THE EFFECTS OF DIVIDEND TAXATION ON SHORT SELLING

Jacob R. Thornock

A dissertation submitted to the faculty of the University of North Carolina at Chapel Hill in partial fulfillment of the requirements for the degree of Doctor of Philosophy in the Kenan-Flagler Business School.

Chapel Hill
2010

Approved by:

Michelle Hanlon

Wayne Landsman

Edward Maydew

Adam Reed

Douglas Shackelford

ABSTRACT

JACOB R. THORNOCK: The Effects of Dividend Taxation on Short Selling
(Under the direction of Edward Maydew)

I examine the effects of dividend taxation on the primary parties involved in a short sale: the lender of the stock and the short seller. Using a proprietary dataset of short lending fees and quantities, I find evidence that the supply of shortable shares decreases and lending fees increase around the dividend record date. Moreover, I find greater increases in lending fees and decreases in loan supply for lenders that are sensitive to dividend taxation. The loan fee increase and loan supply decrease are consistent with a tax-induced shift in the loan supply curve. In addition, I examine effects on short sellers of the incomplete price drop on the ex-date. I find a significant decrease in short volume before the ex-date followed by a significant increase after the ex-date. This finding is consistent with short sellers delaying trading to avoid the cost of an incomplete price drop. To my knowledge, this is the first paper to examine the effects of dividend taxes in the domestic short selling market.

I dedicate this dissertation to my wife, Kerrie, and our children, Allie, Lukas and Mia.

This work is truly our joint accomplishment.

ACKNOWLEDGEMENTS

I thank my dissertation committee: Edward Maydew (Chair), Michelle Hanlon, Wayne Landsman, Adam Reed, and Douglas Shackelford for their continuous support and guidance on this project. I am also very grateful to the professors and students at the University of North Carolina for their help and encouragement throughout the program. I appreciate helpful comments on this paper from Jeff Abarbanell, Dirk Black, John Campbell, Craig Chapman, Ted Christensen, Shane Dikolli, Mike Drake, Scott Dyreng, Pete Lisowsky, Kevin Markle, Sam Melessa, Matt Ringgenberg, Darren Roulstone, Terry Shevlin, Mohan Venkatachalam and Jerry Zimmerman as well as from workshop participants at Brigham Young University, Duke University, Northwestern University, Penn State University, Stanford University, University of California at Los Angeles, University of Illinois at Urbana-Champagne, University of Oregon, University of Rochester, University of Southern California, University of Washington, Washington University at St. Louis, and Yale University. Finally, I thank the data provider for the use of their confidential database, as well as several anonymous practitioners in securities lending who provided useful insights and comments.

TABLE OF CONTENTS

LIST OF TABLES

Table

LIST OF FIGURES

Figure

1. Introduction

This paper examines the effects of dividend taxation on short selling around dividend dates. The ability to sell securities short is important to the market because it helps improve the incorporation of negative information into stock prices (Diamond and Verrecchia, 1987) and helps to align stock prices with fundamental values (Dechow et al., 2001). It is therefore important to understand how constraints to short selling arise. The purpose of this paper is to examine the extent to which dividend taxes give rise to additional costs of short selling.

There is little empirical evidence on the effects of taxation on short selling in the United States, likely because of the lack of data on investor tax characteristics and short selling volume. For this paper, I employ a proprietary dataset of short lending data, which includes loan costs and loan availability. These data identify the tax preferences of the equity lenders who provide shares to short sellers, making it possible to directly examine the effects of taxation on stock lending. In addition, I employ data on actual short sales volume for NYSE, Nasdaq and AMEX firms, which allow me to examine how taxes directly affect short sellers' trading relative to others' trading.

I examine two channels through which taxation can affect short selling. The first channel, which I call the "loan effect," is through the equity loan market. Short sellers borrow shares of stock from the equity loan market, which is composed of lendable shares held by large institutions and brokers. A stock loan that is open over the dividend record date can have adverse tax consequences to the lender. The dividend can lose preferential "qualified dividend" tax rates, which would increase the tax rate from 15% to up to 38%. In addition, the dividend no longer qualifies for the dividends received deduction (DRD) against corporate income. Some lenders, such as pension funds, are tax-exempt and thus indifferent to these tax consequences, while others, such as retail brokerages, are sensitive to dividend taxes and in response can reduce loan supply. For example, Fidelity suggests that it could "recall dividend-paying shares" prior to the record date to avoid increasing dividend tax rates to the owners of the stock.[1] The data used in this study identify the tax-sensitivity of each lender, which I exploit to examine how short selling costs vary with lenders' exposure to dividend taxation.

