SHORT SELLING AND CORPORATE TAX AVOIDANCE

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ABSTRACT

This study examines short selling as one external determinant of corporate tax avoidance. Prior research suggests that short sellers have information advantages over retail investors, and high short-interest levels are a bearish signal of targeted stock prices. As a result, when short-interest levels are high, managers have been shown to take actions to minimize the negative effect of high short interest on firms’ stock prices. Tax-avoidance activities may convey a signal of bad news (i.e., high stock price crash risk). We predict that, when short-interest levels are high, managers possess incentives to reduce firm tax avoidance in order to reduce the associated stock price crash risk. Consistent with this prediction, we find that short interest is negatively associated with subsequent tax-avoidance levels. This effect is incremental to other factors identified by prior research. We conclude that short selling significantly constrains corporate tax avoidance.

Keywords: Short selling; tax avoidance; stock price crash risk; effective tax rates; book-tax differences; tax shelters

INTRODUCTION

A popular research stream in the tax accounting literature focuses on corporate tax avoidance. One area that draws a widespread interest is the determinants of corporate tax avoidance, especially after Shackelford and Shevlin (2001) expressed a demand for more research in understanding the cross-sectional differences in firms’ willingness to avoid taxes. The extant literature has studied...
mostly *internal* determinants of corporate tax avoidance, such as how firms with various characteristics, tax-planning opportunities, and managerial incentives are able to avoid more taxes.\(^1\) Each of these previously examined determinants encourages managers and their firms to engage in more tax-avoidance activities. In this chapter, we investigate whether firms attempt to respond to one *external* factor, short selling, by strategically *reducing* their tax-avoidance activities.

Compared to taking a long position in a security, short selling is more risky and costly, as short sellers trade on securities they do not directly own. Therefore, short sellers will not execute a transaction unless they expect that security’s price to fall by a sufficient amount to compensate for the costs and risks of shorting (Diamond & Verrecchia, 1987). Prior literature suggests that short sellers hold an information advantage over retail investors and even analysts (Drake, Rees, & Swanson, 2011; Khan & Lu, 2013). When short sellers concentrate to bet on a specific security’s price decline, this high short-interest level signals to the market that the targeted stock is overvalued relatively to its fundamentals, and the stock price is likely to decrease (i.e., greater stock price crash risk). In fear of this negative signal that high short interest can send to firms’ existing and prospective investors, prior research finds that managers respond to high short interest by decreasing discretionary accruals (and the likelihood of marginally beating earnings targets) and adjusting their disclosure policy to reduce bad news forecasts (Fang, Huang, & Karpoff, 2015; Li & Zhang, 2015).

To avoid the chance of questionable tax positions being detected, scrutinized, and overturned by taxing authorities, tax-avoidance activities often have complex structures. These complex structures correspondingly increase the complexity of financial reporting and often signal hidden bad news. For example, Enron used tax-shelter arrangements to manipulate earnings while preventing investors from understanding the source of the fabricated revenue (JCT, 2003). As bad news associated with misleading tax-avoidance activities accumulates, firms’ stock price crash risk significantly increases (Kim, Li, & Zhang, 2011). This risk is exacerbated when a firm experiences high short interest, a period when a large number of sophisticated investors trade on a firm’s anticipated stock price declines by shorting the firm’s shares for a profit. Because managers closely monitor their firms’ market prices and face strong incentives to stave off stock price crashes (Bergstresser & Philippon, 2006; Burgstahler & Dichev, 1997), we argue that, when short-interest levels are high and the stock price is more sensitive to firm-specific bad news, it is reasonable to expect firm managers to constrain negative-signal hoarding activities, such as tax-avoidance activities (Grullon, Michenaud, & Weston, 2015).

To measure tax avoidance, we use a variety of proxies calculated from financial statement data. Specifically, we use four proxies following prior literature: cash and GAAP effective tax rates (ETRs), discretionary permanent book-tax differences, and tax-shelter scores (Frank, Lynch, & Rego, 2009; Gallemore & Labro, 2015; Wilson, 2009). To measure short interest, we use open short-interest positions reported eight and a half months before the current fiscal year-end (i.e., three and a half months after the previous fiscal year-end) so that short sellers may digest
the financial statements from the previous fiscal year before taking (or not taking) short positions in firms’ securities.²

Consistent with our hypothesis that short-selling curbs tax avoidance, we find that high short interest observed during the fourth month after the previous fiscal year-end is positively associated with subsequent cash and GAAP ETRs (i.e., less tax avoidance). Further, as predicted, we find strong negative associations between short-interest levels and our two more egregious tax-avoidance proxies — discretionary permanent book-tax differences and tax-shelter scores — indicating that short selling has a strong constraining effect on more aggressive tax-avoidance activities.

We perform several additional analyses and robustness tests. First, we use two-stage least squares (2SLS) estimation to address endogeneity concerns and bolster the causal inferences that we draw from our results. Specifically, in our first-stage model, we use the industry-year mean level of short interest as our instrumental variable (IV) to predict firm-specific short interest. We verify that this variable is not a weak instrument. Then, in our second-stage model, we replace actual short-interest levels with the predicted values from our first-stage model and find consistent results for three of four tax-avoidance outcome variables.

Second, we partition our sample into low, middle, and high analyst coverage subsamples. As prior literature suggests that firms with less analyst following are more likely to experience a stock price crash risk related to tax avoidance, we expect managers of these firms to face greater incentives to reduce tax avoidance under the scrutiny of short sellers. However, contrary to our expectation, we find that results are more pronounced in firms with more analyst coverage (i.e., the high analyst coverage tercile). One possible explanation is that managers of firms with more analyst coverage tend to be more accountable to external investors and thus focus more on stock market conditions. These managers are, therefore, more likely to be aware of high short-interest levels and consequently more likely to rein in tax-avoidance activities following increases in short interest.

Third, we examine three alternative specifications of our short-interest variable: (1) measuring short interest in the middle of the fifth month after the previous fiscal year-end, (2) varying the timing of the measurement of short interest with each firm’s filer status (i.e., large accelerated filers, accelerated filers, and nonaccelerated filers), and (3) measuring short interest as a 12-month average. Our results are qualitatively similar under these alternative specifications.

Fourth, it is possible that managers respond to short interest by providing more information related to existing tax positions in their firms’ disclosures. We address this possibility by controlling for transparency related to tax avoidance. Our main results are robust to including this control.

This study demonstrates how managers strategically react to high short interest by subsequently constraining tax avoidance. There is a long stream of research within the larger tax-avoidance literature examining whether tax avoidance is “good” or “bad” (i.e., do managers engage in tax avoidance to enhance firm value or to extract rents?). We contribute to this research stream by demonstrating that managers rein in tax avoidance in response to short-selling pressure. Specifically, our study complements Kim et al. (2011), who demonstrate
that stock price crash risk is positively associated with tax avoidance. Our results indicate that managers view tax avoidance as one dial they may turn to alleviate the concentrated short-selling attention their firms experience. Our study also builds on and supports Hoopes, Mescall, and Pittman (2012), who demonstrate that managers are able to “undo” most tax-avoidance activities in a relatively short time (less than a year). The implication for managers is that, regardless of whether tax avoidance truly is “good” or “bad,” reducing tax avoidance is (1) doable in a short window and (2) may alleviate the short-selling pressure their firms are experiencing.

We also contribute to the literature on short selling by showing that short selling has a constraining effect on corporate tax avoidance. This finding is complementary and incremental to other monitoring effects of short selling demonstrated by prior studies, such as detecting financial misconduct and preventing earnings management (Fang et al., 2015; Li & Zhang, 2015).

Finally, we add to the large body of research that studies the determinants of tax avoidance. While much of the work in the related literature is dedicated to identifying tax-avoidance determinants that are internal to the firm and encourage more tax avoidance, only a few articles examine external factors such as the tax authority monitoring and reputation costs that encourage less tax avoidance. We provide evidence of the existence of another external determinant of tax avoidance — short selling — by showing that managers reduce firm tax-avoidance activities when short-interest levels are high.

The remainder of the chapter is organized as follows. The section following discusses the related literature and develops our hypothesis. The next section thereafter describes variable definitions, data sources, and empirical models. The section thereafter presents primary results that test the association between short selling and tax avoidance. This section also presents additional analyses and robustness tests. Finally, the last section concludes.

**LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT**

*Determinants of Corporate Tax Avoidance*

Although government tax authorities such as the Internal Revenue Service (IRS) impose corporate income taxes on all profitable firms at specified statutory rates, firm managers maintain a considerable amount of discretion over the tax-planning strategies they choose to undertake and the associated tax-avoidance outcomes. Dyreng, Hanlon, and Maydew (2008) provide empirical evidence to support the argument that firms can strategically avoid taxes over the long run and keep long-term cash ETRs (i.e., the ratio of cash taxes paid to pretax income) at a level that is significantly lower than the statutory tax rate. In fact, many studies in accounting and finance identify factors that determine corporate tax-avoidance outcomes (e.g., Dyreng, Hanlon, & Maydew, 2010). Much of the literature points to determinants that are embedded in firm characteristics, tax-planning opportunities, and managerial incentives. These determinants are often
internal and encourage more tax avoidance (i.e., lower ETRs, larger book-tax differences, and a greater likelihood of tax-shelter participation). For example, firms that have larger capital expenditures, more extensive foreign operations, subsidiaries located in tax havens, more aggressive financial reporting, and more tax services provided by their external auditors with tax-specific industry expertise have lower tax liabilities (Frank et al., 2009; Gupta & Newberry, 1997; Klassen & Laplante, 2012; Lisowsky, 2010; McGuire, Omer, & Wang, 2012; Rego, 2003; Wilson, 2009). When a firm is managed by a CEO who has high stock option convexity or after-tax compensation incentives, or when a firm’s tax department is evaluated as a profit center as opposed to a cost center, the firm’s managers also are incentivized to avoid more taxes (Gaertner, 2014; Rego & Wilson, 2012; Robinson, Sikes, & Weaver, 2010).

Prior literature provides limited evidence on external factors that influence firm tax avoidance; these factors normally play a constraining role in determining corporate tax avoidance. For example, Hoopes et al. (2012) show that firms undertake fewer aggressive tax positions when there is stricter monitoring and tax enforcement from the IRS. Prior research also suggests that reputational costs prevent egregious tax avoidance (Graham, Hanlon, Shevlin, & Shroff, 2013). Hanlon and Slemrod (2009) find a negative stock market reaction when the media exposes a firm engaging in tax shelters, indicating that firms suffer a reputational cost when they are “caught” engaging in these activities. Chen, Chen, Cheng, and Shevlin (2010) also provide evidence of this reputational cost argument, demonstrating that firms owned/managed by founding family members engage in less tax avoidance than nonfamily firms, presumably because family firms are more sensitive to reputational and litigation costs associated with aggressive tax avoidance. On the other hand, Gallemore, Maydew, and Thornock (2014) suggest that firms do not bear reputational costs of tax avoidance in terms of executive or auditor turnover, sales growth or advertising expenses, or the likelihood of making the Fortune magazine list for “most admired companies.” Overall, the extant literature provides limited evidence on external factors that influence firm tax avoidance. In this chapter, we contribute by introducing an external element that may have an inhibiting effect on tax avoidance: short selling.

