avenue for our measure to make a contribution is to find new significant results that we cannot find with the lower-power prior measures.

We present three sets of tests to compare our measure of tax-sensitive investors—*TSII_NEW*—to the measures used in prior research—*TSII_GM, TSII_CL,* and *TSII_IAPD.* First, we examine whether tax-sensitive institutions rebalanced their portfolios in response to the capital gains tax rate reduction enacted in the TRA97. Second, we examine whether tax-sensitive

[18] Our classification is freely available at http://www.iiclassifications.com.

institutions “unlocked” their unrealized gains following the announcement of the 1997 capital gains tax rate cut, resulting in downward price pressure in stocks with a high percentage of tax-sensitive ownership. Third, we test whether tax-sensitive investors experience lower pre-tax portfolio returns due to the constraints placed on their portfolio management by their need to maximize their clients’ after-tax returns. These three tests examine the impact of tax-sensitive ownership on three strands of prior research: portfolio rebalancing incentives, investor effects on firms’ stock prices, and portfolio performance. Although prior work has found evidence of tax-sensitive ownership effects on portfolio rebalancing and stock prices, there is not yet any evidence that tax-sensitivity affects portfolio performance.

Tax-Sensitivity and Portfolio Rebalancing

We examine tax-sensitive portfolio rebalancing around the announcement of the capital gains tax rate reduction enacted in the TRA97. On May 2, 1997, the White House and Congress announced that they had agreed to balance the budget and to reduce the capital gains tax rate. However, they did not announce any specifics on the effective date or the amount of the reduction at that time. Because of the uncertainty created in the markets, on May 7, 1997, Senate Finance Chairman William Roth and House Ways and Means Chairman William Archer jointly announced that the effective date of any rate reduction would be May 7, 1997. Ultimately, TRA97 reduced the maximum statutory individual-level capital gains tax rate from 28% to 20%. TRA97 has been used extensively in studies of capital gains tax incentives as it is arguably one of the cleanest settings to capture market activity by tax-sensitive investors. Unlike other bills (e.g., the Economic Recovery Act of 1981 and Tax Reform Act of 1986), TRA97 made few changes other than the capital gains tax rate reduction. In addition, the market learned about the rate cut in a very

compressed period of time, which helps to alleviate concerns that something other than the capital gains tax rate change is responsible for the portfolio rebalancing and downward price pressure.[19]

Klein (1998, 1999) and Dammon, Spatt, and Zhang (2001) suggest that the tax cost associated with portfolio rebalancing constrains optimal portfolio allocations when the tax cost outweighs the utility from optimally-balanced portfolios. As a result, tax-sensitive investors' portfolios become over-weighted in high past-return stocks. If this is the case, then tax-sensitive institutional investors' portfolios were over-weighted in stocks with large unrealized gains prior to the 1997 capital gains tax rate cut, and they had incentives to rebalance their portfolios after the tax cut. Consistent with this, Chyz and Li (2012) find that tax-sensitive institutional investors (defined using *TSII_CL*) are more likely than tax-insensitive institutional investors to sell appreciated stocks following the TRA97 capital gains tax rate cut.

We test for portfolio rebalancing using a two-stage hierarchical linear model (Raudenbush and Bryk 2002). In the first stage, we estimate a regression of changes in portfolio weights on net unrealized gains and other firm characteristics at the institution-stock-quarter level. This step produces a coefficient (β_{NUG}) that measures the sensitivity of an institutional investor's trading to the amount of its unrealized gains in a stock for each quarter. In the second stage, we regress the coefficient β_{NUG} on a TRA97 indicator variable (i.e., the second quarter of 1997), an indicator variable for tax-sensitive institutional ownership (*TSII_X*), the interaction between the two indicators, and control variables. The variable *TSII_X* represents the four tax-sensitive investor classification methods—*TSII_GM, TSII_CL*, *TSII_IAPD*, and *TSII_NEW*. Assuming that tax-sensitive institutions reduce their holdings of stocks with unrealized gains by a greater-than-usual

[19] Many papers that study the effects of capital gains taxes on firm or individual behavior rely on this event (e.g., Ayers, Li, and Robinson 2008; Blouin, Hail and Yetman 2009; Cook 2008; Dai et al. 2008; Guenther 1999; Lang and Shackelford 2000; Sinai and Gyourko 2004).

amount in the second quarter of 1997 relative to prior quarters and relative to tax-insensitive institutions, the coefficient on the interaction between *TRA97* and *TSII_X* should be negative and significant in the second stage for classifications that effectively measure tax-sensitive ownership.

First-stage estimation

In the first stage, we estimate the following Ordinary Least Squares (OLS) regression by institution-quarter over the period 1995Q1–1997Q2:[20]

$$\Delta WGT_{j,i,q} = \beta_0 + \beta_{NUG}NUG_{j,i,q} + \beta_2 SIZE_{i,q} + \beta_3 SP500_{i,q} + \beta_4 AGE_{i,q} + \beta_5 SGR_{i,q} + \beta_6 BETA_{i,q} + \beta_7 IRISK_{i,q} + \beta_8 EP_{i,q} + \beta_9 DYLD_{i,q} + \beta_{10} BP_{i,q} + \beta_{11} RATE_{i,q} + \beta_{12} DE_{i,q} + \varepsilon_{j,i,q} \quad (2)$$

We require at least 50 stock holdings *i* for each institution *j*, quarter *q* pair to estimate the model (see Appendix B for detailed variable descriptions). The dependent variable, ΔWGT, is the change in portfolio weight that an institution places on a stock during a quarter, where *WGT* equals the institution's total dollar holdings in the stock divided by the institution's total dollar holdings in all stocks in its portfolio (Ben-David and Hirshleifer 2012). The primary independent variable of interest is *NUG*, which equals an institution's net unrealized gain in a stock at the beginning of the quarter scaled by the institution's portfolio market value. We also control for firm characteristics that prior literature shows affect institutions' portfolio allocations (Bushee 2001; Abarbanell et al. 2003), including the natural log of market value (*SIZE*), inclusion in the S&P 500 Index (*SP500*), time listed in years (*AGE*), sales growth (*SGR*), market model beta (*BETA*), idiosyncratic risk (*IRISK*), the earnings-price ratio (*EP*), dividend yield (*DYLD*), book-price ratio (*BP*), the S&P

[20] Following Lang and Shackelford (2000), we limit the estimation period to 1995Q1–1997Q2 for this test and for the subsequent price pressure test. Using a narrow window preceding the announcement quarter of TRA97 should hold constant most macroeconomic variables that could affect returns other than the tax rate change. The period ends in 1997Q2 because any portfolio rebalancing or price pressure due to tax-sensitive investors unlocking their gains should occur shortly after investors learn of the tax rate cut.

common stock rating (*RATE*), and the debt-to-equity ratio (*DE*). We winsorize all continuous variables at the 1st and 99th percentiles.

Panel A of Table 2 provides descriptive statistics of the variables in equation (2). The mean change in weight in individual portfolio stocks is 0.04 percentage points and net unrealized gains for the mean institutional holding in a stock are 0.08% of portfolio market value. Panel B provides the descriptive statistics of each of the beta estimates generated from the estimation of equation (2). The mean β_{NUG} is 0.033, which suggests institutions are momentum trading, on average, during this period of strong stock market performance. However, the standard deviation of β_{NUG} is 0.278, indicating a large variance in institutions' trading responses to net unrealized gains.

Second-stage results

In the second stage of the methodology, we estimate the following OLS regression at the institution-quarter level over the period 1995Q1–1997Q2:

$$\beta_{NUGj,q} = \gamma_0 + \gamma_1 TSII\_X_j + \gamma_2 TRA97_q + \gamma_3 TSII\_X_j * TRA97_q + \sum \gamma_{4\text{-}17} \text{Controls}_{j,q} + \text{InstitutionFE} + \text{QuarterFE} + \varepsilon_{j,q} \quad (3)$$

The dependent variable, β_{NUG}, is the beta estimate on the variable *NUG* from equation (2). *TRA97* is an indicator variable that equals one if the quarter is the second calendar quarter of 1997; zero otherwise.[21] *TSII_X* represents the four tax-sensitive investor classification methods—*TSII_GM, TSII_CL, TSII_IAPD,* and *TSII_NEW*—and equals one if the institution is classified as tax-sensitive; zero if it is classified as tax-insensitive. Consistent with tax-sensitive institutional investors unlocking their unrealized gains following the announcement of TRA97's cut in the capital gains tax rate in May 1997, we expect γ_3 to be negative and significant. In addition to *TE*,

[21] Because equation (3) includes the *TRA97* indicator variable, we do not include a quarter fixed effect for the second quarter of 1997.

PTURN, and *BLOCK*, which are included in equation (1), we also include portfolio-weighted averages of all of the controls from equation (2) where the weights are each stock's proportionate share of the portfolio. We define all variables in Appendix B, and Panel C of Table 2 presents descriptive statistics. We winsorize all continuous variables at the 1st and 99th percentiles.

Panel D of Table 2 presents the results of estimating equation (3). All significance tests are based on standard errors clustered by institution and by quarter (Petersen 2009; Gow, Ormazabal, and Taylor 2010).[22] Column (1) shows that the coefficient on *TSII_GM*TRA97* is negative but not statistically significant, suggesting that this measure of tax-sensitivity is not powerful enough to detect portfolio rebalancing around the 1997 tax rate cut. Column (2) shows that the coefficient on *TSII_CL*TRA97* is negative and significant at the 0.05 level, consistent with the finding in Chyz and Li (2012). Thus, for a legal type classification to measure tax-sensitivity in this setting, it must omit banks and consider insurance companies to be tax-insensitive.

Column (3) of Panel D presents results for *TSII_IAPD*TRA97*. The sample size is only 1,825, compared to 6,172–7,752 for the legal type classifications, due to the smaller number of institution-years classified under this approach. The coefficient on *TSII_IAPD*TRA97* is negative and significant at the 0.05 level. Thus, despite the smaller sample, the IAPD data provides a powerful measure of tax-sensitivity. Column (4) presents results for our classification, which adds the classification sample institutions to the *TSII_IAPD* sample, increasing the sample size to 5,091. The coefficient on *TSII_NEW*TRA97* is negative and significant at the 0.01 level. This result shows that our measure successfully extends the *TSII_IAPD* classification to a larger sample of institutions, allowing us to detect tax-sensitive portfolio rebalancing in a larger sample.