I examine the loan effect using an equilibrium framework that allows me to assess how taxes affect the demand and supply for stock loans. Although the supply and demand curves are unobservable, I infer shifts in the curves by examining changes in both prices and quantities, following Cohen et al. (2008). For example, if loan fees (i.e., loan prices) increase coincident with a decrease in loans available (i.e., loan quantities), then at least an inward shift in supply has occurred. Using combinations of prices and quantities in the loan market, I predict that the loan effect of taxation is associated in an inward shift in the loan supply curve.

I also examine a second channel through which taxes affect short sellers, which I call the "reimbursement effect". The reimbursement effect arises from the requirement by the Internal Revenue Code (IRC) that traders reimburse to lenders the full amount of

[1] http://personal.fidelity.com/planning/tax/content/annualcredit.shtml.cvsr

the dividend on short positions held open over the dividend dates. By meeting this requirement, short sellers ensure that the stock loan will be characterized as a loan rather than a stock sale, which would induce capital gains taxation.[2] Prior research shows that stock prices do not drop by the full amount of the dividend on the ex-date. Among other explanations, this finding has been attributed to taxation (e.g., Elton and Gruber, 1970; Graham et al., 2003). The implication to the short sale market of an incomplete price drop is that the short seller's cost (the reimbursed dividend) is greater than his gain (the price drop). For example, if the price drop is only 80% of the dividend, short sellers lose 20% of the dividend because they must reimburse 100% of the dividend to the equity lender (Dechow et al., 2001).

The findings indicate that taxes affect short selling through both tax channels. Consistent with the loan effect, I find evidence of an inward shift in the supply curve in the shorting market around the dividend record date. That is, I find that lending fees increase and loan quantities decrease around the dividend record date; an increase in price combined with a decrease in quantities is consistent with an inward shift in the loan supply curve. Specifically, around the dividend dates, short lending fees increase by 27% more than the median rate before the dividend dates and by over 400% above the median rate at the 90th percentile. At the 90th percentile, the cost to sell short is over 100 bp, which is considered "on special" (i.e., expensive) for all investors and completely prohibitive for small investors.

Having provided evidence consistent with an inward shift in the loan supply curve, I next examine whether taxes play a role in shifting the supply curve. That is, I

---

[2] IRC §1058 (b)(2).

examine how shorting fees and quantities vary with the lender's sensitivity to taxation. The evidence is consistent with taxation inducing the inward shift in supply: for tax-sensitive lenders, lending fees increase and loan quantities significantly decrease, while for tax-neutral lenders, lending fees increase, but there is no change in lending quantities. These "price-quantity pairs" suggest that dividend taxation is associated with an inward shift in loan supply.

The results also support the reimbursement effect on short selling. In the last days that the stock trades cum-dividend (i.e., the days leading up to the ex-dividend date), short volume decreases significantly, bottoming out on the cum-day (i.e., the last day the stock trades cum-dividend). Following the cum-date, short volume significantly increases for three days and then falls back to normal levels. Next, I examine whether the decrease in short volume before and increase in short volume after the cum-date is the result of the reimbursement effect and find evidence in support of the reimbursement effect. Where dividend reimbursement is costly to short sellers, there is an eight percent total decrease in short volume over the five days before ex-date, followed a four percent increase following the ex-date. This pattern is much smaller when dividend reimbursement is not costly for short sellers. These findings are consistent with the reimbursement effect causing short sellers to delay taking a short position until after the stock trades without the dividend (i.e., on or after the ex-dividend date).

This paper contributes to the literature in several respects. To my knowledge, this is the first paper to provide empirical evidence on the effects of dividend taxes on short selling in domestic equities.[3] In their recent review of tax research in accounting, Hanlon and Heitzman (2009) suggest that examining "whether and how tax policies affect investor and business decisions is a crucial task for academic research" (p. 38). My findings suggest that taxation affects the behavior of short sellers, who appear to delay short positions to avoid the cost of the dividend, and the behavior of equity lenders, who appear to recall loan supply to avoid increased tax costs. In addition, Chetty et al. (2007) suggest that to better understand the effects of taxes on asset prices, more work examining the effect of taxes on trading volume is needed (p. 21). This study contributes by directly examining the effects of taxes on trading volume by a specific group of traders—short sellers.