**Short Selling**

According to the Securities and Exchange Commission’s (SEC) definition, short sellers are traders who borrow a security — usually from institutional owners, brokerages, or broker-dealers — and sell it with the intention of buying the security back at a later date to return to its owner.³ Unlike retail investors who take long positions in corporate securities in anticipation of stock price increases, short sellers undertake transactions with the belief that the stock price will decrease in the future, enabling them to profit from overpriced stocks. Because of a significant amount of costs associated with the short positions (i.e., collateral, borrowing costs, rebate rates, and so on), only informed short sellers who have strong beliefs concerning the downward price prediction will choose to sell a certain security short (Diamond & Verrecchia, 1987). Therefore, short sellers
are not merely noise traders. Mounting evidence supports the notion that short sellers have information advantages over retail investors, and their short positions convey bearish information about the targeted security (Chi, Pincus, & Teoh, 2014; Christophe, Ferri, & Angel, 2004; Desai, Ramesh, Thiagarajan, & Balachandran, 2002; Kecskés, Mansi, & Zhang, 2012; Pownall & Simko, 2005; Senchack and Starke, 1993).

Short sellers benefit the market and play a crucial role in enhancing market efficiency through improving the extent to which current stock prices reflect information about future earnings (Drake, Myers, Myers, & Stuart, 2015). Dechow, Hutton, Meulbroek, and Sloan (2001) find that short sellers are able to use information contained in fundamental ratios such as earnings and book values to take positions in stocks with lower expected future returns. Drake et al. (2011) find that short sellers’ ability to predict future returns surpasses analyst recommendations. Therefore, short sellers’ trading behavior conveys external benefits to other investors and promotes price efficiency.

More recent articles demonstrate that short sellers have the ability to detect financial misconduct and earnings restatements as early as 19 months in advance of subsequent public unwinding of such firm incidents (Desai, Krishnamurthy, & Venkataraman, 2006; Karpoff & Lou, 2010; Massa, Zhang, & Zhang, 2015). High short interest is also linked to high audit risk, in which case, the clients’ financial statements contain material misstatement while auditors issue unqualified opinions (Cassell, Drake, & Rasmussen, 2011). As a result of these factors, high short interest serves as a red flag of firms’ financial reporting opacity and lack of integrity, which could lead to abrupt declines in stock price (Kim & Zhang, 2014; Kim & Zhang, 2016).

**Hypothesis Development**

Existing literature indicates that managers will strategically react to aggregate market conditions to maintain optimistic earnings valuations (Bergman & Roychowdhury, 2008; Brown, Christensen, Elliott, & Mergenthaler, 2012). Because high short-interest levels send strong risky signals to the market, managers of scrutinized firms may respond to intensely pessimistic short-interest levels in order to prevent their firms’ stock prices from crashing. More specifically, managers may behave in a manner to halt or even reverse the negative effect of high short interest and send positive future performance signals to the market. Relevant research provides support for this argument. For example, Fang et al. (2015) and Li and Zhang (2015) study managerial response to short-selling pressure introduced by an SEC regulation. Fang et al. (2015) find that firms facing reduced cost of short selling (and thus increased short-interest levels) significantly reduce their discretionary accruals and likelihood of marginally beating earnings targets, suggesting that short-selling curbs earnings management via discretionary accruals. Li and Zhang (2015) find that managers respond to increased short interest and consequent stock price sensitivity to bad news by reducing the precision and the readability of voluntary disclosures of bad news.
forecasts. The authors interpret the result as managers strategically minimizing the adverse effect of high short interest on share price.

Because tax avoidance may trigger negative stock price reactions (Hanlon & Slemrod, 2009) and is associated with activities that accumulate bad news that, over an extended period, may push the stock price crash risk over a tipping point (Kim et al., 2011), managers in fear of a looming stock price crash may reduce tax avoidance to prevent the exposure of bad news related to this tax avoidance. In particular, managers face incentives to rein in their firms’ tax-avoidance activities when their firms face high short interest, during which period stock prices are more sensitive to bad news. Building on these arguments, we predict that managers will actively respond to high short-interest levels by reducing firm tax avoidance:

**H1.** Corporate tax avoidance is negatively associated with short interest.

**VARIABLE MEASUREMENT, MODEL, AND DATA**

*Measuring Tax Avoidance*

We use several measures of corporate tax avoidance because there is no single proxy used by prior literature that perfectly apprehends this underlying construct (Hanlon & Heitzman, 2010). We choose four measures following existing literature, each representing a unique aspect of the underlying concept. Because we measure tax avoidance as a response to short selling, such that managers must see and have time to modify tax-avoidance activities in response to short-interest levels, we calculate all tax-avoidance proxies as future measures relative to the short-selling variable (we provide details of the timing of our variable measurement in the modeling section). These four proxies are cash ETR (CETR), GAAP ETR (GETR), discretionary permanent book-tax differences (DTAX), and a tax-shelter prediction score (SHELTER).

CETR and GETR capture the overall annual tax-planning outcomes. A manager’s strategic adjustment of a firm’s tax-avoidance level in response to high short interest should be reflected in at least one (if not both) of these two variables. We calculate CETR as cash taxes paid (TXPD) divided by pretax income (PI) less special items (SPI). This variable is commonly used in the tax-avoidance literature, and it is affected by any tax-deferral strategies (e.g., accelerated depreciation for tax purposes) managers may use to reduce current-year cash taxes paid. We calculate GETR as total tax expense (TXT) divided by PI SPI. GETR differs from CETR in that it is not influenced by tax-deferral strategies, but it does reflect the effect of other accounting earnings-related strategies (e.g., designation of unremitted foreign earnings as permanently reinvested). Both variables together would capture the outcomes of overall changes in tax-avoidance activities due to short-selling pressure. Larger values of CETR and GETR represent less tax avoidance.

The remaining two tax-avoidance measures are DTAX and SHELTER. Both variables derive from an array of financial statement ratios and reflect more egregious tax-avoidance activities. DTAX measures discretionary permanent
differences in a firm’s book income and taxable income, and a larger value of \( DTAX \) is associated with aggressive tax reporting and aggressive financial reporting behavior (Frank et al., 2009). Following Frank et al. (2009), we calculate \( DTAX \) as the residual from the following regression estimated by year and industry, where industry is identified using two-digit Standard Industrial Classification (SIC) codes:8

\[
\text{PERMDIFF}_{it} = \alpha_0 + \alpha_1(1/AT_{it-1}) + \alpha_2\text{INTANG}_{it} + \alpha_3\text{UNCON}_{it} + \alpha_4\text{MI}_{it} + \alpha_5\text{CSTE}_{it} + \alpha_6\Delta\text{NOL}_{it} + \alpha_7\text{PERMDIFF}_{it-1} + \epsilon_{it}
\]

\( SHELTER \) is an indicator variable equal to 1 for firms in the top quintile of the predicted probability that the firm is engaged in tax sheltering and 0 otherwise, where the predicted probability is based on the following model from Wilson (2009):

\[
\text{PROB}_{SHELTER} = -4.30 + 6.63 \times \text{BTD} - 1.72 \times \text{LEV} + 0.66 \times \text{LOG}_\text{AT} + 2.26 \times \text{ROA} + 1.62 \times \text{FOREIGN} + 1.56 \times \text{R&D}
\]

Larger values of \( DTAX \) and \( SHELTER \) represent more tax avoidance.

**Empirical Model**

We test our hypothesis using the following empirical model:

\[
\text{TAX}_\text{AVOIDANCE}_{t+1} = \alpha_0 + \alpha_1\text{SHORT}_\text{INTEREST}_{t} + \alpha_2\text{LOG}_\text{AT}_{t+1} + \alpha_3\text{LEV}_{t+1} + \alpha_4\text{ROA}_{t+1} + \alpha_5\text{FOREIGN}_{t+1} + \alpha_6\text{R&D}_{t+1} + \alpha_7\Delta\text{NOL}_{t+1} + \alpha_8\text{DIS}_\text{ACCURUAL}_{t+1} + \alpha_9\text{CAPEX}_{t+1} + \alpha_{10}\text{INST}_\text{OWN}_{t+1} + \alpha_{11}\text{N}_\text{ANALYSTS}_{t+1} + \alpha_{12}\text{BTM}_{t+1} + \alpha_{13}\text{PP&E}_{t+1} + \alpha_{14}\text{SALES}_\text{GROWTH}_{t+1} + \alpha_{15}\text{CFO}_{t+1} + \alpha_{16}\text{YEAR} + \alpha_{17}\text{INDUSTRY} + \epsilon_{t+1}
\]

Eq. (3) models \( \text{TAX}_\text{AVOIDANCE} \) (proxies discussed before) as a function of \( \text{SHORT}_\text{INTEREST} \), the main variable of interest. The Financial Industry Regulatory Authority (FINRA) requires firms to report the gross volume of open short positions on a monthly basis at every mid-month. We obtain short-interest volume reported eight and a half months before tax-avoidance variables are measured (i.e., in the middle of the fourth month after previous fiscal year-end) and scale it by common shares outstanding at the beginning of the month (Chi et al., 2014; Dechow et al., 2001; Hirshleifer et al., 2011; Richardson, 2003).9 During this period, short-selling activities are expected to escalate, responding to fundamental ratios released in the prior year’s financial
statements; the time lag between when we measure short interest and tax avoidance provides managers sufficient time to adjust tax-avoidance activities in response to short-selling pressure. See Fig. 1 for a timeline of variable measurement.