[22] We also rely on clustering to correct for any potential heteroscedasticity created from our use of an estimated dependent variable. See Lewis and Linzer (2005).

In columns (5) and (6), we include our classification and the legal type classifications in the same regression. In both cases, the coefficient on *TSII_NEW*TRA97* is negative and significant at or below the 0.05 level, whereas the coefficients on *TSII_GM*TRA97* and *TSII_CL*TRA97* are negative but not significant. Untabulated F-tests reject the equality of the coefficients on *TSII_NEW*TRA97* and *TSII_GM*TRA97*, but fail to reject for *TSII_NEW*TRA97* and *TSII_CL*TRA97*.[23] Overall, these results suggest that our measure better identifies institutions' tax-sensitivity than the measures based solely on institutional investors' legal types.

Tax-Sensitivity and Price Pressure

We also use the TRA97 event to examine the effect of tax-sensitive ownership on firms' stock prices. The "lock-in effect" theory predicts that tax-sensitive investors will continue to hold a security for which they have large unrealized gains longer than they would in a world with no (or fewer) taxes. Essentially, the greater the tax liability on the past appreciation of an investor's current investment, the less likely an investor is to find an alternate investment that can compensate the investor for the liability. These investors are effectively "locked-in" to the investment. The capital gains tax rate cut that became effective on May 7, 1997 provided an opportunity for tax-sensitive investors to "unlock" their unrealized gains. When a group of tax-sensitive investors reaches their reservation price at the same time in such an event, it could result in downward price pressure in a firm's stock price. In such a situation, there is a temporary sell-side liquidity shock whereby the supply of a stock temporarily exceeds the demand for it, leading to a temporary reduction in price. Several prior studies document downward price pressure following the announcement of the effective date of the 1997 capital gains tax rate cut (e.g., Ayers et al. 2008;

[23] We do not include the comparison between *TSII_NEW* and *TSII_IAPD* because *TSII_NEW* encompasses *TSII_IAPD* in this test (i.e., all institutions that *TSII_IAPD* classifies as tax-sensitive are also classified as tax-sensitive by *TSII_NEW*).

Cook 2008; Blouin et al. 2009). Dai et al. (2008) find that this price pressure is associated with tax-sensitive ownership, which they measure as one minus institutional ownership plus investment company ownership.[24]

We test whether prices of stocks held by tax-sensitive institutional investors with greater net unrealized gains in the stock were affected relatively more by the lock-in event. We estimate the following OLS regression:

$$RETURN_{i,t} = \beta_0 + \beta_1 WKL97_t + \beta_2 TSII\_X\_NUG_{i,t} + \beta_3 TSII\_X\_NUG_{i,t} * WKL97_t + \beta_4 TSII\_X\_PCT_{i,t}$$
$$+ \beta_5 APPR_{i,t} + \beta_6 APPR_{i,t} * WKL97_t + \sum\beta_{7\text{-}17}\text{Controls}_{i,t} + \text{FirmFE} + \text{WeekFE} + \varepsilon_{i,t} \quad (4)$$

RETURN is the weekly stock return calculated as the sum of the logged daily returns from Wednesday to the following Tuesday less the weekly return from the stock's size-matched portfolio. The lock-in event, May 7 to May 13, is when many tax-sensitive investors learned that their future capital gain realizations would be taxed at a lower rate. We expect that tax-sensitive institutional investors unlocked their unrealized gains during this week, creating downward price pressure. *WKL97* is an indicator variable that equals one for days in the lock-in period (May 7 to May 13 of 1997), and zero otherwise. *TSII_X_NUG* is the sum of net unrealized gains of all tax-sensitive institutional investors in a stock at the beginning of the quarter scaled by the stock's market capitalization, where *TSII_X* represents the four tax-sensitive investor classification methods—*TSII_GM, TSII_CL, TSII_IAPD,* and *TSII_NEW.* We expect β_3 to be negative and significant. The variable *TSII_X_PCT* captures the percent of a stock's outstanding shares owned by tax-sensitive institutional investors.[25]

[24] Using a different setting, Jin (2006) finds that "locking in" of capital gains by tax-sensitive institutions (defined using IAPD data, insurance companies, and hedge funds) creates upward price pressure around earnings announcements.

[25] We include *TSII_X_PCT* to control for non-event related effects of tax-sensitive ownership on firm performance. For example, if tax-sensitive institutions trade less on average than other institutions, then the greater their holdings the fewer available shares in float (which has implications for price impact and price discovery). If we exclude the *TSII_X_PCT* variables, the results are quantitatively similar.

We include a series of controls intended to capture firm performance and risk characteristics: *SIZE, SP500, SGR, BETA, IRISK, EP, DYLD, BP, RATE,* and *DE* (all defined above and in Appendix B). We also include *APPR*, which equals a stock's price appreciation over the prior two years and is set equal to zero if the stock's price depreciated over the prior two years. In addition, we include the interaction of *APPR* and *WKL97* to show that the effect of tax-sensitive institutional investors' net unrealized gains on market returns is incremental to the basic lock-in results found in Dai et al. (2008) and Blouin et al. (2009). We winsorize all continuous variables at the 1st and 99th percentiles.

Panel A of Table 3 presents the univariate statistics for the variables used in this analysis. Our sample is comprised of firms on CRSP from January 1, 1995, to June 30, 1997. We have 256,117 weekly return observations representing 2,063 firms.[26] The mean (median) weekly size-adjusted return over the sample period for the sample firms (*RETURN*) equals -0.10% (-0.30%). The mean aggregate unrealized capital gains of tax-sensitive institutional investors as a percentage of a firm's market capitalization ranges from 3.8% to 4.4% for the legal types classifications (*TSII_GM_NUG* and *TSII_CL_NUG*), compared to only 0.4% and 0.6% for *TSII_IAPD* and *TSII_NEW*, respectively. The aggregate unrealized gains for the latter two classifications are smaller because they classify a smaller percentage of institutions as tax-sensitive. This can also be seen in the mean percentage holdings for each classification of tax-sensitive investors, which is 27.4% for *TSII_GM* and 24.4% for *TSII_CL*, compared to only 2.2% for *TSII_IAPD* and 3.4% for *TSII_NEW*. The mean (median) price appreciation over the prior two years (*APPR*) for the sample stocks equals 51.6% (21.4%).[27]

[26] We remove earnings announcement weeks from our sample because they are periods of active rebalancing (see Blouin, Raedy, and Shackelford 2003; Jin 2006).

[27] As with all event studies, a confounding event could potentially explain the findings. However, in this particular setting, the tax-event likely contributes to systematic performance of the economy because the tax rate cut affects

Panel B of Table 3 presents the results of estimating equation (4). All significance tests are based on standard errors clustered by firm and by week. Columns (1) and (2) report the results using the *NUG* and *PCT* variables based on *TSII_GM* and *TSII_CL*, respectively. In both cases, the coefficients on the variables that measure price pressure effects (*TSII_GM_NUG*WKL97* and *TSII_CL_NUG*WKL97*) are negative and significant at the 0.01 level, suggesting that the legal type classifications have the power to detect price pressure due to tax-sensitive investors unlocking their gains during the lock-in week. Columns (3) and (4) show that the coefficients on the price pressure variables for *TSII_IAPD* and *TSII_NEW* (*TSII_IAPD_NUG*WKL97* and *TSII_NEW_NUG*WKL97*, respectively) are also negative and significant at the 0.01 level. Thus, all four classification methods have sufficient power to detect price pressure around the 1997 tax rate cut.

Columns (5) and (6) report results for models including the *NUG* and *PCT* variables for both *TSII_NEW* and for the legal type methods (*TSII_GM* and *TSII_CL*, respectively). The coefficient on *TSII_NEW_NUG*WKL97* remains negative and significant at the 0.01 level in both columns (5) and (6), with a coefficient magnitude that is similar to the stand-alone results in column (4). In contrast, the coefficient on *TSII_GM_NUG*WKL97* is now positive and significant at the 0.01 level and the coefficient on *TSII_CL_NUG*WKL97* is positive but not significant. Untabulated F-tests reject the equality of the coefficient on *TSII_NEW_NUG*WKL97* to the coefficients on *TSII_GM_NUG*WKL97* and *TSII_CL_NUG* WKL97* at the 0.01 level.

return factors such as momentum (see Dai et al. 2008). While we cannot rule out all competing explanations for our results, any confounding event would have to explain a positive stock price response in the week before the lock-in event (see Lang and Shackelford 2000) and then a negative stock response in the following week.

In column (7), we report our results for the model that includes *TSII_NEW_NUG* WKL97* and *TSII_IAPD_NUG*WKL97*. Our results indicate that both *TSII_NEW_NUG*WKL97* and *TSII_IAPD_NUG*WKL97* are negative and significant. Given that we rely on the IAPD data as a "seed" in our classification process, it would be surprising if the IAPD sample of firms did not react strongly to tax incentives. Although the coefficient on *TSII_IAPD_NUG*WKL97* appears to be larger than the coefficient on *TSII_NEW_NUG*WKL97*, an F-test suggests that they are not statistically different from one another. The significant coefficient on *TSII_NEW_NUG* WKL97* suggests that our measure successfully captures tax-sensitivity among institutional that cannot be captured using the *TSII_IAPD* approach.

In summary, these results suggest that our measure better identifies institutions' tax-sensitivity than those based solely on institutional investors' legal type, and continues to perform as well as the measure based on the small-sample IAPD approach.