[3] Two other papers, Arnold et al. (2005) and Christopherson et al. (2005) have documented the existence of shorting against the box, which is associated with capital gains taxation, and cross-border securities lending, which is associated with dividend taxation. However neither of these effects is currently feasible within the United States.

2. Background

2.1 Mechanics of Short Selling and Equity Lending

A short sale entails selling securities that are not owned by the seller. The short seller establishes a short position by borrowing a stock and selling it in the open market. He then closes the position by buying the stock back at a later time, using the purchased shares to extinguish the initial loan of the stock. By selling short, an investor can profit from a decrease in the stock price if the purchase price of the stock is less than the sale price.

In general, a short sale requires a temporary loan of a security, which is sold to the purchaser of the stock.[4] There are two main parties in an equity loan, the lender and the borrower. Stock lenders are beneficial owners of securities who directly loan their shares to borrowers or loan their shares via intermediate agent lenders whose specialty is finding borrowers for the stock. Because third-party lenders are the agent representative for the beneficial owner and act on behalf of the owner, for expositional purposes, this paper will refer to both owners and intermediate lenders as simply "lenders."

Like other markets, the equity loan market clears at the price where supply equals demand (Cohen et al., 2008). The supply of securities available for lending is provided by large institutions that have long-term long positions in equities. Lenders, such as retail investors, mutual funds, pensions, endowments, foundations and insurance companies,

[4] The exception occurs when a stock is sold as part of a short sale, but delivery of the stock does not take place three days later. This is commonly referred to as a naked short sale.

cover the cross-section of investors.[5] The demand for securities loans is derived mostly for settlement issues, such as short selling and covering delivery failures. The lending fee is determined by supply and demand in the lending market; high demand or low supply increases the fee collected by the lender from the borrower (Kolasinski et al., 2009).

The lender retains most of the rights associated with owning the original stock, including distributions such as interest and dividends. If the stock loan is open over the dividend record date, the short seller is required by the IRC to repay the value of the dividend to the lender in order to classify the transfer of securities as a loan. This repayment is called a "substitute dividend."[6] As part of the loan contract, the lender gives up the right to vote for securities on loan over voting record dates (Christofferson et al., 2007; Faulkner, 2008). The voting rights of the security are transferred to the new owner (i.e., the purchaser of the stocks sold short). A retail borrower is required by SEC Regulation T to meet initial margin requirements of 50% of transaction value. The proceeds from the short sale are escrowed as part of the collateral requirement and the collateral is marked to market daily. Lenders profit by investing the collateral in short-term cash investments. When the loan is closed, the borrower returns the shares and the lender returns the collateral less a fee called the rebate rate. Practitioners refer to stocks with high fees (and low rebate rates) as being "on special" (D'Avolio, 2002).[7]

[5] In general, retail investors loan their securities as part the margin agreement with their broker. Retail investors generally do not know that their shares are on loan and do not receive compensation for loaning their stocks.

[6] This reimbursement is often called a substitute dividend, a manufactured dividend or a payment in lieu of dividend. These terms are used interchangeably in the text.

[7] Typical lending fees, even for stocks on special, are small. A $1MM stock loan (requiring 102% collateral) with specialness of 100 bp for seven calendar days is $198 = ($1.02MM)(0.01)(7/360).

It is important to note the timing and settlement of a stock loan transaction for each party. For a transaction (long or short) on trade date *t*, settlement takes place on date $t + 3$. The stock loan corresponds to the settlement date; that is, the loan for a short sale that trades on day *t* is settled on day $t + 3$. The implication of delayed settlement for this study is that short-selling that occurs on the cum-dividend day corresponds to a stock loan on the dividend record date, which occurs three days later. Thus, each party has a different event date for the same event: for short-sellers the event date is the cum-date, and for stock lenders the event date is the record date. In the research design section below, I address how I account for the different event dates for each party.