In Eq. (3), we also include a series of variables to control for factors that are known to impact corporate tax avoidance. First, we control for factors inherent in firm characteristics that also correlate with tax avoidance (Chen et al., 2010; Dyreng et al., 2008; Frank et al., 2009; Graham & Tucker, 2006). These factors include the natural logarithm of total assets ($\text{LOG}\_\text{AT}$), leverage ($\text{LEV}$), return on assets ($\text{ROA}$), the book-to-market ratio ($\text{BTM}$), sales growth ($\text{SALES}\_\text{GROWTH}$), and the change in net operating loss carryforwards ($\Delta\text{NOL}$). Second, we control for variables that represent tax-planning opportunities and expenditures that also could affect tax-avoidance outcomes (Gupta & Newberry, 1997; Hanlon, 2005; Klassen & Laplante, 2012; Rego, 2003). These variables include capital expenditures ($\text{CAPEX}$), an indicator variable for foreign income ($\text{FOREIGN}$), pretax cash flow from operations ($\text{CFO}$), depreciation tax shields ($\text{PP&E}$), and research and development expense ($\text{R&D}$). Lastly, we control for financial reporting quality factors following Khurana and Moser (2012) and Frank et al. (2009). These control variables include discretionary accruals calculated using the performance-adjusted modified Jones model ($\text{DIS}\_\text{ACCRUAL}$) (Kothari, Leone, & Wasley, 2005), institutional ownership as a percent of shares outstanding ($\text{INST}\_\text{OWN}$), and the natural logarithm of the number of analysts following the firm ($\text{N}\_\text{ANALYSTS}$). We measure these control variables contemporaneously to our tax-avoidance variables. We also include year and industry fixed effects in the regressions, and we cluster standard errors by firm.

As discussed previously, smaller (larger) values of $\text{CETR}$ and $\text{GETR}$ ($\text{DTAX}$ and $\text{SHELTER}$) represent more tax avoidance. Therefore, a significantly positive (negative) coefficient on $\text{SHORT}\_\text{INTEREST}$ ($\alpha_1$) in the $\text{CETR}$ and $\text{GETR}$ ($\text{DTAX}$ and $\text{SHELTER}$) regressions would support our hypothesis that short-selling constrains corporate tax avoidance.

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**Timeline of Variable Measurement**

<table>
<thead>
<tr>
<th>year $t$ fiscal year-end</th>
<th>3.5 months after year $t$ fiscal year-end</th>
<th>year $t+1$ fiscal year-end</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\downarrow$</td>
<td>$\downarrow$</td>
<td></td>
</tr>
<tr>
<td>$\text{SHORT}_\text{INTEREST}(t)$</td>
<td>$\text{TAX}_\text{AVOIDANCE}(t+1)$</td>
<td></td>
</tr>
</tbody>
</table>

Fig. 1. Timeline of Variable Measurement. Note: A timeline of variable measurement in the main model. $\text{SHORT}\_\text{INTEREST}(t)$ is measured eight and a half months before $\text{TAX}\_\text{AVOIDANCE}(t + 1)$ variables (i.e. $\text{CETR}$, $\text{GETR}$, $\text{DTAX}$, and $\text{SHELTER}$) are measured (i.e., three and a half months after the previous fiscal year-end).
Data

We begin our sample selection with all available firm-year observations in the Compustat — Fundamentals Annual database between 2000 and 2013 to calculate tax-avoidance variables. We require firms to have nonmissing total assets and positive special items-adjusted PI. We also require at least 10 observations per industry-year combination, where industry is identified using two-digit SIC code. We eliminate firms in the financial services industry (SIC 6000—6999) and utilities industry (SIC 4900—4949).

We acquire data related to monthly short-selling activities from the Compustat — Supplemental Short-interest file. We measure SHORT_INTEREST as the aggregate raw short-interest level eight and a half months before TAX_AVOIDANCE is calculated (i.e., in the middle of the fourth month after previous fiscal year-end), and we scale it by common shares outstanding at the beginning of the month taken from the monthly CRSP file. We eliminate stocks that are not trading on the New York Stock Exchange, American Stock Exchange, or the NASDAQ Stock Market. We further restrict our analyses to include only ordinary common shares. In the event of multiple security classes for the same firm, we keep the major security with largest short-interest volume.

As for control variables, we take institutional ownership data from the Thomson Reuters Institutional (13f) Holdings file. Analyst-following data come from the I/B/E/S summary file. We calculate other control variables from Compustat. After merging all datasets and eliminating observations based on the criteria discussed previously, the final sample contains 43,773 firm-year observations. Table 1 presents the sample selection process and the number of observations by year and industry.

We present descriptive statistics in Table 2 for all variables used in the regressions. The mean CETR is 0.2402, while the mean GETR is 0.2719. The mean value of DTAX is 0.0377, consistent with Rego and Wilson (2012). The mean (median) short-interest level is 3.78 (1.69 percent of shares outstanding), which is consistent with that of the prior literature (Chi et al., 2014; Christensen, Drake, & Thornock, 2014). Similar to Rego and Wilson (2012), the average firm has total assets worth US$424 million, with 6.00 percent spent on R&D and 6.30 percent spent on capital expenditures. Firms in the sample also have a mean institutional ownership of 38.63 percent and an average of approximately seven analysts following, which is similar to Bergman and Roychowdhury (2008).

EMPIRICAL RESULTS

Our main analyses examine whether managers strategically adjust firm tax-avoidance levels downward as short-interest levels increase. To test our hypothesis, we estimate Eq. (3) using ordinary least squares (OLS) with CETR, GETR, and DTAX as the tax-avoidance proxy and using logistic regression with SHELTER as the tax-avoidance proxy. Table 3 contains the results of these regressions. For CETR, the coefficient on SHORT_INTEREST (0.0010) is
Table 1. Sample Distribution.

Panel A: Sample Selection Process

<table>
<thead>
<tr>
<th>Category</th>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observations with tax avoidance data 2000–2013</td>
<td>157,464</td>
</tr>
<tr>
<td>Missing short interest or control variables</td>
<td>–83,127</td>
</tr>
<tr>
<td>Missing or negative total assets or pretax income</td>
<td>–15,374</td>
</tr>
<tr>
<td>Deleting financial and utility firms</td>
<td>–15,230</td>
</tr>
<tr>
<td>Number of observations for analyses</td>
<td>43,733</td>
</tr>
</tbody>
</table>

Panel B: Number of Observations by Year

<table>
<thead>
<tr>
<th>Year</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>1,694</td>
<td>3.87</td>
</tr>
<tr>
<td>2001</td>
<td>1,671</td>
<td>3.82</td>
</tr>
<tr>
<td>2002</td>
<td>1,695</td>
<td>3.87</td>
</tr>
<tr>
<td>2003</td>
<td>2,206</td>
<td>5.04</td>
</tr>
<tr>
<td>2004</td>
<td>4,063</td>
<td>9.28</td>
</tr>
<tr>
<td>2005</td>
<td>3,975</td>
<td>9.08</td>
</tr>
<tr>
<td>2006</td>
<td>3,941</td>
<td>9.00</td>
</tr>
<tr>
<td>2007</td>
<td>3,828</td>
<td>8.75</td>
</tr>
<tr>
<td>2008</td>
<td>3,778</td>
<td>8.63</td>
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<tr>
<td>2009</td>
<td>3,537</td>
<td>8.08</td>
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<tr>
<td>2010</td>
<td>3,417</td>
<td>7.81</td>
</tr>
<tr>
<td>2011</td>
<td>3,379</td>
<td>7.72</td>
</tr>
<tr>
<td>2012</td>
<td>3,330</td>
<td>7.61</td>
</tr>
<tr>
<td>2013</td>
<td>3,259</td>
<td>7.45</td>
</tr>
<tr>
<td>Total</td>
<td>43,773</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Panel C: Number of Observations by Industry

<table>
<thead>
<tr>
<th>Industry</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumer nondurables</td>
<td>2,710</td>
<td>6.19</td>
</tr>
<tr>
<td>Consumer durables</td>
<td>1,309</td>
<td>2.99</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>5,336</td>
<td>12.19</td>
</tr>
<tr>
<td>Energy</td>
<td>2,792</td>
<td>6.38</td>
</tr>
<tr>
<td>Chemicals and allied products</td>
<td>1,359</td>
<td>3.10</td>
</tr>
<tr>
<td>Business equipment</td>
<td>9,691</td>
<td>22.14</td>
</tr>
<tr>
<td>Telephone and television transmission</td>
<td>2,042</td>
<td>4.66</td>
</tr>
<tr>
<td>Wholesale, retail, and some services</td>
<td>4,617</td>
<td>10.55</td>
</tr>
<tr>
<td>Healthcare</td>
<td>6,202</td>
<td>14.17</td>
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<tr>
<td>Other</td>
<td>7,715</td>
<td>17.63</td>
</tr>
<tr>
<td>Total</td>
<td>43,773</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Notes: The sample selection procedure (Panel A) and composition of observations by year (Panel B) and by Fama-French 12 industry classifications (Panel C). Utility firms (SIC 4900–4949) and financial institutions (SIC 6000–6999) are excluded from analyses.
positive and highly significant \((p < 0.001)\). For \(GETR\), the coefficient on \(SHORT\_INTEREST\) (0.0005) is positive and significant \((p < 0.05)\). These results indicate that short selling measured soon after the release of the financial statements for year \(t\) is significantly associated with an increase in cash taxes paid and book-tax expense in year \(t + 1\). This effect is not only statistically but also economically significant. In particular, a one standard deviation increase in \(SHORT\_INTEREST\) is associated with a 2.60 percentage point increase in \(CETR\) and 1.42 percentage point increase in \(GETR\).

In addition to these two overall annual tax-planning outcome measures, there is also strong evidence that short-interest curbs more egregious tax-avoidance