Tax-Sensitivity and Fund Performance

Finally, we examine whether tax-sensitive portfolio management is associated with fund performance. While prior literature has examined how tax-efficient management of mutual funds affects portfolio decisions (e.g., Barclay, Pearson, and Weisbach 1998; Bergstresser and Poterba 2002; Dickson, Shoven and Sialm 2002; Huddart and Narayanan 2002; Sialm and Starks 2012; Bergstresser and Pontiff 2013), no prior study finds evidence that tax-efficient management by either mutual funds or institutional investors is associated with the returns of the stocks they hold

in their portfolios.[28,29] If tax-sensitivity results in institutional investors holding onto stocks with unrealized gains too long or selling stocks with unrealized losses too soon in order to minimize clients' tax exposure and maximize their after-tax returns, then we expect this to potentially constrain the investment activity of the institution to the point that it could negatively impact pre-tax performance.[30]

We compare the pre-tax performance of tax-sensitive and tax-insensitive institutional investors using several different performance measures, each calculated on a quarterly basis over the years 1996–2013.[31] First, we use the weighted average buy-and-hold return of stocks held in an institution's portfolio at the beginning of the quarter. Second, we compute alphas based on the four factor Fama-French-Carhart model (Fama and French 1993; Carhart 1997). Third, we confirm that portfolio size is not responsible for any abnormal return differences. We subtract the mean Fama-French-Carhart alpha of the institution's portfolio size decile from the institution's Fama-French-Carhart alpha for the particular quarter. Fourth, we consider the trading and governance behavior of institutions by using the Bushee (2001) classification of institutions into three groups—

[28] Sialm and Starks (2012) find no evidence that the portion of the fund held in defined contribution plans, which are tax-deferred, affects mutual fund performance. Because a mutual fund's tax liability is allocated pro-rata to all of its owners, deferred capital gains (called capital gains overhang) can result in a tax liability for an investor even if the investor purchases mutual fund shares that subsequently depreciate. This results in conflicting preferences between current and future mutual fund investors with regard to deferred capital gains. This tradeoff is unique to managers of mutual funds largely held in taxable accounts and does not extend to other types of tax-sensitive institutional investors.

[29] Jin (2006) and Blouin et al. (2003) find evidence that tax-sensitivity affects firm-level stock prices around earnings announcements. These studies investigate the "sellers' strike" whereby tax-sensitive investors are reluctant to sell appreciated securities due to the realization of capital gains for tax purposes. Jin (2006) specifically studies institutional investor tax-sensitivity and finds that the greater the tax-sensitive institutions' appreciation in specific firm holdings, the greater the positive firm-level stock price response to earnings announcements. Although there is evidence of tax-sensitivity inducing short-term liquidity related stock price reactions, there is no evidence that tax-sensitivity affects institutions' aggregate portfolio returns.

[30] Our prediction that the portfolio distortions caused by lock-in could result in tax-sensitive investors earning lower pre-tax returns is distinct from implicit taxes. If implicit taxes were the explanation for their lower pre-tax returns, this would suggest that they are investing in tax-favored assets. But that is not actually the case. They are just deferring the gain or accelerating the loss on a tax-disfavored asset, which constrains when they can trade the stocks in their portfolios (Klein 1998, 1999; Dammon, Spatt, and Zhang 2001).

[31] We begin with 1996 rather than 1995 because we match an institution's performance measures with its classification from the previous year, and *TSII_NEW* is first available in 1995.

transient, dedicated, and quasi-indexer—based on their portfolio turnover and blockholdings.[32] We subtract the mean Fama-French-Carhart alpha of an institution's "governance" group from the institution's Fama-French-Carhart alpha for the particular quarter.[33] Finally, we consider an institution's legal type by subtracting the mean Fama-French-Carhart alpha of the institution's legal type from the institution's Fama-French-Carhart alpha for the particular quarter.

Panel A of Table 4 reports the results for the two legal type classifications of tax-sensitive investors (*TSII_GM, TSII_CL).* For both classifications, there is no difference in raw returns, but three measures of alpha are significantly greater for tax-sensitive institutions than for tax-insensitive institutions. These results suggest the tax-sensitive institutions perform *better* than tax-insensitive institutions, which is contrary to the expectation that tax-efficient management is associated with lower pre-tax fund performance. However, the alpha that controls for legal type is not significantly different between tax-sensitive and tax-insensitive institutions for both classifications. Thus, the legal type classifications simply reflect the short-term fund performance differences between investment advisers and pensions (see Bushee and Goodman 2007).

Panel B of Table 4 reports results for *TSII_IAPD* in columns (1) through (3). The results show that the average raw return on the stocks held by tax-sensitive institutions is significantly lower than on stocks held by tax-insensitive institutions using the *TSII_IAPD* classification. This lower return is consistent with tax-sensitivity being associated with lower pre-tax fund performance. However, none of the four alpha measures is significantly lower for tax-sensitive institutions and, in fact, the alpha adjusted for legal type is significantly greater for tax-sensitive institutions. These

[32] As an example of this classification affecting fund performance, Yan and Zhang (2009) find that higher portfolio turnover institutions perform better than lower turnover institutions.

[33] The Governance adjustment also controls for the potential effect of transaction costs on the portfolio returns. Compared to tax-sensitive investors, the tax-insensitive investors trade more frequently, which will tend to increase portfolio transaction costs, but trade smaller blocks in larger firms, which will tend to reduce portfolio transaction costs. Thus, the relation between portfolio turnover and portfolio transaction costs is ex ante unclear. However, any such relation will be captured by this control for transient trading strategies.

results suggest that the *TSII_IAPD* classification lacks the power to detect the effect of tax-sensitivity on fund performance after controlling for additional portfolio characteristics. This finding is likely due to the fact that the institutions in the IAPD sample exhibit much less variation in portfolio size, governance, and legal type than the universe of Form 13F institutions.

Columns (4) through (6) of Panel B present the results for our classification, *TSII_NEW*. The average raw return for tax-sensitive institutions is 2.2%, which is 34 basis points lower than the 2.55% average return for tax-insensitive institutions; this 16% difference is significant at the 0.01 level.[34] We find the same results for all four measures of alpha: tax-sensitive institutions earn significantly lower alphas than tax-insensitive institutions. On an annualized basis, the Fama-French-Carhart alpha is 1.4% for tax-sensitive institutions compared to 1.7% for tax-insensitive institutions, which is a 24% difference.[35] Overall, our measure of tax-sensitivity is the only measure with the power to detect a significant effect of tax-sensitivity on fund stock performance, which is a finding that prior literature has not documented.

Summary

We find evidence suggesting that our measure of tax-sensitivity provides more power to detect tax-sensitivity than prior measures. The broadest classification using legal type, *TSII_GM,* only detects tax-sensitivity in the price pressure test, but our measure dominates it when we include both in the same model. The legal type classification that excludes banks, *TSII_CL,* detects tax-sensitivity in both portfolio rebalancing and price pressure tests, but again our measure dominates it. The *TSII_IAPD* approach of hand-collecting clientele information for a small set of investment advisers, and adding pensions and endowments, works very well in the portfolio rebalancing and

[34] The 16% difference equals (2.2%–2.55%)/2.2%.

[35] The 21% difference equals (1.4%–1.7%)/1.4%.

price pressure tests, but lacks the power to find significant differences in fund performance due to tax-sensitivity after controlling for fund characteristics. This lack of power is likely due to the smaller sample size and limited variation in fund characteristics for the institutions classified by this method. Our method detects significant effects of tax-sensitivity in all three tests. It has the advantages of being able to account for heterogeneity in tax-sensitivity within legal types (unlike *TSII_GM* and *TSII_CL*) and to classify a larger number of institutions than the IAPD approach.

Sensitivity Analyses

We perform a number of untabulated sensitivity analyses on the *TSII_NEW* results. First, recall that *TSII_NEW* is a combination of the *TSII_IAPD* sample (i.e., calibration sample) and the institutions that we classify in our classification sample. We test whether the results of the three tests hold using only the institutions from our classification sample. In the portfolio rebalancing test, the coefficient on the interaction between *TRA97* and this sample of tax-sensitive institutions is negative but not significant ($p = 0.18$). In the price pressure test, the coefficient on the interaction between *WKL97* and *NUG* for this sample is negative and significant ($p = 0.03$). In the fund performance test, the return performance of this sample of tax-sensitive institutions is significantly lower than that of tax-insensitive institutions at the 0.01 level for each measure. Thus, the results for *TSII_NEW* are not solely attributable to the inclusion of the *TSII_IAPD* institutions; the additional institutions we classify as tax-sensitive generally exhibit tax-sensitivity on their own.

Second, the portfolio rebalancing and price pressure tests are clustered in calendar time. To ensure that some second-quarter effect is not responsible for the results, we estimated the results using pseudo-event dates in the other sample years (i.e., 1995Q2 and 1996Q2 for the portfolio rebalancing test and May 10, 1995 and May 8, 1996 for the price pressure test). In all cases, the coefficient on the interaction between *TSII_NEW* or *TSII_NEW_NUG* and the event indicator is

not significant. We also estimated the results using alternative pseudo-event dates for each test.[36] For the portfolio rebalancing tests, the coefficient on the interaction is not significant in eight of the nine cases (the coefficient is negative and significant in 1995Q1). For the price pressure tests, all but one of the other pseudo-event dates yielded insignificant coefficients on the interaction.[37] Thus, our results do not reflect general time trends or a second-quarter effect.

Finally, we attempt to provide some evidence on the sources of the differences in results between our measure and the prior legal type measures (*TSII_GM* and *TSII_CL*). We estimate a series of tests in which we replace a legal type classification of an institution with our classification one legal type at a time. For example, in one test, we use the *TSII_GM* classification for all legal types except investment advisers, for which we use our classification. We find that most of the improvement in our methodology over prior work is due to recognizing the heterogeneous classification of investment advisers (46.1% are tax-sensitive), rather than treating all of them as tax-sensitive. We also find some modest improvement due to recognizing the heterogeneous classification of insurance companies rather than treating them all as tax-sensitive (*TSII_GM*) or as tax-insensitive (*TSII_CL*), but only for the portfolio rebalancing test. Thus, the ability to classify tax-sensitivity within legal type, especially among the largest group, investment advisers, drives the superior performance of our measure of tax-sensitive institutions.