The loan of the stock to a third party, such as a short seller, is not taxable in the United States, so long as the loan is recallable and all distributions are reimbursed back to the lender.[8] The Internal Revenue Code section 1058 affirms that an equity loan is a non-taxable exchange of the stock for a securities loan contract. Thus, the lender does not recognize a tax gain or loss on initiation of stock loan. Fees earned from the loan, however, are taxable. In addition, lenders may face additional tax consequences for lending over the dividend dates and receiving a substitute dividend in lieu of the standard dividend. This study focuses on two specific characteristics of the substitute dividend that can affect short sellers: the loan effect and the reimbursement effect, which are discussed in more detail below.

2.2. Loan Effect

[8] Bris et al. (2007) report that in some countries (e.g., Chile, Finland), a stock loan is taxed as a sale of the stock, which significantly deters securities lending in those countries.

Lending a security over the dividend record date can have two distinct adverse tax consequences. First, lending over the record date can change the treatment of the dividend from qualified to unqualified. The Jobs and Growth Tax Relief Reconciliation Act of 2003 (JGTRRA) reduced the federal tax rate qualified dividends to 15% from 38%. However, substitute dividends are not taxed as qualified dividend income, but instead are taxed at ordinary income rates as high as 38%.[9] Lenders are well aware of this potential tax cost of securities lending. For example, Vanguard acts as the agent lender for retail owners of its mutual funds. To protect the dividends received in the funds from additional taxation, Vanguard monitors securities lending of qualified dividends and states that it can "restrict lending by a particular fund if it could have adverse tax consequences to the fund's shareholders."[10]

The second possible adverse tax consequence associated with lending over the record date involves deduction of the dividend received from corporate income. The DRD allows for a 70% deduction on dividends received from other corporations. Corporate lenders, such as corporations and insurance companies, subject to corporate taxation in the U.S. will face a heavier tax burden if their shares are lent over the record date because substitute dividends are not eligible for the DRD (Fabozzi, 2004).[11]

These adverse tax consequences only apply to some lenders.[12] Mutual funds and retail brokerages with clients whose holdings may be subject to additional taxation are sensitive to losing dividend qualification, and insurance companies and other

[9] http://www.irs.gov/irb/2003-40_IRB/ar18.html; http://www.irs.gov/publications/p550/ch04.html#d0e12370

[10] https://advisors.vanguard.com/VGApp/iip/site/advisor/researchcommentary/news/article?File=IWE_NewsSecuritiesLending; see also: http://www.sec.gov/comments/4-590/4590-16.pdf.

[11] Section 1.1058-1(d). This rule is intended to remove duplicate tax benefits that would arise if both the lender and the borrower claimed the DRD against corporate income.

[12] http://www.eseclending.com/about_securities/lending101.php

corporations are sensitive to losing the deduction for dividends received. Lenders that face no tax consequences, such as foundations, pension funds, and endowments, should be indifferent to lending over the record date because they neither lose the DRD nor face increased dividend taxation. I exploit this variation in tax-sensitivity in securities lenders in testing whether dividend taxes affect short sellers through the loan effect.

2.3. Reimbursement Effect

As mentioned above, when a security is on loan over the dividend record date, the short seller is required by the IRC § 1058 to reimburse the amount of the dividend to the lender. By meeting this requirement, short sellers ensure that the stock loan is treated as a temporary transfer of stock, rather than a stock nosale that would induce capital gains taxation. The compensation the short seller receives for purchasing the stock cum-dividend is the drop in price that occurs from the cum-date to the ex-date. Thus, if the price drop is less than the amount of the dividend, the short seller will lose the difference because she must pay a full substitute dividend regardless of the incomplete drop in price.[13] For example, in a frictionless market, if the dividend is one dollar, the price should drop by one dollar from the cum-dividend date to the ex-dividend date. However, if the price drops by only eighty cents (because of taxation or other market frictions), the short seller loses twenty cents because he reimburses a full dollar.

To summarize, taxes can be associated with short sales constraints in two ways. First, taxes on the owners who supply loans to short sellers can cause them to recall supply, which increases shorting fees. Second, the tax code requires that short sellers

[13] Another tax cost facing short sellers is that short positions are always treated as short-term capital gains, regardless of how long the position has been open.

reimburse the dividend back to the lender. The incomplete price drop is costly to short sellers who reimburse the lender the full amount of the dividend.