---

**Table 2.** Descriptive Statistics for Tax Avoidance, Short Interest, and Other Regression Variables.

<table>
<thead>
<tr>
<th>Variables</th>
<th>(N)</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>25th</th>
<th>50th</th>
<th>75th</th>
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<tbody>
<tr>
<td>(CETR)</td>
<td>28,759</td>
<td>0.2402</td>
<td>0.2125</td>
<td>0.0781</td>
<td>0.2130</td>
<td>0.3312</td>
</tr>
<tr>
<td>(GETR)</td>
<td>30,957</td>
<td>0.2719</td>
<td>0.1855</td>
<td>0.1487</td>
<td>0.2987</td>
<td>0.3685</td>
</tr>
<tr>
<td>(DTAX)</td>
<td>38,558</td>
<td>0.0377</td>
<td>2.1050</td>
<td>-0.1303</td>
<td>0.0114</td>
<td>0.2150</td>
</tr>
<tr>
<td>(SHELTER)</td>
<td>41,486</td>
<td>0.2005</td>
<td>0.4003</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
</tr>
<tr>
<td>(SI)</td>
<td>43,667</td>
<td>0.0378</td>
<td>0.0569</td>
<td>0.0027</td>
<td>0.0169</td>
<td>0.0479</td>
</tr>
<tr>
<td>(LOG_AT)</td>
<td>43,722</td>
<td>6.2076</td>
<td>2.1038</td>
<td>4.6732</td>
<td>6.1591</td>
<td>7.6412</td>
</tr>
<tr>
<td>(LEV)</td>
<td>43,571</td>
<td>0.1965</td>
<td>0.2476</td>
<td>0.0002</td>
<td>0.1244</td>
<td>0.3000</td>
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<tr>
<td>(ROA)</td>
<td>43,720</td>
<td>-0.0163</td>
<td>0.3891</td>
<td>-0.0432</td>
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<td>0.1198</td>
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<tr>
<td>(FOREIGN)</td>
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<td>0.4955</td>
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<tr>
<td>(R&amp;D)</td>
<td>43,720</td>
<td>0.0600</td>
<td>0.1352</td>
<td>0.0000</td>
<td>0.0019</td>
<td>0.0623</td>
</tr>
<tr>
<td>(\Delta NOL)</td>
<td>43,720</td>
<td>0.0779</td>
<td>0.5587</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0104</td>
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<tr>
<td>(DIS_ACCRUAL)</td>
<td>42,278</td>
<td>-0.1188</td>
<td>1.5347</td>
<td>-0.1651</td>
<td>-0.0188</td>
<td>0.0684</td>
</tr>
<tr>
<td>(CAPEX)</td>
<td>43,536</td>
<td>0.0630</td>
<td>0.0937</td>
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<td>0.0342</td>
<td>0.0711</td>
</tr>
<tr>
<td>(INST_OWN)</td>
<td>43,760</td>
<td>0.3863</td>
<td>0.3514</td>
<td>0.0002</td>
<td>0.3381</td>
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<tr>
<td>(N_ANALYSTS)</td>
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<td>0.0000</td>
<td>1.3863</td>
<td>2.1972</td>
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<tr>
<td>(BTM)</td>
<td>43,701</td>
<td>0.5725</td>
<td>1.1206</td>
<td>0.2586</td>
<td>0.4667</td>
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<tr>
<td>(PP&amp;E)</td>
<td>43,689</td>
<td>0.2989</td>
<td>0.3045</td>
<td>0.0785</td>
<td>0.1938</td>
<td>0.4266</td>
</tr>
<tr>
<td>(SALES_GROWTH)</td>
<td>43,656</td>
<td>0.0889</td>
<td>0.2929</td>
<td>-0.0182</td>
<td>0.0542</td>
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<tr>
<td>(CFO)</td>
<td>43,646</td>
<td>0.0430</td>
<td>0.2668</td>
<td>0.0156</td>
<td>0.0839</td>
<td>0.1466</td>
</tr>
</tbody>
</table>

**Notes:** See Appendix A for variable definitions. The sample is composed of all Compustat firms that have available data for tax avoidance, short interest, and control variables. These firms also have non-missing total assets and positive special items-adjusted pretax income. We require at least 10 observations per industry-year combination, where industry is identified using two-digit SIC code. Utility firms (SIC 4900–4949) and financial institutions (SIC 6000–6999) are excluded from these analyses. All continuous variables are winsorized at the 1st and 99th percentiles, except for \(CETR\) and \(GETR\), which are winsorized at zero and one.
Table 3. Results for Ordinary Least Squares (OLS) and Logistic Regressions of Tax Avoidance and Short Interest.

<table>
<thead>
<tr>
<th></th>
<th>CETR</th>
<th></th>
<th>GETR</th>
<th></th>
<th>DTAX</th>
<th></th>
<th>SHELTER</th>
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<tbody>
<tr>
<td></td>
<td>Sign</td>
<td>(SE)</td>
<td>Sign</td>
<td>(SE)</td>
<td>Sign</td>
<td>(SE)</td>
<td>Sign</td>
<td>(SE)</td>
</tr>
<tr>
<td>SHORT</td>
<td>+</td>
<td>0.0010***</td>
<td>+</td>
<td>0.0005**</td>
<td>−</td>
<td>0.0026**</td>
<td>−</td>
<td>0.0216***</td>
</tr>
<tr>
<td>INTEREST</td>
<td></td>
<td>(0.0003)</td>
<td></td>
<td>(0.0002)</td>
<td></td>
<td>(0.0016)</td>
<td></td>
<td>(0.0056)</td>
</tr>
<tr>
<td>LOG_AT</td>
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<td>0.0015</td>
<td>−0.0132**</td>
<td>2.4678***</td>
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<tr>
<td></td>
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<td>(0.0011)</td>
<td></td>
<td>(0.063)</td>
<td></td>
<td>(0.1163)</td>
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<td></td>
</tr>
<tr>
<td>LEV</td>
<td>−0.0509***</td>
<td>−0.0181**</td>
<td>0.1535*</td>
<td>−5.804***</td>
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<td></td>
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<tr>
<td></td>
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<td>(0.0076)</td>
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<td>(0.0931)</td>
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<td>(0.3362)</td>
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<td>ROA</td>
<td>0.0098</td>
<td>0.2626***</td>
<td>0.4226***</td>
<td>19.2159***</td>
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<td></td>
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<td>R&amp;D</td>
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<td>−0.3052***</td>
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<td>(0.1950)</td>
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<td>(0.6615)</td>
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<td>0.0001</td>
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<tr>
<td>CAPEX</td>
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<td>(0.0420)</td>
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<tr>
<td>BTM</td>
<td>0.0122***</td>
<td>0.0021</td>
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<td>0.1735**</td>
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<tr>
<td></td>
<td>(0.0030)</td>
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<td>(0.0070)</td>
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<td>(0.0704)</td>
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<tr>
<td>PP&amp;E</td>
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<td>−0.0222**</td>
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<td>SALES_GROWTH</td>
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<td>−0.0157***</td>
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<td>−0.3509*</td>
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<td>(0.0470)</td>
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<td>(0.2083)</td>
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<tr>
<td>CFO</td>
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<td>−0.0969***</td>
<td>−0.0117</td>
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<tr>
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<td>INTERCEPT</td>
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<td>0.1927***</td>
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<td>(1.2347)</td>
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<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>Industry FE</td>
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<td>Yes</td>
<td>Yes</td>
<td></td>
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<td></td>
<td></td>
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<tr>
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<td>29,647</td>
<td>37,092</td>
<td>39,828</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Adj. (Pseudo) $R^2$</td>
<td>7.89%</td>
<td>8.58%</td>
<td>13.42%</td>
<td>77.10%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes: See Appendix A for variable definitions. All regressions include year and industry fixed effects, and standard errors are clustered by firm. *, **, and *** denote two-tailed (one-tailed when there is a predicted sign) statistical significance at the 10%, 5%, and 1% level, respectively.
behavior. As predicted, \textit{SHORT\_INTEREST} loads significantly negatively on both \textit{DTAX} (\(p < 0.05\)) and \textit{SHELTER} (\(p < 0.01\)), suggesting that short interest has a constraining effect on egregious corporate tax-avoidance activities. Taking the results of all four tax-avoidance variables together, consistent with our hypothesis, evidence suggests that firm tax avoidance is affected by short selling. Managers appear to reduce tax-avoidance activities in response to high short-selling pressure, presumably to stave off stock price crashes.

Next, we perform several additional analyses and robustness tests to provide a better understanding of the constraining effect of short selling on tax avoidance. First, we enhance the internal validity of our research design by re-estimating Eq. (3) using an IV model. We then perform a cross-sectional analysis by partitioning the sample into low, middle, and high analyst-following terciles. We also perform robustness checks using different windows to measure short interest. Finally, we rule out an alternative explanation by introducing an additional control variable to our main model.

\textit{Two-stage Least Squares Model}

In the main model, we incorporate temporal precedence (i.e., the measurement of short-interest level at an earlier point in time than the measurement of tax-avoidance level) in our research design to infer causality that managers respond to high short-selling pressure by reducing subsequent tax-avoidance behavior. To strengthen this argument, we estimate an additional 2SLS model using an IV. In the first stage, we use the industry-year mean short-interest level taken in the middle of the fourth month after year \(t\)'s fiscal year-end (\textit{INDUSTRY\_SI}) as our IV to calculate a predicted short-interest level (\textit{PRED\_SI}) for each firm-year observation in year \(t\). We then use the predicted short-interest level from year \(t\) in the second-stage model to test its effect on tax avoidance in year \(t+1\). We believe that average industry short interest is an appropriate IV because we expect it to be positively associated with firm-level short interest but theoretically unrelated to firm-level tax avoidance.

We show the first-stage model in Table 4, Panel A. As expected, \textit{INDUSTRY\_SI} is a significantly positive predictor of \textit{SHORT\_INTEREST}. We also empirically validate our choice of IV with an F statistic that rejects the null that \textit{INDUSTRY\_SI} is a weak instrument at the 0.01 level (Stock, Wright, & Yogo, 2002). We include all control variables from the main model in our first-stage model, and we measure them in year \(t\). From this first-stage model, we take the predicted value (\textit{PRED\_SI}) and use it as an explanatory variable in our second-stage model. In this second stage, we measure control variables in year \(t+1\) to match tax avoidance. We report results of the effect of predicted short interest in year \(t\) on tax avoidance in year \(t+1\) in Table 4, Panel B. We find consistent results using three out of four proxies for tax avoidance, with the exception of \textit{GETR}. Overall, our 2SLS model provides support for our inference that managers constrain tax-avoidance activities due to high short interest.
Table 4. Two-stage Least Squares Method for Tax Avoidance and Short Interest.