[36] For the portfolio rebalancing test, we use the remaining quarters in the sample as pseudo-event dates. We also add the third and fourth quarters of 1997 to the sample and use each as pseudo-event dates. For the price pressure test, we use the same week in the quarter before and after the event week-quarter (February 12 and August 6 of 1997) and we also do this for 1995 and 1996 (February 8 and August 9 of 1995, and February 7 and August 7 of 1996), and we include the four weeks leading up to the event (April 2, 9, 16, and 23 of 1997).

[37] The coefficient on the interaction of the August 9, 1995 week indicator variable and *TSII_NEW_NUG* is negative and significant but the coefficient is very small (-0.038 vs. -0.254 for the interaction of *TSII_NEW_NUG*WKL97* in Table 3, Panel B).

VII. CONCLUSION

We create a new measure of tax-sensitive institutional ownership using the trading behavior and portfolio characteristics of institutional investors. We classify all Form 13F institutional investors over the period 1995–2013 as either tax-sensitive or tax-insensitive. Then, we compare our approach to prior methods of measuring tax-sensitive investors in three sets of tests: portfolio rebalancing, price pressure, and portfolio performance. We find that our measure of tax-sensitive investors dominates measures based on legal type in the portfolio rebalancing and price pressure tests. In the portfolio performance test, our measure of tax-sensitivity is the only one that finds that tax-sensitive investors have significantly lower pre-tax returns on their portfolio stocks, which is a new result in the literature. This evidence suggests that our measure of tax-sensitive institutions provides more power to detect tax-sensitivity than prior measures.

However, we provide the following caveats concerning our measure. First, as we are unable to observe actual tax-related trading, we must infer the supremacy of our measure using a series of association tests. As with all empirical work, these tests could be confounded by measurement error and there could be an alternative explanation for our results. Second, our measure was not able to detect sensitivity to the dividend tax rate change in 2003. This could be attributable to the fact that the 2003 Act included a capital gains tax cut in addition to the dividend tax cut or it could be because our measure is not designed to capture all of the aspects of dividend tax-sensitivity (e.g., whether an institution receives the dividends received deduction). Third, our calibration sample is based on investment adviser clientele data collected in 2006 that we assume does not change over time (based on conversations with investment advisers). To the extent that the clienteles do change over time, this could affect our classification.

Despite these caveats, our approach improves upon prior work that classifies institutions based on legal type by accounting for the heterogeneity that exists within legal types. For example, prior classifications based on legal type classify approximately 90% of institutions representing about 80% of the value of assets held by institutions as tax-sensitive. Our measure only classifies 46% of institutions as tax-sensitive. These 46% percent of institutions hold 12.4% of equity held by sample institutions or roughly $500 billion. Interestingly, we also document that the level of tax-sensitive institutions has been declining over time whereas the alternate measures suggest it has been increasing. We find significant heterogeneity within each of the legal types (other than pensions and endowments), suggesting that studies that classify all institutional investors within a certain legal type as either tax-sensitive or tax-insensitive are subject to significant classification error. Furthermore, our measure will allow future researchers to avoid omitting all institutional investors of a particular legal type (e.g., banks or investment companies) from their studies simply because the tax-sensitivity of the institutions is unknown. We also improve upon prior work that classifies only a small sample of institutions using clientele information provided on Form ADV by classifying the majority of institutional investors. In this way, our measure provides a more powerful measure of tax-sensitive investors that has the potential to find new evidence on the effects of tax-sensitive investors in future research settings.

There is a vast literature in public economics that studies the implication of investor-level taxation on market activity. Our measure may help further much of this research. For example, prior work studies whether investor-level taxes affect long-run equilibrium prices and firms' cost of capital. Our measure may help this work evaluate the average tax rate of the aggregate "price-setting" investor. Investor-level tax-sensitivity is also salient for the mergers and acquisition literature. Our measure could be associated with both the level of deal premium and/or the

composition of the deal consideration (which affects the level of tax on the transaction). It is conceivable that our approach could also be used to detect dividend clienteles. Although our *TSII_NEW* measure was unable to detect institutions' sensitivity to dividends around the 2003 Tax Act, our measure could be adapted to detect tax-sensitivity to dividends in settings such as the analysis of the ex-day dividend price drop.

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APPENDIX A
ILLUSTRATION OF REALIZED AND UNREALIZED GAIN AND LOSS ESTIMATION

This appendix provides an example of how we estimate an institutional investor's quarterly realized and unrealized gains and losses in a particular stock. First, we assume that a quarterly increase in the number of shares held by an institutional investor reflects a purchase of that many shares in the current quarter. We estimate the purchase price as the average of the three month-end prices of the stock in the quarter, which becomes the institutional investor's tax basis for these shares. We use quarterly holdings data starting in 1980, which is the first year that Form 13F reports are available, to determine the tax basis of shares held. We assume that shares held at the end of the first quarter of 1980 were purchased during that quarter. When the number of shares that an institution owns in a stock decreases in a quarter, we treat this as a sale and set the sales price equal to the average of the three month-end prices in the quarter. If the institutional investor owns multiple lots of the same stock that were purchased at different prices, then we assume that the institutional investor uses highest-in first-out (HIFO) in calculating realized gains/losses on sales.[38] We adjust stock prices and the quarterly holdings data for stock splits.

In the table below, we provide an example for holdings of Institutional Investor J in Stock I. The investor owns 50,000 shares at the end of the first quarter of 1980. We assume that the investor purchases the 50,000 shares in the first quarter of 1980 at $31.88/share, which is the average of the three month-end prices for the quarter. In the second quarter of 1980, the investor does not purchase or sell any shares. The investor now has a $43,500 unrealized gain on the 50,000 shares [50,000*($32.75–$31.88)]. In the third quarter of 1980, the investor purchases an additional 844 shares. It now has a $537,500 unrealized gain on the original 50,000 shares [50,000*($42.63–

[38] Under U.S. tax law, an institution can designate the lot of stocks to be sold. With highest-in, first-out, an institution sells shares that it purchased at the highest price first in order to minimize capital gains or maximize capital losses. Prior studies measure unrealized and realized gains and losses similarly (Huddart and Narayanan 2002; Jin 2006).

$31.88)]. The investor does not purchase or sell shares in the fourth quarter of 1980. It now has a total unrealized gain equal to $708,844.28, which consists of a $706,000 unrealized gain on the 50,000 shares purchased in the first quarter of 1980 and a $2,844.28 unrealized gain on the 844 shares purchased in the third quarter. We estimate the unrealized gains in the first three quarters of 1981 and the unrealized loss in the fourth quarter of 1981 analogously.

Date	Institutional Investor	Stock	# Shares Held	Average of 3 Month-End Prices	Realized Gain/Loss	Unrealized Gain/Loss
19800331	J	I	50,000	$ 31.88	N/A	N/A
19800630	J	I	50,000	$ 32.75	N/A	$ 43,500.00
19800930	J	I	50,844	$ 42.63	N/A	$ 537,500.00
19801231	J	I	50,844	$ 46.00	N/A	$ 708,844.28
19810331	J	I	51,610	$ 49.00	N/A	$ 861,376.28
19810630	J	I	52,314	$ 44.50	N/A	$ 629,131.28
19810930	J	I	53,120	$ 35.88	N/A	$ 178,184.60
19811231	J	I	54,099	$ 30.00	N/A	$ (134,161.00)
19820331	J	I	51,099	$ 41.00	$ (6,455.40)	$ 467,383.40
19820630	J	I	-	$ 39.75	$ 403,509.65	N/A

The first decrease in the number of shares owned by the investor occurs in the first quarter of 1982, which we treat as a sale of 3,000 shares. We set the sales price equal to $41/share, which is the average of the three month-end prices in the quarter. Because the investor owns multiple lots of the stock purchased at different prices, we apply HIFO in determining the tax basis of the shares sold. The lot with the highest price is the 766 shares purchased at $49/share in the first quarter of 1981. The lot with the next highest price is the 704 shares purchased at $44.50/share in the second quarter of 1981, followed by the lot of 844 shares purchased at $42.63/share during the third quarter of 1980. At this point, we have allocated a tax basis to 2,314 of the 3,000 shares sold. Thus, we need to allocate basis to the remaining 686 shares. The lot with the next highest price is the 806 shares purchased at $35.88/share during the third quarter of 1981. We assume that only 686 of these shares are sold. The estimated realized loss on the sale equals $(6,455.40) [766*($41–$49)

+ 704*($41–$44.50) + 844*($41–$42.63) + 686*($41–$35.88)]. The investor also has a $467,383.40 unrealized gain on the remaining shares held [50,000*($41–$31.88) + 120*($41–$35.88) + 979*($41–$30)]. The investor does not own any shares at the end of the second quarter of 1982. We treat this as a sale of 51,099 shares during the second quarter of 1982, with a realized gain of $403,509.65 on the sale.