3. Literature Review and Hypothesis Development

3.1 Taxation and Portfolio Choice Literature

The effects of investor taxation on ex-dividend day asset prices and trading volume has been extensively researched. It is well known that the price-drop-to-dividend ratio is less than one; however there is no consensus explanation for why this irregularity would occur. Several explanations for the incomplete price drop have emerged in the literature, including taxation (Elton and Gruber, 1970), transactions costs (Kalay, 1982), price discreteness (Bali and Hite, 1998), and bid-ask bounce (Frank and Jagannathan, 1998). The underlying theme among all of these explanations is trading frictions, in the form of taxation, transaction costs or other frictions, that arise around the dividend dates. These frictions reduce the ability of arbitrageurs to trade away excess returns and thus give rise to overpricing on the ex-date.

Elton and Gruber (1970) suggest that ex-day price drop is a function of differential sensitivity to dividend and capital gains taxation. In a frictionless market, they show that in equilibrium, $(P_{cum} - P_{ex})(1 - t_{cg}) = Div(1 - t_{div})$, and thus

$$\textit{Price-Drop Ratio} = PDR = \frac{P_{cum} - P_{ex}}{Div} = \frac{(1 - t_{div})}{(1 - t_{cg})} \quad (1)$$

where P_{cum} is the price of the stock the day before it goes ex-dividend, and P_{ex} is the price of the stock on the ex-date, Div is the amount of the dividend and t_{cg} and t_{div} are the capital gains and dividend tax rates, respectively. Since that initial paper, dozens of papers have documented an association between the incomplete price-drop and taxation (see Graham (2006) for a recent survey). For example, Graham et al. (2003) find that the median price drop is only 75% of the amount of the dividend, which they attribute to dividend taxation.

There is also a large literature on the effects of taxation on equity portfolio choice (Hanlon and Heitzman, 2009). Researchers have examined the investor response to both dividend and capital gains taxation. With regard to dividend taxation, studies find evidence that investors form clienteles based on their preference for dividend taxes. For example, Graham and Kumar (2006) find evidence that high-tax rate investors own stocks with lower dividend yields. There is also evidence that international dividend withholding tax incentives influence the worldwide portfolio decisions of individual investors (e.g., Desai and Dharmapala, 2009).

With regard to capital gains taxation, there is evidence that capital gains taxation induces "lock-in", in which investors delay stock sales to avoid higher short-term capital gains taxation (e.g., Blouin et al., 2003; Dai et al., 2008). Others have found evidence that investors carry out inefficient tax trading and portfolio location with regard to capital gains (Barber and Odean, 2004) and that capital gains taxes affect the managers' decisions to sell their stock (e.g., Jin and Kothari, 2008).

At this point in the literature, it is really not a question of whether taxation affects portfolio allocation decisions, but rather where and by how much do taxes matter in investors' decisions (Shackelford and Shevlin, 2001). The sheer number of papers exploring the effects of taxes on investors' equity portfolio decisions suggests that it is an open and important question.

3.2 Short Selling Literature

Short selling can be expensive in many ways. In addition to transactions costs and broker fees, there are many legal and institutional constraints that prevent short selling. Almazan et al. (2000) find that only about 30% of mutual funds are allowed by their charters to sell short and many countries (e.g., Finland, Spain and New Zealand) completely prohibit the practice or have tax regulations that make shorting impracticable (Bris et al., 2007; Charoenrook and Daouk, 2005). Cultural norms in some institutions and countries also give rise to short sales constraints (Lamont, 2005; Nagel, 2005).

With regard to how taxes affect short selling, there are two effects that have been documented: shorting against the box and cross-border securities lending, although neither of which is currently practicable in the United States. Investors who wish to reduce their taxation can extend the holding period of the asset until it qualifies for favorable long-term capital gains rates (Shackelford and Verrecchia, 2002). In a "short sale against the box," an investor avoids higher short-term capital gains taxation by taking a short hedge position against the same security that has an accumulated gain, thereby locking in the gain until the qualification period expires. Brent et al. (1990) find evidence that short interest is lower in December than in other months, which is consistent with investors using shorting against the box as a tax-deferral strategy. Arnold et al. (2004) find evidence that since shorting against the box is not based on private information, the remaining short selling will be more informative and thus have a greater influence on prices. However, the Taxpayer Relief Act of 1997 (TRA97) made shorting against the box an impractical strategy by removing its tax benefits.