Panel A: First-stage Model Calculates Predicted Short-interest Level (PRED_SI)

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<tr>
<th></th>
<th>Coeff.</th>
<th>SE</th>
</tr>
</thead>
<tbody>
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<td>INDUSTRY_SI</td>
<td>0.7820</td>
<td>(0.0197)**</td>
</tr>
<tr>
<td>LOG_AT</td>
<td>0.1680</td>
<td>(0.0161)**</td>
</tr>
<tr>
<td>LEV</td>
<td>0.3170</td>
<td>(0.1136)**</td>
</tr>
<tr>
<td>ROA</td>
<td>0.1812</td>
<td>(0.0793)**</td>
</tr>
<tr>
<td>FOREIGN</td>
<td>−0.5412</td>
<td>(0.0561)**</td>
</tr>
<tr>
<td>R&amp;D</td>
<td>2.5397</td>
<td>(0.2406)**</td>
</tr>
<tr>
<td>ΔNOL</td>
<td>0.0561</td>
<td>(0.0470)**</td>
</tr>
<tr>
<td>DIS_ACCRUAL</td>
<td>−0.0263</td>
<td>(0.0177)**</td>
</tr>
<tr>
<td>CAPEX</td>
<td>4.4815</td>
<td>(0.3533)**</td>
</tr>
<tr>
<td>INST_OWN</td>
<td>4.0630</td>
<td>(0.1059)**</td>
</tr>
<tr>
<td>N_ANALYSTS</td>
<td>0.2585</td>
<td>(0.0372)**</td>
</tr>
<tr>
<td>BTM</td>
<td>−0.4134</td>
<td>(0.0335)**</td>
</tr>
<tr>
<td>PP&amp;E</td>
<td>−0.8774</td>
<td>(0.1272)**</td>
</tr>
<tr>
<td>SALES_GROWTH</td>
<td>1.2939</td>
<td>(0.0796)**</td>
</tr>
<tr>
<td>CFO</td>
<td>0.8646</td>
<td>(0.1404)**</td>
</tr>
<tr>
<td>INTERCEPT</td>
<td>−2.0740</td>
<td>(0.1239)**</td>
</tr>
<tr>
<td>Observations</td>
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<td></td>
</tr>
<tr>
<td>Adj. $R^2$</td>
<td>16.96%</td>
<td></td>
</tr>
</tbody>
</table>

Weak identification test: $F$ statistic = 121.007***

Panel B: Second-stage Results of Tax Avoidance and Short Interest

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>PRED_SI</td>
<td>+</td>
<td>0.0018*** (0.0005)</td>
<td>+</td>
<td>−0.0004 (0.0003)</td>
<td>−</td>
<td>−0.0040 (0.0021)</td>
<td>−</td>
<td>−0.0363*** (0.0094)</td>
</tr>
<tr>
<td>LOG_AT</td>
<td>0.0041*** (0.0002)</td>
<td>0.0015 (0.0011)</td>
<td>−0.0119* (0.0062)</td>
<td>2.5796***</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LEV</td>
<td>−0.0505*** (0.0092)</td>
<td>−0.0153** (0.0078)</td>
<td>0.1538 (0.0948)</td>
<td>−5.8386***</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ROA</td>
<td>0.0238 (0.0227)</td>
<td>0.2939*** (0.021)</td>
<td>0.4334*** (0.1309)</td>
<td>20.1688***</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FOREIGN</td>
<td>0.0263*** (0.0043)</td>
<td>0.0058* (0.0035)</td>
<td>−0.0301 (0.0194)</td>
<td>6.0752***</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R&amp;D</td>
<td>−0.2716*** (0.0382)</td>
<td>−0.3235*** (0.0347)</td>
<td>0.1642 (0.1956)</td>
<td>6.9321***</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ΔNOL</td>
<td>0.0006 (0.0049)</td>
<td>−0.0039 (0.0043)</td>
<td>0.6877*** (0.0765)</td>
<td>19.5943***</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DIS_ACCRUAL</td>
<td>−0.0003 (0.0008)</td>
<td>−0.0005 (0.0006)</td>
<td>−0.0073 (0.0089)</td>
<td>0.0006 (0.0181)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Cross-sectional Analysis

We further probe our research question by investigating the cross-sectional variation in the effect of short selling on firm tax avoidance. Prior literature suggests that financial analysts play an important role in monitoring managers’ behavior. Firms with less analyst coverage are associated with weaker corporate governance and higher stock price crash risk (Kim et al., 2011). As a result, managers of these firms have a stronger incentive to take actions to avoid stock price decreases. Therefore, we predict that the constraining effect of short selling on tax avoidance to be more pronounced in firms with less analyst following.

To test the previous conjecture, we partition the full sample into three subsamples based on the number of analysts following the firm and re-estimate Eq. (3) within each subsample. In particular, we partition the full sample into low, middle, and high analyst-following terciles by the \( N\_ANALYSTS \) values each year.\(^{17} \) Table 5 presents our findings. Contrary to our expectation, the impact of short selling on tax avoidance is more pronounced as analyst coverage increases. Specifically, the low analyst coverage tercile subsample shows fairly

---

**Table 4. (Continued)**

Panel B: Second-stage Results of Tax Avoidance and Short Interest

<table>
<thead>
<tr>
<th>( \text{CETR} )</th>
<th>( \text{GETR} )</th>
<th>( \text{DTAX} )</th>
<th>( \text{SHELTER} )</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pred. Sign</strong></td>
<td><strong>Coeff. (SE)</strong></td>
<td><strong>Pred. Sign</strong></td>
<td><strong>Coeff. (SE)</strong></td>
</tr>
<tr>
<td>CAPEX</td>
<td>0.0321</td>
<td>0.0468*</td>
<td>0.0819</td>
</tr>
<tr>
<td></td>
<td>(0.0299)</td>
<td>(0.0265)</td>
<td>(0.1577)</td>
</tr>
<tr>
<td>INS_TOWN</td>
<td>0.0073</td>
<td>0.0601***</td>
<td>0.0214</td>
</tr>
<tr>
<td></td>
<td>(0.0074)</td>
<td>(0.0062)</td>
<td>(0.0296)</td>
</tr>
<tr>
<td>( N_ANALYSTS )</td>
<td>-0.0114***</td>
<td>-0.0139***</td>
<td>-0.0099</td>
</tr>
<tr>
<td></td>
<td>(0.0025)</td>
<td>(0.0022)</td>
<td>(0.0117)</td>
</tr>
<tr>
<td>BTM</td>
<td>0.0124***</td>
<td>0.0020</td>
<td>-0.0035</td>
</tr>
<tr>
<td></td>
<td>(0.0030)</td>
<td>(0.0041)</td>
<td>(0.0073)</td>
</tr>
<tr>
<td>PP&amp;E</td>
<td>-0.0373***</td>
<td>-0.0229**</td>
<td>-0.0519</td>
</tr>
<tr>
<td></td>
<td>(0.0127)</td>
<td>(0.0103)</td>
<td>(0.0659)</td>
</tr>
<tr>
<td>SALES_GROWTH</td>
<td>-0.0592***</td>
<td>-0.0168***</td>
<td>0.0460</td>
</tr>
<tr>
<td></td>
<td>(0.0066)</td>
<td>(0.0053)</td>
<td>(0.0466)</td>
</tr>
<tr>
<td>CFO</td>
<td>-0.1775***</td>
<td>-0.1251***</td>
<td>-0.0746</td>
</tr>
<tr>
<td></td>
<td>(0.0227)</td>
<td>(0.0198)</td>
<td>(0.02074)</td>
</tr>
<tr>
<td>( \text{INTERCEPT} )</td>
<td>0.2402***</td>
<td>0.2585***</td>
<td>0.1880***</td>
</tr>
<tr>
<td></td>
<td>(0.0375)</td>
<td>(0.0445)</td>
<td>(0.0626)</td>
</tr>
<tr>
<td>Year FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Industry FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>27,274</td>
<td>29,210</td>
<td>36,505</td>
</tr>
<tr>
<td>Adj. (Pseudo) ( R^2 )</td>
<td>7.87%</td>
<td>8.77%</td>
<td>13.58%</td>
</tr>
</tbody>
</table>

Notes: See Appendix A for variable definitions. All regressions include year and industry fixed effects, and standard errors are clustered by firm. *, **, and *** denote two-tailed (one-tailed when there is a predicted sign) statistical significance at the 10%, 5%, and 1% level, respectively.
**Table 5.** Cross-sectional Results for Ordinary Least Squares (OLS) and Logistic Regressions of Tax Avoidance and Short Interests by Number of Analysts Following.

<table>
<thead>
<tr>
<th>Low Analysts Tercile</th>
<th>( \text{CETR} )</th>
<th>( \text{GETR} )</th>
<th>( \text{DTAX} )</th>
<th>( \text{SHELTER} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \text{SHORT}_{\text{INTEREST}} )</td>
<td>+ 0.0004</td>
<td>(0.0007)</td>
<td>+ 0.0008*</td>
<td>(0.0006)</td>
</tr>
<tr>
<td>Controls</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Year FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Industry FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>7,207</td>
<td>7,907</td>
<td>12,670</td>
<td>13,038</td>
</tr>
<tr>
<td>Adj. (Pseudo) ( R^2 )</td>
<td>7.82%</td>
<td>7.48%</td>
<td>10.69%</td>
<td>76.48%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Middle Analysts Tercile</th>
<th>( \text{CETR} )</th>
<th>( \text{GETR} )</th>
<th>( \text{DTAX} )</th>
<th>( \text{SHELTER} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \text{SHORT}_{\text{INTEREST}} )</td>
<td>+ 0.0016***</td>
<td>(0.0006)</td>
<td>+ 0.0002</td>
<td>(0.0004)</td>
</tr>
<tr>
<td>Controls</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Year FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Industry FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>8,723</td>
<td>9,524</td>
<td>12,415</td>
<td>12,564</td>
</tr>
<tr>
<td>Adj. (Pseudo) ( R^2 )</td>
<td>7.94%</td>
<td>7.86%</td>
<td>16.39%</td>
<td>71.53%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>High Analysts Tercile</th>
<th>( \text{CETR} )</th>
<th>( \text{GETR} )</th>
<th>( \text{DTAX} )</th>
<th>( \text{SHELTER} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \text{SHORT}_{\text{INTEREST}} )</td>
<td>+ 0.0012***</td>
<td>(0.0004)</td>
<td>+ 0.0006**</td>
<td>(0.0003)</td>
</tr>
<tr>
<td>Controls</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Year FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Industry FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>11,717</td>
<td>12,216</td>
<td>12,007</td>
<td>13,697</td>
</tr>
<tr>
<td>Adj. (Pseudo) ( R^2 )</td>
<td>11.71%</td>
<td>15.65%</td>
<td>18.15%</td>
<td>77.25%</td>
</tr>
</tbody>
</table>

*Notes:* See Appendix A for variable definitions. All regressions include year and industry fixed effects, and standard errors are clustered by firm. *, **, and *** denote two-tailed (one-tailed when there is a predicted sign) statistical significance at the 10%, 5%, and 1% level, respectively.
weak relation between short selling and tax avoidance, the middle analyst coverage tercile subsample exhibits an effect in two of four specifications, and the high analyst coverage tercile demonstrates a very strong effect using all four proxies for tax avoidance. We interpret this result as evidence that managers of firms with high analyst coverage are more attuned to preserving and protecting firm value for external shareholders and thus pay more attention to stock market conditions. These managers, as a result, are more likely to strategically respond to high short-interest levels by reducing tax-avoidance activities.

Robustness Tests

Alternative Measures of Short Interest
We consider several alternative measures of our main independent variable of interest to confirm the robustness of our findings. First, we re-estimate Eq. (3) measuring monthly short interest in the middle of the fifth month after the prior fiscal year-end, consistent with Hirshleifer et al. (2011). We show in Table 6, Panel A that results using all four proxies of tax avoidance are similar to our main findings shown in Table 3. Managers appear to respond to high short interest observed during the fifth month after prior fiscal year-end by reducing tax avoidance.