APPENDIX B
VARIABLE DEFINITIONS

Variable	Calculation
ABN(PLR4)	PLR (the proportion of losses realized) is an institution's realized losses during a quarter scaled by the total losses that the institution could realize during the quarter. ABN(PLR4) equals PLR for quarter 4 minus the average PLR for quarters 2 and 3.
ABN(PLR1)	ABN(PLR1) equals PLR for quarter 1 minus the average PLR for quarters 2 and 3.
ABN(PGR4)	PGR (the proportion of gains realized) is an institution's realized gains during a quarter scaled by the total gains that the institution could realize during the quarter. ABN(PGR4) equals PGR for quarter 4 minus the average PGR for quarters 2 and 3.
ABN(PGR1)	ABN(PGR1) equals PGR for quarter 1 minus the average PGR for quarters 2 and 3.
TE	Natural log of institution's portfolio market value ($ thousands)
NSTK	Number of stocks held in an institution's portfolio
PTURN	Portfolio turnover factor score from factor analysis in Bushee (2001). The variables that comprise the factor are an institution's quarterly portfolio turnover percentage, an institution's quarterly portfolio turnover percentage using only sales transactions, the percentage of the institution's total holdings held continuously for two years, and the percentage of the institution's portfolio firms held continuously for two years.
BLOCK	Blockholding factor score from factor analysis in Bushee (2001). The variables that comprise the factor are the percentage of the institution's total holdings held in large blocks (greater than 5%), the percentage of the institution's portfolio firms held in large blocks (greater than 5%), the institution's average percentage ownership in its portfolio firms, and the institution's average investment size in its portfolio firms.
FSIZE	Firm size factor score from factor analysis in Abarbanell et al. (2003). The variables that comprise the factor are the weighted average market capitalization of stocks held in an institution's portfolio, the percent of the institution's holdings that are in S&P 500 firms, the weighted average of time listed of stocks held in an institution's portfolio, and the weighted average of stock price per share of stocks held in an institution's portfolio.
PGROW	Prior growth and risk factor score from factor analysis in Abarbanell et al. (2003). The variables that comprise the factor are the weighted average prior three-years earnings growth for stocks held in an institution's portfolio, the weighted average prior three-years sales growth for stocks held in an institution's portfolio, the weighted average market model beta for stocks held in an institution's portfolio, and the weighted average standard deviation of returns over prior 36 months for stocks held in an institution's portfolio.
VALUE	Value factor score from factor analysis in Abarbanell et al. (2003). The variables that comprise the factor are the weighted average of earnings-to-price ratio of stocks held in an institution's portfolio, the weighted average of book-to-price ratio of stocks held in an institution's portfolio, and the weighted average of dividend-to-price ratio of stocks held in an institution's portfolio.

APPENDIX B
Continued

Variable	Calculation
FIDUC	Fiduciary factor score from factor analysis in Abarbanell et al. (2003). The variables that comprise the factor are the weighted average S&P stock rating of stocks held in an institution's portfolio, the weighted average debt-to-equity ratio of stocks held in an institution's portfolio, the percent of the institution's holdings that are in firms with positive earnings, and the percent of the institution's holdings that are in firms with five years of consecutive earnings growth.
WASIZE	WAMC from Abarbanell et al. (2003), which equals the weighted average natural log of market capitalization of stocks held in an institution's portfolio, where the weight equals the number of shares that an institution owns in a stock times the stock price
WASP500	WASP from Abarbanell et al. (2003), which equals an institution's percent holdings in S&P 500 firms
WAAGE	WATIME from Abarbanell et al. (2003), which equals the weighted average of the number of days listed on CRSP of stocks held in an institution's portfolio, where the weight equals the number of shares that an institution owns in a stock times the stock price. Note that for this variable, age is stated in terms of days listed, whereas the stock level variable AGE that we use in equation (2) is stated in terms of years.
WASGR	Weighted average geometric mean sales growth for three previous years for stocks held in an institution's portfolio, where the weight equals the number of shares that an institution owns in a stock times the stock price (Abarbanell et al. 2003)
WABETA	WABTA from Abarbanell et al. (2003), which equals the weighted average market model beta estimated over prior 36 months for stocks held in an institution's portfolio, where the weight equals the number of shares that an institution owns in a stock times the stock price
WAIRISK	WASTD from Abarbanell et al. (2003), which equals weighted average standard deviation of returns over prior 36 months for stocks held in an institution's portfolio, where the weight equals the number of shares that an institution owns in a stock times the stock price
WAEP	Weighted average of earnings-to-price ratio, where earnings are earnings before extraordinary items of stocks held in an institution's portfolio and the weight equals the number of shares that an institution owns in a stock times the stock price (Abarbanell et al. 2003)
WADYLD	WADP from Abarbanell et al. (2003), which equals the weighted average of dividend-to-price ratio of stocks held in an institution's portfolio, where the weight equals the number of shares that an institution owns in a stock times the stock price
WABP	Weighted average of book-to-price ratio of stocks held in an institution's portfolio, where the weight equals the number of shares that an institution owns in a stock times the stock price (Abarbanell et al. 2003)
WARATE	Weighted average S&P stock rating (9 = A+, 0 = not rated) of stocks held in an institution's portfolio, where the weight equals the number of shares that an institution owns in a stock times the stock price (Abarbanell et al. 2003)
WADE	Weighted average debt-to-equity ratio of stocks held in an institution's portfolio, where the weight equals the number of shares that an institution owns in a stock times the stock price (Abarbanell et al. 2003)

APPENDIX B
Continued

Variable	Calculation
ΔWGT	Change in the portfolio weight (*WGT*) that an institution places on a stock during a quarter, where *WGT* equals the institution's total dollar holdings in the stock divided by the institution's total dollar holdings in all stocks in its portfolio
NUG	Institution's net unrealized gains scaled by portfolio market value. See Appendix A for an example of net unrealized gains calculation.
SIZE	Natural log of stock's market capitalization
SP500	1 if stock is in S&P 500 index; 0 otherwise
AGE	Stock's age based on the first date that the stock was included in CRSP and expressed in years. Note that for this variable, age is stated in terms of years listed, whereas the portfolio weighted-average variable WAAGE is stated in terms of days listed.
SGR	Geometric mean of stock's sales growth over the past three years
BETA	Beta from a market model using monthly returns over the past three years
IRISK	Standard deviation of a stock's daily market model residuals over the past year
EP	Stock earnings per share before extraordinary items divided by price
DYLD	Stock's dividend-to-price ratio
BP	Stock's book-to-price ratio
RATE	Stock's S&P common stock rating (9 = A+, 0 = not rated)
DE	Stock's debt-to-equity ratio
TSII_NEW	1 if institution is tax-sensitive in either our calibration sample (*TSII_IAPD*=1) or classification sample; 0 otherwise
TSII_IAPD	1 if institution is an investment adviser whose majority clientele are high net-worth individuals; 0 if institution is a pension, endowment, or investment adviser whose majority clientele are tax-exempt entities (i.e., pensions, endowments, charitable organizations, and/or state and local governments)
TSII_GM	1 if institution is an insurance company, investment company or investment adviser; 0 if institution is a bank, pension, or endowment
TSII_CL	1 if institution is investment company or investment adviser; 0 if institution is an insurance company, pension, or endowment
TRA97	1 if quarter is second calendar quarter of 1997; 0 if quarter is 1995Q1–1997Q1
RETURN	Stock's weekly stock return calculated as the sum of the logged daily returns from Wednesday to the following Tuesday less the weekly return from the stock's size-matched portfolio
TSII_NEW_NUG	Sum of beginning-of-quarter net unrealized gains in a stock of institutional investors that our model classifies as tax-sensitive and of tax-sensitive institutional investors in our calibration sample (*TSII_IAPD*) scaled by the stock's market capitalization
TSII_IAPD_NUG	Sum of beginning-of-quarter net unrealized gains in a stock of tax-sensitive institutional investors in our calibration sample (investment advisers whose primary clientele are high net-worth individuals) scaled by the stock's market capitalization

APPENDIX B
Continued

Variable	Calculation
TSII_GM_NUG	Sum of beginning-of-quarter net unrealized gains in a stock of investment advisers, investment companies, and insurance companies, scaled by the stock's market capitalization
TSII_CL_NUG	Sum of beginning-of-quarter net unrealized gains in a stock of investment advisers and investment companies, scaled by the stock's market capitalization
TSII_NEW_PCT	Percent of a stock's outstanding shares owned by institutional investors that our model classifies as tax-sensitive and by tax-sensitive institutional investors in our calibration sample (*TSII_IAPD*)
TSII_CALIB_PCT	Percent of a stock's outstanding shares owned by tax-sensitive institutional investors in our calibration sample (investment advisers whose primary clientele are high net-worth individuals)
TSII_GM_PCT	Percent of a stock's outstanding shares owned by investment advisers, investment companies, and insurance companies
TSII_CL_PCT	Percent of a stock's outstanding shares owned by investment advisers and investment companies
APPR	Appreciation in a stock's price over past two years; equal to zero if stock depreciated
WKL97	1 if during lock-in period (May 7 to May 13 of 1997); 0 otherwise

APPENDIX C
MUTUAL FUNDS AND SENSITIVITY TO DIVIDEND TAXES

Mutual Funds

One potential concern with our classification scheme is that we must classify institutions at the 13F filing level. As a result, we classify a mutual fund family that has a mix of tax-sensitive and tax-insensitive funds based on the net tax-sensitivity of the whole family. Mutual funds were only required to report holdings on a quarterly basis beginning in 2004. Because one of the primary determinants of our classification is realized losses in the fourth quarter, we are unable to identify the tax-sensitivity of individual mutual funds in the same manner as we do using aggregate institution-level data.[39] Thus, we conduct a separate analysis to verify our classification of investment advisers, which includes the mutual fund families.

We use annual survey data from 1997-2013 from *Pensions and Investments*. Mutual fund families are asked to report the year-end dollar amount of mutual fund assets that are held in Defined Contribution (DC) retirement plans for their 12 funds with the largest dollar amounts held in DC plans in each of five different investment categories (Domestic Equity Funds, Domestic Fixed Income Funds, International Equity Funds, Balanced Funds, and Money Market Funds). According to our contact at *Pensions and Investments*, all identified mutual fund families are asked to complete the survey. Thus, a mutual fund family's absence from the survey dataset is likely due to the fund family not managing funds held in DC plans. We focus on the fund families that report plan assets for actively-managed domestic equity funds.[40] Because income earned in DC plans is tax-deferred, fund families in the dataset are more likely to be tax-insensitive.

[39] We recognize that some mutual funds filed quarterly reports prior to 2004; however, we need quarterly reports for all funds in order to correctly classify funds using our methodology.

[40] See pionline.com for more details regarding the survey data. Sialm and Starks (2012) use the data in their study of mutual fund tax clienteles, and Christoffersen, Geczy, Musto and Reed (2006) use the data in their study of managers' decisions with respect to cross-border dividend payments in 2003.

We match 568 fund family-year observations in the *Pensions and Investments* dataset to investment advisers and investment companies in Thomson Reuters, of which 68 (12%) are associated with investment advisers that we classify as tax-sensitive and 500 (88%) are associated with investment advisers that we classify as tax-insensitive.[41] Moreover, the 568 fund family-year observations represent 69 unique fund families, with eight (12%) classified as tax-sensitive and 61 (88%) as tax-insensitive. The fact that the vast majority of the fund families that complete the *Pensions & Investments* survey are investment advisers that we classify as tax-insensitive provides support for our classification.