Several studies examine cross-border dividend tax arbitrage using securities lending, which entails moving shares to countries with reduced tax rates on dividends (McDonald, 2001; Christofferson et al., 2005). For example, an investor in a high-tax country lends stocks to an investor in a low-tax country on the dividend record date. The low tax investor then receives the dividend, which is taxed at lower rates in her country, and the two parties split the gains from the transaction. This transaction is effective at reducing taxation across tax regimes, but not within the same tax regime. The effect of taxes on domestic short selling and equity lending is not addressed in the literature.

3.3 Hypothesis Development

The equity loan market is composed of many lenders of stocks. The most common types of lenders are institutions who have large investments with a long holding period. These institutions have differential preferences for taxation. The loan effect, as mentioned above, posits that lenders that face increased taxes if they receive substitute dividends (on stock they lent to short sellers) rather than actual dividends will reduce their loan supply to avoid tax costs. I predict the increased tax costs on lenders around dividend dates will cause the quantity of lendable shares to decrease and lending fees to increase. This discussion leads to the first set of hypotheses on the loan effect:

H1a: The supply of lendable shares shifts downward around the dividend dates in response to unfavorable tax consequences to beneficial owners, and in response, lending fees will increase.

H1b: The increase in lending fees and the decrease in loan supply are positively (negatively) related to the lender's sensitivity to dividend taxation.

Next, I consider the second avenue through which taxes can affect short sellers—the reimbursement effect. A trader who sells short on the cum-date and repurchases the shares on ex-date makes a profit if

$$P_{cum} - P_{ex} - (P_{cum} - P_{ex})t_{cg} - Div(1 - t_{cg}) - C(1 - t_{cg}) > 0. \quad (2)$$

The short seller sells the stock cum-dividend and receives P_{cum} and repays Div back to the lender. The short seller unwinds the position by purchasing the stock on the open market for P_{ex} and returning it back to the lender and pays transaction costs of *C*. Rearranging equation (2) to match the *PDR* and ignoring transaction costs, a short position is profitable if

$$PDR = \frac{P_{cum} - P_{ex}}{Div} > 1. \quad (3)$$

However, we know from prior research that, on average, *PDR* < 1. For example, Graham et al. (2003) find a median *PDR* of 0.75 during 2001 and Zhang et al. (2008) find a median *PDR* of 0.75 in 2005. For my sample, which covers the period 2005 - 2007, the median *PDR* is 0.79. This finding suggests that for the median dollar of dividend paid, the real cost to the short seller is 21 cents. This discussion leads to the second set of hypotheses on the reimbursement effect:

H2a : Short selling is reduced (increased) in the days leading up to (following) the cum-dividend date.

H2b: The drop in short selling before and on the cum-dividend date is a function of the potential reimbursement cost.

These predictions are similar to those in Michaely and Vila (1996), which posit that abnormal trading volume around the ex-date is decreasing in transaction costs.

4. Data and Research Design

4.1 Data and Variable Construction

Prior research examining the effects of taxation on investor's trading has difficulty isolating the tax-status of the trader (Shevlin, 2007). Proprietary data have made it possible for some researchers to directly identify investor tax-status and more directly infer tax effects on portfolio decisions (e.g., Ivkovic et al., 2005; Sikes, 2009; Desai and Jin, 2009). My data offer a similar advantage.

This study uses a proprietary database of stock lending availability and lending fees from multiple lenders, such as retail brokerages, pensions, insurance companies, banks and mutual funds, over several years. This database is comprised of lending activities for nine large lenders with varying sensitivity to dividend taxation on stock loans.[14] I exploit this feature of the data to examine whether cross-sectional variation in dividend tax sensitivity is associated with variation in lending fees and loan supply.