Our second alternative measure of short interest considers each firm’s filer status. In particular, large accelerated filers are required to file Form 10-K no later than 60 days after the fiscal year-end, while accelerated (nonaccelerated) filers must file Form 10-K within 75 (90) days after the fiscal year-end. We therefore take the short interest in the middle of the third month after the prior fiscal year-end for large accelerated filers and in the middle of the fourth month after the prior fiscal year-end for accelerated filers and nonaccelerated filers. We re-estimate Eq. (3) using this alternative short-interest measure and present our results in Table 6, Panel B. Our results are robust to this specification.

We create a third alternative measure of short interest using an average of monthly short-interest levels from the fifth month after the prior fiscal year-end until the fourth month after the current fiscal year-end. Similar to managers who monitor firm performance and make tax-avoidance decisions throughout the entire year, short sellers continuously monitor the financial performance and engage in investment activities throughout the year, even after the fiscal year-end (but before the release of annual report). We present our results using this average measure in Table 6, Panel C, and find that our inference remains unchanged using three of four tax-avoidance measures.

Disclosure Transparency
The potential tax savings from complex tax-avoidance transactions can be accompanied by a cost of opaque corporate disclosure and increased information asymmetry between firm managers and outside parties; managers at these tax-aggressive firms may provide more tax-related disclosures to mitigate these transparency problems (Balakrishnan, Blouin, & Guay, 2012). When a firm is under the scrutiny of short sellers, it is possible that its manager will respond not only by reducing tax avoidance but also by improving the transparency related
**Table 6.** Results for Ordinary Least Squares (OLS) and Logistic Regression of Tax Avoidance and Short Interest Using Alternative Short-interest Measures.

<table>
<thead>
<tr>
<th></th>
<th>CETR</th>
<th>GETR</th>
<th>DTAX</th>
<th>SHELTER</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Panel A:</strong></td>
<td>SHORT_INTEREST</td>
<td>+ 0.0008*** (0.0003)</td>
<td>+ 0.0005** (0.0002)</td>
<td>– 0.0028** (0.0016)</td>
</tr>
<tr>
<td></td>
<td>LOG_AT</td>
<td>0.0041*** (0.0013)</td>
<td>0.0014 (0.0011)</td>
<td>– 0.0123** (0.0063)</td>
</tr>
<tr>
<td></td>
<td>LEV</td>
<td>– 0.0502*** (0.0090)</td>
<td>– 0.0172** (0.0076)</td>
<td>0.1472 (0.0925)</td>
</tr>
<tr>
<td></td>
<td>ROA</td>
<td>0.0018 (0.0228)</td>
<td>0.2590*** (0.0217)</td>
<td>0.4227*** (0.1198)</td>
</tr>
<tr>
<td></td>
<td>FOREIGN</td>
<td>0.0256*** (0.0043)</td>
<td>0.0068* (0.0035)</td>
<td>– 0.0170 (0.0196)</td>
</tr>
<tr>
<td></td>
<td>R&amp;D</td>
<td>– 0.2634*** (0.0363)</td>
<td>– 0.2999*** (0.0347)</td>
<td>0.2710 (0.1944)</td>
</tr>
<tr>
<td></td>
<td>ΔNOL</td>
<td>– 0.0000 (0.0046)</td>
<td>– 0.0066 (0.0041)</td>
<td>0.6901*** (0.0755)</td>
</tr>
<tr>
<td></td>
<td>DIS_ACCRUAL</td>
<td>– 0.0004 (0.0007)</td>
<td>– 0.0004 (0.0006)</td>
<td>0.0002 (0.0086)</td>
</tr>
<tr>
<td></td>
<td>CAPEX</td>
<td>0.0188 (0.0287)</td>
<td>0.0227 (0.0255)</td>
<td>0.0239 (0.1498)</td>
</tr>
<tr>
<td></td>
<td>INST_OWN</td>
<td>0.0107 (0.0070)</td>
<td>0.0569*** (0.0060)</td>
<td>– 0.0036 (0.0303)</td>
</tr>
<tr>
<td></td>
<td>N_ANALYSTS</td>
<td>– 0.0108*** (0.0025)</td>
<td>– 0.0142*** (0.0021)</td>
<td>– 0.0071 (0.0120)</td>
</tr>
<tr>
<td></td>
<td>BTM</td>
<td>0.0120*** (0.0029)</td>
<td>0.0031 (0.0042)</td>
<td>– 0.0016 (0.0073)</td>
</tr>
<tr>
<td></td>
<td>PP&amp;E</td>
<td>– 0.0402*** (0.0125)</td>
<td>– 0.0222** (0.0101)</td>
<td>– 0.0431 (0.0644)</td>
</tr>
<tr>
<td></td>
<td>SALES_GROWTH</td>
<td>– 0.0549*** (0.0064)</td>
<td>– 0.0147*** (0.0053)</td>
<td>0.0296 (0.0470)</td>
</tr>
<tr>
<td></td>
<td>CFO</td>
<td>– 0.1472*** (0.0226)</td>
<td>– 0.0932*** (0.0207)</td>
<td>– 0.0150 (0.1972)</td>
</tr>
<tr>
<td></td>
<td>INTERCEPT</td>
<td>0.2437*** (0.0380)</td>
<td>0.2583*** (0.0438)</td>
<td>0.1762*** (0.0611)</td>
</tr>
</tbody>
</table>

**Panel B:** SHORT_INTEREST Measured in Third Month After the Prior Fiscal Year-end for Large Accelerated Filers and During the Fourth Month After the Prior Fiscal Year-end for Accelerated Filers and Nonaccelerated Filers

|                | SHORT_INTEREST    | + 0.0009*** (0.0003) | + 0.0004** (0.0002) | – 0.0028** (0.0016) | – 0.0237*** (0.0058) |
|                | LOG_AT             | 0.0038*** (0.0014) | 0.0013 (0.0012) | – 0.0140** (0.0065) | 2.4565*** (0.1171) |

Percentage of observations and adjusted (Pseudo) $R^2$ are shown in the last row.
## Table 6. (Continued)

<table>
<thead>
<tr>
<th></th>
<th>CETR</th>
<th>GETR</th>
<th>DTAX</th>
<th>SHELTER</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LEV</strong></td>
<td>−0.0525*** (0.0093)</td>
<td>−0.0225*** (0.0081)</td>
<td>0.1546 (0.0948)</td>
<td>−5.5002*** (0.3372)</td>
</tr>
<tr>
<td><strong>ROA</strong></td>
<td>0.0068 (0.0221)</td>
<td>0.2580*** (0.0227)</td>
<td>0.3921*** (0.1393)</td>
<td>19.1242*** (1.4357)</td>
</tr>
<tr>
<td><strong>FOREIGN</strong></td>
<td>0.0261*** (0.0043)</td>
<td>0.0071* (0.0036)</td>
<td>−0.0205 (0.0202)</td>
<td>5.8022*** (0.2996)</td>
</tr>
<tr>
<td><strong>R&amp;D</strong></td>
<td>−0.2583*** (0.0370)</td>
<td>−0.3130*** (0.0355)</td>
<td>0.2176 (0.1959)</td>
<td>6.0978*** (0.6468)</td>
</tr>
<tr>
<td><strong>ΔNOL</strong></td>
<td>−0.0001 (0.0048)</td>
<td>−0.0066 (0.0042)</td>
<td>0.6696*** (0.0765)</td>
<td>18.7800*** (1.2593)</td>
</tr>
<tr>
<td><strong>DIS_ACCRUAL</strong></td>
<td>−0.0003 (0.0008)</td>
<td>−0.0004 (0.0006)</td>
<td>0.0087 (0.0092)</td>
<td>−0.0099 (0.0149)</td>
</tr>
<tr>
<td><strong>CAPEX</strong></td>
<td>0.0152 (0.0293)</td>
<td>0.0192 (0.0262)</td>
<td>0.0053 (0.1507)</td>
<td>1.9067** (0.8378)</td>
</tr>
<tr>
<td><strong>INST.Owner</strong></td>
<td>0.0111 (0.0072)</td>
<td>0.0575*** (0.0061)</td>
<td>0.0108 (0.0315)</td>
<td>−0.4980*** (0.1203)</td>
</tr>
<tr>
<td><strong>N_ANALYSTS</strong></td>
<td>−0.0113*** (0.0025)</td>
<td>−0.0145*** (0.0022)</td>
<td>−0.0125 (0.0122)</td>
<td>0.1070** (0.0424)</td>
</tr>
<tr>
<td><strong>BTM</strong></td>
<td>0.0113*** (0.0026)</td>
<td>−0.0014 (0.0058)</td>
<td>−0.0004 (0.0068)</td>
<td>0.1687** (0.0677)</td>
</tr>
<tr>
<td><strong>PP&amp;E</strong></td>
<td>−0.0361*** (0.0126)</td>
<td>−0.0173* (0.0104)</td>
<td>−0.0382 (0.0653)</td>
<td>0.0901 (0.2515)</td>
</tr>
<tr>
<td><strong>SALES_GROWTH</strong></td>
<td>−0.0538*** (0.0065)</td>
<td>−0.0154*** (0.0054)</td>
<td>0.0316 (0.0544)</td>
<td>−0.2852 (0.2049)</td>
</tr>
<tr>
<td><strong>CFO</strong></td>
<td>−0.1565*** (0.0228)</td>
<td>−0.1000*** (0.0214)</td>
<td>0.0397 (0.2115)</td>
<td>0.3632 (0.6332)</td>
</tr>
<tr>
<td><strong>INTERCEPT</strong></td>
<td>0.2222*** (0.0372)</td>
<td>0.2317*** (0.0444)</td>
<td>0.1692*** (0.0686)</td>
<td>−24.8758*** (1.2503)</td>
</tr>
<tr>
<td>Year FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Industry FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>26,983</td>
<td>28,952</td>
<td>36,525</td>
<td>39,163</td>
</tr>
<tr>
<td>Adj. (Pseudo) $R^2$</td>
<td>7.83%</td>
<td>8.65%</td>
<td>13.43%</td>
<td>39.163</td>
</tr>
</tbody>
</table>

Panel C: **SHORT_INTEREST** Measured as an Average of Monthly Short Interests from the fifth Month After Prior Fiscal Year-end Until the Fourth Month After Current Fiscal Year-end
to the disclosure of tax-avoidance activities. We address this concern by directly controlling for disclosure transparency, thereby separating the effect of short selling on actual tax-avoidance activities from the transparency of the disclosure of these activities. Following Balakrishnan et al. (2012), we use analyst forecast error to proxy for transparency. FORECAST_ERROR is the absolute value of the difference between the median analyst forecast issued immediately before the fiscal year-end and the actual earnings for that fiscal year, scaled by the price at the end of previous year, averaged over the three years prior to the measurement of our tax-avoidance variables. In a more transparent financial disclosure environment, one would expect to see less analyst forecast error.