Sensitivity to Dividend Taxes

A natural extension of our analysis is to consider whether our classification scheme can detect portfolio rebalancing around changes in the dividend tax rate. In an untabulated test, we modify the analysis in Panel D of Table 2 to examine whether tax-sensitive institutions increase the portfolio weight they place on stocks with higher dividend yields following the Jobs and Growth Tax Relief Reconciliation Act of 2003 (JGTRRA03), relative to prior to the act and relative to the tax-insensitive institutions. JGTRRA03 reduced the maximum statutory tax rate on dividend income from 38.6% to 15% and the maximum statutory tax rate on capital gains from 20% to 15%.

When we conduct the Table 2, Panel D analysis surrounding JGTRRA03, we find no evidence that the tax-sensitive institutional investors under any classification method (*TSII_GM, TSII_CL, TSII_IAPD, TSII_NEW*) increased the weight placed on stocks with higher dividend yields in their portfolios following the act. However, it is not clear whether we would expect these institutions to react to the dividend tax rate reduction for several reasons. First, rebalancing their portfolios towards higher dividend yield stocks would likely require institutions to realize capital gains

[41] As we explain earlier in the paper, we combine investment companies with investment advisers.

associated with the non-dividend paying stocks. Auerbach and Hassett (2006) document that non-dividend paying stocks outperformed dividend-paying stocks around the 2003 dividend tax rate reduction. Thus, it is possible that the cost of the incremental capital gains taxes that would be realized usurped the benefit of shifting towards higher dividend yield stocks. Second, as many of our tax-sensitive institutions are banks that have a fiduciary responsibility to hold "safe" securities (Del Guercio 1996), we suspect that decisions regarding dividend-paying securities may be relatively less sensitive to taxes than to fiduciary considerations. Third, some of the tax-sensitive institutions in our sample are corporations (insurance companies), and corporations are not tax-disadvantaged with respect to dividends. Both the second and third explanation suggest that higher dividend tax rates might not have discouraged ownership of dividend-paying stocks prior to JGTRRA03.

In contrast to our finding, Sialm and Starks (2012) find that dividend distributions by mutual funds held primarily in taxable accounts increased significantly following JGTRRA03, whereas they observe no difference for mutual funds held primarily in tax-deferred accounts. Moreover, they find that mutual funds held primarily in tax-deferred accounts distributed significantly more dividends than mutual funds held primarily in taxable accounts prior to JGTRRA03 and no difference between the two following JGTRRA03. From these findings, they conclude that mutual funds held primarily in taxable accounts increased their propensities to hold dividend-paying stocks following JGTRRA03. However, mutual funds are not subject to the same fiduciary considerations as banks nor are they corporations. Thus, dividend taxes likely served as a greater deterrent to owning dividend-paying stocks prior to JGTRRA03 for mutual funds than for the tax-sensitive institutions in our sample that are banks, which could explain the difference in results.

FIGURE 1
Example of Classifying an Institutional Investor as Tax-Sensitive in 1995

Calibration Regression Sample Periods		Initial Classification		Final Classification
1991	→	TSI_{91}		
1992	→	TSI_{92}		
1993	→	TSI_{93}	Modal	
1994	→	TSI_{94}		
1995	→	TSI_{95}		$TSII\_NEW_{95}$

In the first-stage, we estimate annual logistic regressions in the calibration sample using one year of data. The parameter estimates from the regressions are applied to the classification sample to initially classify each institution-year as tax sensitive (TSI=1) or tax-insensitive (TSI=0). We determine the final classification of each institution-year as tax-sensitive (TSII_NEW=1) or tax-insensitive (TSII_NEW=0) using the modal value of the classifications for the five years leading up to and including year t (i.e., the institution has to be classified as tax-sensitive in at least three of the five prior years in order for its final classification to be tax-sensitive).

TABLE 1
Classification of Tax-Sensitive Institutional Investors

Panel A: Logistic Regression Using Calibration Sample

		Number of Years	
	Mean	Pos (Sig)	Neg (Sig)
Intercept	2.191***	22 (17)	1 (0)
	(7.330)		
ABN(PLR4)	0.008***	21 (12)	2 (0)
	(8.130)		
ABN(PGR4)	-0.005***	5 (0)	18 (3)
	(-4.940)		
ABN(PLR1)	-0.003**	10 (1)	13 (6)
	(-2.490)		
ABN(PGR1)	0.006***	19 (8)	4 (0)
	(4.150)		
TE	-0.035***	0 (0)	23 (23)
	(-16.030)		
NSTK	-0.000***	3 (0)	20 (0)
	(-3.430)		
PTURN	-0.007***	2 (0)	21 (10)
	(-5.140)		
BLOCK	0.010***	22 (5)	1 (0)
	(7.520)		
FSIZE	-0.005	7 (1)	16 (4)
	(-1.600)		
PGROW	-0.008***	2 (0)	21 (5)
	(-5.580)		
VALUE	-0.006**	3 (1)	20 (10)
	(-2.570)		
FIDUC	0.014***	22 (16)	1 (0)
	(5.380)		
	Mean	Min	Max
Observations	356.9	183	450
Pseudo-R^2	0.201	0.140	0.234
AUC	0.793	0.750	0.816

The mean coefficients are based on 23 annual logistic regressions between 1991 and 2013. The dependent variable (*TSII_IAPD*) equals one if the institution is an investment adviser whose primary clientele is high net-worth individuals, and equals zero if the institution is a pension, endowment, or an investment adviser whose primary clientele includes pensions, endowments, charitable organizations, and/or state and local governments. In parentheses below the mean coefficient estimates are t-statistics based on Fama-Macbeth standard errors with Newey-West autocorrelation corrections. Next to each mean coefficient is the number of years the coefficient was positive (positive and significantly different from zero at the 0.10 level) in the 23 annual regressions, followed by the number of years the coefficient was negative (negative and significantly different from zero at the 0.10 level) in the 23 annual regressions. At the bottom of the table are the mean, min, and max number of observations, pseudo R-squared, and Area under the Curve (AUC) of the annual regressions. See Appendix B for variable definitions. ***, **, and * denote statistical significance at the 0.01, 0.05, and 0.10 level, respectively, using a two-tailed test.

TABLE 1
Continued

Panel B: Institutions Classified as Tax-Sensitive and Tax-Insensitive

		Average	Classification in Year t+5		Classification in Year t+10	
Classification	Institution-Years	Total Equity (billions)	Tax-Sensitive	Tax-Insensitive	Tax-Sensitive	Tax-Insensitive
Tax-Sensitive	6,785 (46.2%)	$201.7 (6.2%)	77.9%	22.1%	65.1%	34.9%
Tax-Insensitive	7,892 (53.8%)	$3,038.8 (93.8%)	9.2%	90.8%	9.6%	90.4%

Column (1) presents the number and percent of institution-years that we classify as either tax-sensitive or tax-insensitive in the classification sample. Column (2) presents the average total equity managed annually by these institutions (stated in $billions and as a percent of the total equity managed annually by all institutions in the classification sample). The last four columns report the percentage of institutions in a given year that maintain or change their tax-sensitive classification five and ten years later.

Panel C: Mean Portfolio Characteristics by Sample

	Calibration Sample			Classification Sample		
	Tax-Sensitive	*Tax-Insensitive*	Diff	*Tax-Sensitive*	*Tax-Insensitive*	Diff
ABN(PLR4)	0.067	0.021	***	0.072	0.022	***
ABN(PGR4)	0.019	0.018		0.027	0.020	**
ABN(PLR1)	0.006	0.004		-0.009	0.002	**
ABN(PGR1)	0.019	0.010	*	0.005	0.004	
TE	12.921	14.183	***	12.320	14.533	***
NSTK	154.602	332.064	***	111.881	451.336	***
PTURN	-0.955	-0.223	***	-0.857	0.482	***
BLOCK	-0.513	-0.060	***	-0.338	0.509	***
FSIZE	1.873	1.117	***	1.504	0.878	***
PGROW	-0.588	-0.138	***	-0.720	0.000	***
VALUE	-1.061	-0.775	***	-0.852	-0.672	***
FIDUC	-0.602	-1.251	***	-1.395	-1.971	***
Observations	4,658	2977		6,785	7,892	

The first (second) set of columns in this table present the mean values of the portfolio characteristics included in equation (1) for the tax-sensitive and tax-insensitive institutions in the calibration (classification) sample and denotes whether the difference in means is statistically significant. See Appendix B for variable definitions. ***, **, * Difference is significantly different from zero at the 0.01, 0.05, and 0.10 level, respectively, using a two-tailed test.

TABLE 1
Continued

Panel D: Classification of Tax-Sensitive Institutions by Legal Type

	Number of Institution-Years		Percent Tax-Sensitive	
	Tax-Sensitive	Tax-Insensitive	Number	Total Equity
Classification Sample:				
Banks	1,160	687	62.8%	7.0%
Hedge Funds	433	1,059	29.0%	9.9%
Insurance Companies	197	603	24.6%	2.1%
Investment Advisers	4,383	5,124	46.1%	5.9%
Miscellaneous	612	419	59.4%	6.5%
	6,785	7,892	46.2%	6.2%
Calibration Sample:				
Pensions and Endowments		1,126	0.0%	0.0%
Tax-Insensitive (IAPD)		1,851	0.0%	0.0%
Tax-Sensitive (IAPD)	4,658		100.0%	100.0%
Total	11,443	10,869	51.3%	12.4%

This table presents the total number and the percent of institution-year observations associated with institutions that our classification scheme classifies as either tax-sensitive or tax-insensitive within each legal type.