We re-estimate Eq. (3) with FORECAST_ERROR as an additional control variable (Table 7). SHORT_INTEREST remains highly significant ($p < 0.01$) in the predicted directions in the CETR and DTAX regressions and significant

<table>
<thead>
<tr>
<th></th>
<th>CETR</th>
<th>GETR</th>
<th>DTAX</th>
<th>SHELTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>(SE)</td>
<td>(SE)</td>
<td>(SE)</td>
<td>(SE)</td>
<td></td>
</tr>
<tr>
<td>R&amp;D</td>
<td>$-0.2599^{***}$</td>
<td>$-0.3142^{***}$</td>
<td>$0.3433^{*}$</td>
<td>$6.3768^{***}$</td>
</tr>
<tr>
<td>(0.0382)</td>
<td>(0.0367)</td>
<td>(0.2073)</td>
<td>(0.7202)</td>
<td></td>
</tr>
<tr>
<td>$\Delta NOL$</td>
<td>$0.000$</td>
<td>$-0.0064$</td>
<td>$0.6128^{***}$</td>
<td>$19.2968^{***}$</td>
</tr>
<tr>
<td>(0.0049)</td>
<td>(0.0043)</td>
<td>(0.0702)</td>
<td>(1.3266)</td>
<td></td>
</tr>
<tr>
<td>$DIS_ACCURUAL$</td>
<td>$-0.0002$</td>
<td>$-0.0002$</td>
<td>$-0.0006$</td>
<td>$0.0045$</td>
</tr>
<tr>
<td>(0.0008)</td>
<td>(0.0006)</td>
<td>(0.0090)</td>
<td>(0.0182)</td>
<td></td>
</tr>
<tr>
<td>$CAPEX$</td>
<td>$0.0238$</td>
<td>$0.0265$</td>
<td>$0.0140$</td>
<td>$1.8858^{**}$</td>
</tr>
<tr>
<td>(0.0300)</td>
<td>(0.0264)</td>
<td>(0.1547)</td>
<td>(0.8633)</td>
<td></td>
</tr>
<tr>
<td>$INST_OWN$</td>
<td>$0.0106$</td>
<td>$0.0571^{***}$</td>
<td>$-0.0078$</td>
<td>$-0.5417^{***}$</td>
</tr>
<tr>
<td>(0.0073)</td>
<td>(0.0062)</td>
<td>(0.0298)</td>
<td>(0.1255)</td>
<td></td>
</tr>
<tr>
<td>$N_ANALYSTS$</td>
<td>$-0.0111^{***}$</td>
<td>$-0.0148^{***}$</td>
<td>$-0.0098$</td>
<td>$0.1119^{**}$</td>
</tr>
<tr>
<td>(0.0026)</td>
<td>(0.0022)</td>
<td>(0.0118)</td>
<td>(0.0439)</td>
<td></td>
</tr>
<tr>
<td>$BTM$</td>
<td>$0.0121^{***}$</td>
<td>$0.0016$</td>
<td>$-0.0014$</td>
<td>$0.1716^{**}$</td>
</tr>
<tr>
<td>(0.0034)</td>
<td>(0.0046)</td>
<td>(0.0077)</td>
<td>(0.0712)</td>
<td></td>
</tr>
<tr>
<td>$PP&amp;E$</td>
<td>$-0.0354^{***}$</td>
<td>$-0.0209^{**}$</td>
<td>$-0.0412$</td>
<td>$0.1651$</td>
</tr>
<tr>
<td>(0.0129)</td>
<td>(0.0104)</td>
<td>(0.0675)</td>
<td>(0.2596)</td>
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</tr>
<tr>
<td>$SALES_GROWTH$</td>
<td>$-0.0546^{***}$</td>
<td>$-0.0162^{***}$</td>
<td>$-0.0326$</td>
<td>$-0.4783^{**}$</td>
</tr>
<tr>
<td>(0.0068)</td>
<td>(0.0055)</td>
<td>(0.0473)</td>
<td>(0.2325)</td>
<td></td>
</tr>
<tr>
<td>$CFO$</td>
<td>$-0.1646^{***}$</td>
<td>$-0.1054^{***}$</td>
<td>$-0.0850$</td>
<td>$0.5660$</td>
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<td>(0.2131)</td>
<td>(0.6035)</td>
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</tr>
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<td>$INTERCEPT$</td>
<td>$0.2195^{***}$</td>
<td>$0.2139^{***}$</td>
<td>$0.2004^{***}$</td>
<td>$-25.4148^{***}$</td>
</tr>
<tr>
<td>(0.0444)</td>
<td>(0.0504)</td>
<td>(0.0764)</td>
<td>(1.2920)</td>
<td></td>
</tr>
<tr>
<td>Year FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Industry FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
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<td>28,111</td>
<td>34,598</td>
<td>37,316</td>
</tr>
<tr>
<td>Adj. (Pseudo) $R^2$</td>
<td>7.77%</td>
<td>8.92%</td>
<td>13.50%</td>
<td>77.25%</td>
</tr>
</tbody>
</table>

Notes: See Appendix A for variable definitions. All regressions include year and industry fixed effects, and standard errors are clustered by firm. *, **, and *** denote two-tailed (one-tailed when there is a predicted sign) statistical significance at the 10%, 5%, and 1% level, respectively.
Table 7. Test of the Effect of Short Selling on Tax Avoidance Controlling for Disclosure Transparency.

<table>
<thead>
<tr>
<th>Variable</th>
<th>CETR</th>
<th>GETR</th>
<th>DTAX</th>
<th>SHELTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>SHORT_INTEREST</td>
<td>+ 0.0015***</td>
<td>+ 0.0005**</td>
<td>- 0.0052***</td>
<td>- 0.0187**</td>
</tr>
<tr>
<td></td>
<td>(0.0003)</td>
<td>(0.0003)</td>
<td>(0.0019)</td>
<td>(0.0083)</td>
</tr>
<tr>
<td>LOG_AT</td>
<td>0.0069***</td>
<td>0.0028*</td>
<td>-0.0038</td>
<td>3.2900***</td>
</tr>
<tr>
<td></td>
<td>(0.0018)</td>
<td>(0.0016)</td>
<td>(0.0074)</td>
<td>(0.1401)</td>
</tr>
<tr>
<td>LEV</td>
<td>-0.0572***</td>
<td>-0.0311***</td>
<td>-0.0082</td>
<td>-7.5429***</td>
</tr>
<tr>
<td></td>
<td>(0.0124)</td>
<td>(0.0099)</td>
<td>(0.0726)</td>
<td>(0.4309)</td>
</tr>
<tr>
<td>ROA</td>
<td>0.1300***</td>
<td>0.4022***</td>
<td>0.2702</td>
<td>25.5632***</td>
</tr>
<tr>
<td></td>
<td>(0.0322)</td>
<td>(0.0287)</td>
<td>(0.1657)</td>
<td>(1.5891)</td>
</tr>
<tr>
<td>FOREIGN</td>
<td>0.0242***</td>
<td>0.0063</td>
<td>-0.0580**</td>
<td>8.0387***</td>
</tr>
<tr>
<td></td>
<td>(0.0052)</td>
<td>(0.0042)</td>
<td>(0.0233)</td>
<td>(0.3781)</td>
</tr>
<tr>
<td>R&amp;D</td>
<td>-0.2450***</td>
<td>-0.2675***</td>
<td>0.0923</td>
<td>9.0352***</td>
</tr>
<tr>
<td></td>
<td>(0.0482)</td>
<td>(0.0449)</td>
<td>(0.2444)</td>
<td>(1.1592)</td>
</tr>
<tr>
<td>ΔNOL</td>
<td>-0.0004</td>
<td>-0.0019</td>
<td>0.6984***</td>
<td>25.4518***</td>
</tr>
<tr>
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<td>(0.0042)</td>
<td>(0.1137)</td>
<td>(1.6468)</td>
</tr>
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<td>DIS_ACCRUAL</td>
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<td>-0.0004</td>
<td>-0.0758***</td>
<td>0.0455</td>
</tr>
<tr>
<td></td>
<td>(0.0009)</td>
<td>(0.0008)</td>
<td>(0.0134)</td>
<td>(0.0344)</td>
</tr>
<tr>
<td>CAPEX</td>
<td>0.0236</td>
<td>0.0640*</td>
<td>0.2845</td>
<td>0.8609</td>
</tr>
<tr>
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<td>(0.0445)</td>
<td>(0.0376)</td>
<td>(0.2655)</td>
<td>(1.3915)</td>
</tr>
<tr>
<td>INS_TOWN</td>
<td>0.0015</td>
<td>0.0604***</td>
<td>0.0743*</td>
<td>** -0.4853*</td>
</tr>
<tr>
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<td>(0.0093)</td>
<td>(0.0084)</td>
<td>(0.0402)</td>
<td>(0.2036)</td>
</tr>
<tr>
<td>N_ANALYSTS</td>
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<td>-0.0190***</td>
<td>-0.0190</td>
<td>0.2997***</td>
</tr>
<tr>
<td></td>
<td>(0.0039)</td>
<td>(0.0033)</td>
<td>(0.0180)</td>
<td>(0.0799)</td>
</tr>
<tr>
<td>BTM</td>
<td>0.0172***</td>
<td>0.0096*</td>
<td>-0.0206*</td>
<td>0.3972***</td>
</tr>
<tr>
<td></td>
<td>(0.0062)</td>
<td>(0.0052)</td>
<td>(0.0122)</td>
<td>(0.1455)</td>
</tr>
<tr>
<td>PP&amp;E</td>
<td>-0.0265</td>
<td>-0.0135</td>
<td>-0.0928</td>
<td>0.3737</td>
</tr>
<tr>
<td></td>
<td>(0.0168)</td>
<td>(0.0134)</td>
<td>(0.0793)</td>
<td>(0.3980)</td>
</tr>
<tr>
<td>SALES_GROWTH</td>
<td>-0.0783***</td>
<td>-0.0174***</td>
<td>0.1464**</td>
<td>-0.2343</td>
</tr>
<tr>
<td></td>
<td>(0.0095)</td>
<td>(0.0065)</td>
<td>(0.0624)</td>
<td>(0.2898)</td>
</tr>
<tr>
<td>CFO</td>
<td>-0.2713***</td>
<td>-0.1995***</td>
<td>-0.1839</td>
<td>-1.8444</td>
</tr>
<tr>
<td></td>
<td>(0.0354)</td>
<td>(0.0290)</td>
<td>(0.2168)</td>
<td>(1.0033)</td>
</tr>
<tr>
<td>FORECAST_ERROR</td>
<td>-0.1138</td>
<td>-0.1453***</td>
<td>-1.0202***</td>
<td>0.4659</td>
</tr>
<tr>
<td></td>
<td>(0.0783)</td>
<td>(0.0507)</td>
<td>(0.3621)</td>
<td>(0.9683)</td>
</tr>
<tr>
<td>Constant</td>
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<td>0.1825***</td>
<td>0.2511***</td>
<td>-33.4358***</td>
</tr>
<tr>
<td></td>
<td>(0.0590)</td>
<td>(0.0614)</td>
<td>(0.0706)</td>
<td>(1.5143)</td>
</tr>
<tr>
<td>Year FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Industry FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>16,642</td>
<td>17,549</td>
<td>18,920</td>
<td>21,018</td>
</tr>
<tr>
<td>Adj. (Pseudo) $R^2$</td>
<td>9.92%</td>
<td>11.38%</td>
<td>18.46%</td>
<td>78.85%</td>
</tr>
</tbody>
</table>

Notes: See Appendix A for variable definitions. All regressions include year and industry fixed effects, and standard errors are clustered by firm. *, **, and *** denote two-tailed (one-tailed when there is a predicted sign) statistical significance at the 10%, 5%, and 1% level, respectively.
(p < 0.05) in the predicted directions in the GETR and SHELTER regressions. These results provide confidence that short selling has a significant constraining effect on tax avoidance, incremental to any effect of transparency related to tax-avoidance disclosures.