TABLE 1
Continued

Panel E: Comparison of Different Classifications of Tax-Sensitive Investors

	TSII_GM			*TSII_CL*			*TSII_IAPD*			*TSII_NEW*		
	Tax-Sensitive	Tax-Insensitive	Total	Tax-Sensitive	Tax-Insensitive	Total	Tax-Sensitive	Tax-Insensitive	Total	Tax-Sensitive	Tax-Insensitive	Total
Banks		2,993								1,160	687	
Hedge Funds	3,004			3,004						433	1,059	
Insurance Companies	1,055				1,055					197	603	
Investment Advisers	16,874			16,874						4,383	5,124	
Miscellaneous										612	419	
Pensions and Endowments		1,126			1,126			1,126			1,126	
Tax-Insensitive (IAPD)	1,851			1,851				1,851			1,851	
Tax-Sensitive (IAPD)	4,658			4,658			4,658			4,658		
Total Institution-Years	27,442	4,119	31,561	26,387	2,181	28,568	4,658	2,977	7,635	11,443	10,869	22,312
	86.9%	*13.1%*		*92.4%*	*7.6%*		*61.0%*	*39.0%*		*51.3%*	*48.7%*	
Avg. Total Equity (billions)	$3,862.8	$1,170.2	$5,033.0	$3519.8	$740.4	$4,260.2	$337.4	$752.9	$1,090.3	$539.4	$3,798.5	$4,337.9
	76.7%	*23.3%*		*82.6%*	*17.4%*		*30.9%*	*69.1%*		*12.4%*	*87.6%*	

This table presents the number of institution-year observations associated with institutions classified as either tax-sensitive or tax-insensitive within each legal type by four different classification schemes. It also presents the percent of total institution-year observations classified as either tax-sensitive or tax-insensitive by each of the classifications. The last row presents the average total equity managed annually by tax-sensitive or tax-insensitive institutional investors for each of the four classifications both in dollars ($billions) and as a percent of the total equity managed by all institutions within a classification.

TABLE 2
Analysis of Effect of Taxes on Portfolio Composition Surrounding Taxpayer Relief Act of 1997

Panel A: Univariate Statistics of Variables in Equation (2)

Variable	Mean	Median	Std Dev	Min	Max
ΔWGT	0.0004	0.0000	0.0027	-0.0170	0.0195
NUG	0.0008	0.0000	0.0023	-0.0023	0.0165
SIZE	7.4728	7.5329	1.9482	2.5239	11.6009
SP500	0.4602	0.0000	0.4984	0.0000	1.0000
AGE	25.4552	23.0000	21.5029	0.0000	72.0000
SGR	0.1761	0.1139	0.2454	-0.3060	1.5649
BETA	1.0919	1.0125	0.7229	-2.5292	7.1254
IRISK	0.0211	0.0173	0.0115	0.0075	0.0718
EP	0.0384	0.0512	0.0748	-0.5590	0.1785
DYLD	0.0150	0.0108	0.0173	0.0000	0.0998
BP	0.4409	0.3785	0.2885	-0.1011	1.7455
RATE	4.6969	5.0000	2.6176	1.0000	9.0000
DE	0.8891	0.4902	1.7701	-2.5218	16.1519

N = 2,458,685. See Appendix B for variable definitions.

Panel B: Univariate Statistics of Coefficient Estimates from Estimation of Equation (2)

Beta Estimate	Mean	Median	Std Dev	Min	Max
βNUG	0.0333	0.0365	0.2782	-2.7495	2.2715
βSIZE	0.0000	0.0000	0.0005	-0.0048	0.0042
βSP500	0.0000	0.0000	0.0015	-0.0151	0.0162
βAGE	0.0000	0.0000	0.0000	-0.0005	0.0004
βSGR	0.0005	0.0002	0.0027	-0.0223	0.0272
βBETA	0.0000	0.0000	0.0007	-0.0051	0.0068
βIRISK	0.0026	0.0003	0.0892	-0.8094	0.9276
βEP	0.0011	0.0002	0.0137	-0.1453	0.1400
βDYLD	-0.0004	-0.0003	0.0439	-0.6374	0.5698
βBP	0.0000	0.0000	0.0024	-0.0230	0.0215
βRATE	0.0000	0.0000	0.0002	-0.0016	0.0018
βDE	0.0000	0.0000	0.0004	-0.0041	0.0046

N = 7,752.

TABLE 2
Continued

Panel C: Univariate Statistics of Variables in Equation (3)

Variable	N	Mean	Median	Std Dev	Min	Max
βNUG	7,752	0.0333	0.0365	0.2782	-2.7495	2.2715
TRA97	7,752	0.1009	0	0.3012	0	1
TSII_GM	7,752	0.7497	1	0.4332	0	1
TSII_CL	6,172	0.8571	1	0.3500	0	1
TSII_IAPD	1,825	0.5430	1	0.4983	0	1
TSII_NEW	5,091	0.4219	0	0.4939	0	1
TE	7,752	13.6647	13.4315	1.5871	9.2185	17.8397
PTURN	7,752	-0.0427	-0.2008	0.9256	-1.6252	3.0232
BLOCK	7,752	-0.0702	-0.3789	0.7453	-1.0997	5.5565
WASIZE	7,752	8.7006	8.9070	1.0154	4.3860	10.8150
WASP500	7,752	0.6400	0.6933	0.2414	0.0000	1.0000
WAAGE	7,752	15.6198	16.4596	3.7597	2.7181	22.7547
WASGR	7,752	0.1653	0.1395	0.0978	-0.0808	0.6191
WABETA	7,752	1.0555	1.0250	0.1840	0.4000	2.1270
WAIRISK	7,752	0.0745	0.0690	0.0199	0.0470	0.1790
WAEP	7,752	0.0537	0.0550	0.0146	-0.1112	0.1180
WADYLD	7,752	0.0246	0.0245	0.0068	0.0000	0.0728
WABP	7,752	0.3885	0.3744	0.1027	0.1541	1.0686
WARATE	7,752	6.4989	6.5774	0.8178	0.0000	8.7813
WADE	7,752	0.3353	0.3180	0.1462	0.0265	1.6567

See Appendix B for variable definitions.

TABLE 2
Continued

Panel D: Multivariate Analyses

Independent Variables	(1)	(2)	(3)	(4)	(5)	(6)
TRA97	-0.015	0.008	-0.019	0.003	0.007	0.028
	(0.033)	(0.035)	(0.071)	(0.045)	(0.044)	(0.051)
*TSII_GM*TRA97*	-0.012				-0.001	
	(0.015)				(0.012)	
*TSII_CL*TRA97*		-0.052***				-0.043
		(0.015)				(0.024)
*TSII_IAPD*TRA97*			-0.080**			
			(0.034)			
*TSII_NEW*TRA97*				-0.053***	-0.053***	-0.057**
				(0.014)	(0.014)	(0.021)
TE	0.193***	0.194***	0.139*	0.184***	0.183***	0.203***
	(0.041)	(0.045)	(0.068)	(0.050)	(0.050)	(0.056)
PTURN	0.032*	0.035	0.013	0.036**	0.035**	0.037*
	(0.016)	(0.022)	(0.033)	(0.014)	(0.014)	(0.020)
BLOCK	-0.042	-0.037	-0.036	-0.052	-0.056	-0.066
	(0.030)	(0.043)	(0.058)	(0.029)	(0.030)	(0.040)
WASIZE	-0.036	-0.027	0.085	0.015	0.016	0.019
	(0.058)	(0.066)	(0.107)	(0.065)	(0.066)	(0.078)
WASP500	-0.121	-0.157	-0.613*	-0.350	-0.357	-0.475
	(0.150)	(0.181)	(0.300)	(0.212)	(0.213)	(0.273)
WAAGE	0.007	0.011	0.019	0.010	0.010	0.019
	(0.011)	(0.014)	(0.026)	(0.015)	(0.016)	(0.019)
WASGR	0.093	0.093	0.112	0.140	0.157	0.134
	(0.184)	(0.218)	(0.251)	(0.141)	(0.146)	(0.166)
WABETA	0.075	0.047	-0.030	0.103	0.106	0.067
	(0.077)	(0.092)	(0.155)	(0.115)	(0.118)	(0.136)
WAIRISK	0.372	0.672	1.168	-0.856	-0.879	-0.546
	(1.914)	(2.192)	(1.499)	(1.968)	(1.964)	(1.843)
WAEP	-0.833	-0.917	-1.541	-1.465	-1.358	-1.633
	(1.332)	(1.512)	(1.395)	(1.159)	(1.186)	(1.126)

Table 2, Panel D (continued)

Independent Variables	(1)	(2)	(3)	(4)	(5)	(6)
WADYLD	2.422	3.235	4.983	2.393	2.551	3.925
	(3.246)	(3.421)	(7.533)	(5.086)	(5.173)	(5.484)
WABP	0.261	0.301	0.601	0.455**	0.451*	0.497**
	(0.192)	(0.196)	(0.412)	(0.191)	(0.203)	(0.167)
WARATE	0.008	0.025	0.040	-0.012	-0.011	-0.001
	(0.032)	(0.032)	(0.050)	(0.044)	(0.045)	(0.051)
WADE	0.187*	0.166*	-0.082	0.058	0.063	0.007
	(0.084)	(0.082)	(0.231)	(0.119)	(0.122)	(0.113)
Institution Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Quarter Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7,752	6,172	1,825	5,091	5,041	4,093
Adjusted R-squared	0.171	0.181	0.199	0.167	0.167	0.177

Columns (1)–(4) presents the results of estimating equation (3) using classifications used in prior studies (*TSII_GM*, *TSII_CL*, and *TSII_IAPD*) and using our classification (*TSII_NEW*), respectively. Columns (5) and (6) include our classification as well as each of the two prior classifications based on legal type (*TSII_GM* and *TSII_CL*, respectively). The dependent variable is β_{NUG}. Standard errors are clustered at the institution level and quarter level and appear in parentheses below coefficient estimates. See Appendix B for variable definitions. ***, **, and * denote statistical significance at the 0.01, 0.05, and 0.10 level, respectively, using a two-tailed test.