CONCLUSION

In this chapter, we introduce one external determinant of corporate tax avoidance: short selling. Prior research suggests that short sellers have information advantages over retail investors, and high short-interest levels are a bearish signal of targeted firms’ stock prices. As a result, firm managers have been shown to limit the use of discretionary accruals to meet earnings targets and strategically disclose less precise bad news forecasts when short interest is high to minimize the negative effect of short-selling pressure on firms’ stock prices. We argue that, because tax avoidance is associated with complex transactions that hoard and accumulate bad news, managers in fear of stock price crashes under the microscope of short sellers may reduce tax avoidance to reduce this pressure.

Consistent with this prediction, we find that managers report lower firm tax-avoidance levels following high short-interest levels. Specifically, cash and GAAP ETRs are higher and discretionary permanent book-tax differences and the probability of having a tax shelter are lower after periods of high short interest. These effects are incremental and robust to using 2SLS to address endogeneity and controlling for disclosure transparency. Further, we show that the main effect is mostly driven by firms with high analyst coverage; it is possible that these firms’ managers are more sensitive to the market conditions and make strategic adjustments to tax-avoidance activities in accordance with these conditions (e.g., high levels of short interest).

NOTES

1. See Hanlon and Heitzman (2010) for a survey.
2. For example, for a firm with a current fiscal year-end of December 31, 2010, we measure short interest reported around April 15, 2010, three and a half months after the previous fiscal year-end of December 31, 2009.
4. Some critics suggest that short selling has a harmful impact on the market because arbitrageurs can improperly drive down a security price for personal profit. In April 2008, the SEC charged a short seller with securities fraud and market manipulation for intentionally disseminating false rumors that caused a 17% stock price decline in the accused firm (SEC, 2008). The SEC, in fact, adopted Rule 10A-1 under the Securities Exchange Act of 1934 that prevents short selling of any listed securities at successively lower price (SEC, 1999). However, the constraints are shown to limit short selling’s effectiveness to arbitrage and therefore weaken the intermediary role of short selling on price discovery (Charoenrook & Daouk, 2005; Hirshleifer, Teoh, & Yu, 2011; Nagel, 2005).
5. Khan and Lu (2013) investigate potential sources of short sellers’ information and find evidence consistent with leaked information from firm insiders.
7. We winsorize both CETR and GETR at 0 and 1 to facilitate interpretation (Dyreng et al., 2008; Gallemore & Labro, 2015; Guenther, Matsunaga, & Williams, 2016).

8. See Appendix A for detailed variable definitions.

9. Including all 12 monthly short-interest observations induces serial correlation, and averaging short interest across 12 months imposes an unnecessary assumption that short arbitrageurs maintain their positions for 12 months, although, in our later robustness tests, we show that our results persist using an average monthly short interest measure.

10. Hoopes et al. (2012) provide evidence that nearly 70% of tax avoidance is changeable in a year, suggesting that the eight and a half months between managers’ observation of short-interest levels and the measurement of their firms’ tax avoidance outcomes at year-end is sufficient to capture modifications in tax avoidance activities resulting from short-selling pressure.

11. We winsorize all continuous variables at one percent on each tail to control for the influence of outliers.

12. Our results are robust to calculating control variables one year before we measure tax avoidance (i.e., in year \( t \) rather than year \( t + 1 \)).

13. This requirement is necessary for one of the control variables, discretionary accruals calculated using the performance-adjusted modified Jones model (\( DIS\_ACC\_RUAL \)).

14. We winsorize \( SHORT\_INTEREST \) at 0 and 1.

15. We assign values of zero to our institutional ownership and analyst following variables if data are missing from Thomson 13F database or from I/B/E/S.

16. We make statistical inferences using one-tailed tests for variables with predictions based on our directional hypothesis.

17. We also partition the sample into terciles with no-, low-, and high analyst coverage, respectively, and find very similar results.

18. We thank a reviewer for these suggestions.

ACKNOWLEDGMENTS

We thank Yijun Li (AAA discussant), session participants at the 2017 ATA Midyear Meeting and 2017 AAA Annual Meeting, and workshop participants at Texas Tech University for their valuable questions and comments.

REFERENCES


APPENDIX 1: VARIABLE DEFINITIONS

Main Variables:

\[ \text{CETR} = \frac{\text{Cash taxes paid}}{\text{Pretax income less special items}} \]

\[ \text{GETR} = \frac{\text{Total tax expense}}{\text{Pretax income less special items}} \]

\[ \text{DTAX} = \text{Residual from the following regression estimated by year and two-digit SIC code based on model from Frank et al. (2009):} \]

\[
\begin{align*}
\text{PERMDIFF}_{it} &= \alpha_0 + \alpha_1 \left( \frac{1}{\text{AT}_{it-1}} \right) \\
&\quad + \alpha_2 \text{INTANG}_{it} + \alpha_3 \text{UNCON}_{it} \\
&\quad + \alpha_4 \text{MI}_{it} + \alpha_5 \text{CSTE}_{it} + \alpha_6 \Delta \text{NOL}_{it} \\
&\quad + \alpha_7 \frac{\text{PERMDIFF}_{it-1}}{\text{C0}} + \epsilon_{it}
\end{align*}
\]

Other variables in this regression are defined as follows:

\[ \text{SHELTER} = \text{An indicator variable set equal to 1 for firms in the top quintile of the predicted probability the firm is engaged in tax sheltering based on the model from Wilson (2009):} \]

\[
\begin{align*}
\text{PROB}_\text{SHELTER} &= -4.30 + 6.63 \times \text{BTD} - 1.72 \times \text{LEV} \\
&\quad + 0.66 \times \text{LOG}_\text{AT} + 2.26 \times \text{ROA} + 1.62 \\
&\quad \times \text{FOREIGN} + 1.56 \times \text{R&D}
\end{align*}
\]

Other variables in this regression are defined as follows:

\[ \text{SHORT_INTEREST} = \text{Short interest reported in the middle of the fourth month after the previous fiscal year-end, scaled by total shares outstanding at the beginning of the month} \]

Control Variables in Main Analysis:

\[ \text{LOG_AT} = \text{The natural logarithm of (1 + total assets)} \]

\[ \text{LEV} = \text{Total long-term debt scaled by beginning total assets} \]

\[ \text{ROA} = \text{Pretax income scaled by beginning total assets} \]

\[ \text{FOREIGN} = \text{An indicator variable that equals 1 if firm has foreign income, 0 otherwise} \]

\[ \text{R&D} = \text{Research and development expense scaled by beginning total assets} \]

\[ \Delta \text{NOL} = \text{Change in net operating loss carryforwards scaled by beginning total assets} \]

\[ \text{DIS_ACCRUAL} = \text{Residual from the following regression estimated by year and two-digit SIC code based on model from Kothari et al. (2005):} \]

\[
\begin{align*}
\text{TA}_{it} &= \alpha_0 + \alpha_1 \left( \frac{1}{\text{AT}_{it-1}} \right) + \alpha_2 \Delta \text{SALES}_{it} \\
&\quad + \alpha_3 \text{PP&E}_{it} + \alpha_4 \text{ROA}_{it} + \epsilon_{it}
\end{align*}
\]

\[ \text{CAPEX} = \text{Capital expenditures scaled by beginning total assets} \]

\[ \text{INST_OWN} = \text{Institutional ownership expressed as a percentage of shares outstanding} \]

\[ \text{N_ANALYSTS} = \text{The natural logarithm of (1 + number of analysts following)} \]

\[ \text{BTM} = \text{Book-to-market ratio} \]

\[ \text{PP&E} = \text{Property, plant, and equipment scaled by beginning total assets} \]

\[ \text{SALES_GROWTH} = \text{One-year change in total sales scaled by beginning total assets} \]
CFO  = Operating cash flow scaled by beginning total assets

Additional Control Variable in Robustness Analysis:

FORECAST_ERROR  = Average analyst forecast error over the three years prior to the measurement of tax-avoidance measures. Each year, analyst forecast error = (median analyst forecast issued immediately before the fiscal year-end – actual earnings for that fiscal year)/price at the end of the previous year. This variable is calculated following Balakrishnan et al. (2012)

Other Variables Used to Calculate DTAX and SHELTER:

PERMDIFF  = Total book-tax differences less temporary book-tax differences = pretax income – (current federal tax expense + current foreign tax expense)/statutory tax rate – deferred tax expense/statutory tax rate, scaled by beginning total assets. If current federal tax expense is missing, then we set current federal tax expense to total income tax expense less current foreign tax expense less state tax expense less deferred tax expense. Statutory tax rate is assumed to be 0.35 for the entire sample period.

INTANG  = Total intangible assets scaled by beginning total assets

UNCON  = Income (loss) reported under the equity method scaled by beginning total assets

MI  = Income (loss) attributable to minority interest scaled by beginning total assets

CSTE  = Total state tax expense scaled by beginning total assets

BTD  = Pretax income – [(current federal tax expense + current foreign tax expense)/statutory tax rate – ΔNOL], scaled by beginning total assets. If current federal tax expense is missing, then BTD = Pretax income – [(total income tax expense – deferred tax expense – state tax expense – other income tax expense)/statutory tax rate – ΔNOL], scaled by beginning total assets.