TABLE 3
Analysis of Lock-in Induced Price Pressure around Announcement of Taxpayer Relief Act of 1997

Panel A: Univariate Statistics of Variables in Equation (4)

Variable	Mean	Median	Std Dev	Min	Max
RETURN	-0.001	-0.003	0.057	-0.181	0.198
TSII_GM_NUG	0.044	0.026	0.100	-0.291	0.368
TSII_CL_NUG	0.038	0.022	0.089	-0.263	0.339
TSII_IAPD_NUG	0.004	0.000	0.012	-0.033	0.071
TSII_NEW_NUG	0.006	0.001	0.017	-0.054	0.101
TSII_GM_PCT	0.274	0.256	0.194	0.000	0.999
TSII_CL_PCT	0.244	0.228	0.173	0.000	0.912
TSII_IAPD_PCT	0.022	0.008	0.035	0.000	0.328
TSII_NEW_PCT	0.034	0.020	0.049	0.000	0.948
APPR	0.516	0.214	0.796	0.000	4.538
WKL97	0.007	0.000	0.083	0.000	1.000
SIZE	12.189	12.007	2.091	7.999	17.591
SP500	0.163	0.000	0.369	0.000	1.000
SGR	0.131	0.099	0.229	-0.551	1.226
BETA	1.004	0.940	0.889	-1.526	3.785
IRISK	0.032	0.026	0.020	0.008	0.115
EP	0.019	0.049	0.134	-0.84	0.232
DYLD	0.010	0.000	0.015	0.000	0.068
BP	0.584	0.484	0.416	-0.157	2.259
RATE	4.470	4.000	1.948	1.000	9.000
DE	0.688	0.367	1.179	-1.825	8.445

N = 256,117. See Appendix B for variable definitions.

TABLE 3
Continued

Panel B: Multivariate Analyses

Independent variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
TSII_GM_NUG WKL97*	-0.021***				0.010***		
	(0.003)				(0.004)		
TSII_CL_NUG WKL97*		-0.028***				0.005	
		(0.003)				(0.004)	
TSII_IAPD_NUG WKL97*			-0.348***				-0.210***
			(0.015)				(0.034)
TSII_NEW_NUG WKL97*				-0.254***	-0.284***	-0.268***	-0.118***
				(0.012)	(0.015)	(0.015)	(0.026)
TSII_GM_NUG	0.013***				0.010**		
	(0.004)				(0.004)		
TSII_CL_NUG		0.013***				0.009*	
		(0.004)				(0.005)	
TSII_IAPD_NUG			0.093***				0.018
			(0.023)				(0.033)
TSII_NEW_NUG				0.077***	0.028	0.034*	0.066**
				(0.018)	(0.017)	(0.017)	(0.026)
TSII_GM_PCT	0.031***				0.035***		
	(0.004)				(0.004)		
TSII_CL_PCT		0.032***				0.035***	
		(0.004)				(0.004)	
TSII_IAPD_PCT			-0.013				-0.009
			(0.008)				(0.012)
TSII_NEW_PCT				-0.010	-0.033***	-0.030***	-0.003
				(0.006)	(0.007)	(0.007)	(0.009)
APPR	-0.001***	-0.001***	-0.001**	-0.001**	-0.001***	-0.001***	-0.001**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
*APPR*WKL97*	0.001**	0.001**	0.001**	0.001**	0.001*	0.001*	0.001**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
SIZE	-0.024***	-0.024***	-0.024***	-0.024***	-0.024***	-0.024***	-0.024***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
SP500	0.006***	0.006***	0.004*	0.004*	0.006***	0.006***	0.004*
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
SGR	0.008***	0.008***	0.008***	0.008***	0.008***	0.008***	0.008***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)

BETA	-0.001	-0.001	-0.001*	-0.001*	-0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
IRISK	-0.015	-0.016	-0.033	-0.032	-0.014	-0.016	-0.033
	(0.030)	(0.030)	(0.030)	(0.030)	(0.030)	(0.030)	(0.030)
EP	0.021***	0.021***	0.022***	0.022***	0.021***	0.021***	0.022***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
DYLD	-0.051***	-0.053***	-0.054***	-0.053***	-0.050***	-0.051***	-0.053***
	(0.018)	(0.018)	(0.019)	(0.019)	(0.018)	(0.018)	(0.019)
BP	-0.039***	-0.039***	-0.041***	-0.040***	-0.039***	-0.039***	-0.040***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)
RATE	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
DE	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Week Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	256,117	256,117	256,117	256,117	256,117	256,117	256,117
Adj. R-squared	0.019	0.019	0.018	0.018	0.019	0.019	0.018

Columns (1)–(4) presents the results of estimating equation (4) using classifications used in prior studies (*TSII_GM*, *TSII_CL*, and *TSII_IAPD*) and using our classification (*TSII_NEW*), respectively. Columns (5) and (6) include our classification as well as each of the two prior classifications based on legal type (*TSII_GM* and *TSII_CL*, respectively). Column (7) includes our classification as well as *TSII_IAPD*. The dependent variable in each column is the weekly stock return calculated as the sum of the logged daily returns from Wednesday to the following Tuesday less the weekly return from the firm's size-matched portfolio (*RETURN*). Robust standard errors clustered by firm and by week are in parentheses below coefficient estimates. See Appendix B for variable definitions. ***, **, and * denote statistical significance at the 0.01, 0.05, and 0.10 level, respectively, using a two-tailed test.

TABLE 4
Comparison of Performance of Stocks Held in Portfolios of Tax-Sensitive and Tax-Insensitive Institutional Investors

Panel A: Comparison of Performance of Stocks Held by Tax-Sensitive and Tax-Insensitive Institutional Investors Classified Using TSII_GM or TSII_CL

	TSII_GM=1	*TSII_GM*=0	Difference	*TSII_CL*=1	*TSII_CL*=0	Difference
Return	2.3400	2.2000	0.1400	2.3300	2.3700	-0.0400
Fama-French-Carhart Alpha	0.4480	0.2880	0.1600***	0.4620	0.3500	0.1120***
Fama-French-Carhart Alpha Adjusted for Portfolio Size	-0.0050	-0.1530	0.1480***	0.0101	-0.1220	0.1321***
Fama-French-Carhart Alpha Adjusted for Governance	-0.0070	-0.1300	0.1230***	0.0067	-0.0910	0.0977***
Fama-French-Carhart Alpha Adjusted for Legal Type	-0.0080	-0.0150	0.0070	-0.0090	-0.0290	0.0200

This table compares the pre-tax performance of stocks held by tax-sensitive and tax-insensitive institutional investors (classified based on legal type) using various performance measures (expressed as %) over the period 1996–2013. See Appendix B for the definitions of *TSII_GM* and *TSII_CL*. Return equals the weighted average buy-and-hold return of stocks held in an institution's portfolio at the beginning of the quarter. Fama-French-Carhart Alpha equals the quarterly alpha computed using the four-factor Fama-French-Carhart model (Fama and French 1993; Carhart 1997). To adjust for portfolio size, we subtract the mean Fama-French-Carhart alpha of the institution's portfolio size decile from the institution's Fama-French-Carhart alpha for the particular quarter. To control for "governance," we consider the trading and governance behavior of institutions by using the Bushee (2001) classification of institutions into three groups—transient, dedicated, and quasi-indexer—based on their portfolio turnover and blockholdings. We subtract the mean Fama-French-Carhart alpha of an institution's "governance" group from the institution's Fama-French-Carhart alpha for the particular quarter. To control for legal type, we subtract the mean Fama-French-Carhart alpha of the institution's legal type from the institution's Fama-French-Carhart alpha for the particular quarter. We use the legal type classifications in Bushee and Goodman (2007) (http://www.iiclassifications.com). The number of institution-quarter observations for *TSII_GM*=1 (*TSII_GM*=0) institutions equals 98,398 (14,403) for Return and 87,220 (13,454) for the metrics based on a Fama-French-Carhart alpha. The number of institution-quarter observations for *TSII_CL*=1 (*TSII_CL*=0) institutions equals 94,604 (7,625) for Return and 83,572 (7,211) for the metrics based on a Fama-French-Carhart alpha. ***, **, and * denote that the difference is statistically significant at the 0.01, 0.05, and 0.10 level, respectively, using a two-tailed test.

TABLE 4
Continued

Panel B: Comparison of Performance of Stocks Held by Tax-Sensitive and Tax-Insensitive Institutional Investors Classified Using TSII_IAPD or TSII_NEW

	TSII_ IAPD=1	*TSII_ IAPD*=0	Difference	*TSII_ NEW*=1	*TSII_ NEW*=0	Difference
Return	2.1400	2.4800	-0.3400**	2.2000	2.5500	-0.3500***
Fama-French-Carhart Alpha	0.4480	0.4440	0.0040	0.3530	0.4370	-0.0840***
Fama-French-Carhart Alpha Adjusted for Portfolio Size	-0.0510	-0.0590	0.0080	-0.0810	-0.0350	-0.0460***
Fama-French-Carhart Alpha Adjusted for Governance	0.0031	-0.0240	0.0271	-0.0640	-0.0190	-0.0450***
Fama-French-Carhart Alpha Adjusted for Legal Type	-0.0710	-0.1160	0.0450**	-0.0890	-0.0070	-0.0820***

This table compares the pre-tax performance of stocks held by tax-sensitive and tax-insensitive institutional investors as classified by either *TSII_IAPD* or *TSII_NEW* using various performance measures (expressed as %) over the period 1996–2013. See Appendix B for the definitions of *TSII_IAPD* and *TSII_NEW*. Return, Fama-French-Carhart alpha, and the adjustments for portfolio size, governance, and legal type are defined as in Panel A. The number of observations for *TSII_IAPD* = 1 (*TSII_IAPD* = 0) institutions equals 15,919 (9,743) for Return and 15,478 (9,511) for the metrics based on a Fama-French-Carhart alpha. The number of observations for *TSII_NEW* = 1 (*TSII_ NEW* = 0) institutions equals 35,315 (33,735) for Return and 34,841 (33,457) for the metrics based on a Fama-French-Carhart alpha. ***, **, and * denote that the difference is statistically significant at the 0.01, 0.05, and 0.10 level, respectively, using a two-tailed test.