The dataset provides the average loan fee paid for a short position for each firm and day. The loan fee for a given firm *i* on day *t*, $SPECIAL_{it}$, is calculated as the difference between the federal funds rate on day *t* and the average rebate rate on day *t*. Since every short sale has a different contract (and thus a different rebate rate), the rebate rate used in this study is weighted-average rate for all contracts for a given firm-day,

[14] Ideally, the data would allow for analyses of the same lender before and after the passing of JGTRRA in 2003. However, my proprietary dataset does not extend back to 2003; hence, I rely on cross-sectional tests in the research design.

following Gezcy et al. (2002). For a subset of the sample, I observe the lending fee, *SPECIAL*, for each of the nine lenders. I adjust the fee for each lender's benchmark rate following Kolasinski et al. (2009).[15]

The proprietary data also provide the total number of shares available for stock loans as well as the number of shares on loan each day for each lender. Total shares available for firm *i* on day *t*, $AVAIL_{it}$, is the sum of shares available from all lenders scaled by total shares outstanding from CRSP. Total shares on loan, QTY_{ijt}, is measured as the number of shares of stock *i* lent by lender *j* on day *t* divided by total shares outstanding.

To examine the trading activities of short sellers, I collect short selling volume from each of the three exchanges. Short volume for the NYSE is available via NYSE TAQ on WRDS; short volume for the AMEX and Nasdaq exchanges is available from the exchange websites.[16] The short volume database covers all short transactions for firms on the NYSE, Nasdaq and AMEX exchanges over the period January 2005 through May 2007. The data are given at the transaction level; to arrive at a daily measure, I sum across all transactions for a given firm-day, following Diether et al. (2009b).

The primary measure of short volume used in this study is relative short volume to total trading volume. Relative short volume for a given firm *i* on day *t*, $RELSS_{it}$, is calculated as the ratio of total short sale volume to total share volume. As noted in

---

[15] More details about the dataset are provided in Kolasinski, Reed and Ringgenberg (2009), who use the data to map the loan supply curve in the equity lending market.
[16] I thank Mike Drake for providing access to these data.

Diether et al. (2009a), *RELSS* is less skewed than other measures of short-selling activity.[17]

The use of daily short volume data is an improvement over prior research. Most of the prior research on short selling uses monthly short interest, which is a stock variable of the level of outstanding short positions. Daily short volume is only recently publicly available, and it is only available for a limited time frame, 2005 - 2007. The exchanges made these data available in compliance with SEC Regulation SHO requirements.[18]

Following Geczy et al. (2002), I align equity lending dates with short selling dates. Because trade settlement in the U.S. occurs after three days, short selling on day t requires a stock loan on day $t + 3$. As a result, I match short selling on day t with lending fees and stock availability on day $t + 3$. The timing of the dividend dates follows the same $t + 3$ pattern—for a given cum-dividend date t, the dividend record date generally occurs on day $t + 3$.[19] In sum, cum-dividend day short selling corresponds to a stock loan on the dividend record date.

Table 1 presents the criteria used to create the sample. There are 7,871 quarterly dividend observations for common stocks with available short volume, loan supply and lending fees over the sample period 2005 – 2007.[20] I examine quarterly dividends from

---

[17] *RELSS* is used in most studies that examine short volume, including Christophe et al. (2004), Daske et al. (2005), Boehmer et al. (2008), Diether et al. (2009a, 2009b), and Christensen et al. (2009).

[18] The short selling data do have some drawbacks. First, the data provides only short initiations, but not short coverings. That is, the data do not show when the short position is closed by buying back the shares. Second, the short volume data does not identify the short seller: they may be institutions, retail investors or market makers shorting for liquidity reasons. Boehmer, Jones and Zhang (2008) observe short account types and find that 74% of short sales are initiated by institutions.

[19] http://www.sec.gov/answers/dividen.htm

[20] Following Deither et al. (2009a) and other papers, I include only common stocks (CRSP shrcd 10 or 11); I exclude distributions from ADRs, REITs, ETFs and LPs, which face different tax treatment for dividends and capital gains than the majority of the sample firms.

the CRSP distribution files because they are predictable and generally part of a committed dividend strategy of the firm (Dhaliwal and Li, 2007).[21] I restrict the sample to observations with a three-day difference between the cum-dividend date and the record date to ensure that settlement of short volume on the cum-dividend date takes place dividend record date, which removes 600 record date observations. I exclude observations with missing *PDR*, which removes 169 observations. To remove the effects of dividend signaling, if the initial dividend of a firm occurs during the sample period, the observation is excluded (239 observations). In addition, I delete 325 observations with missing control variables, which are defined below. As indicated in Table 1, the final sample includes 6,538 quarterly dividends paid by 1,232 firms during 2005 – 2007.

To examine the effect of a lender's sensitivity to taxation, I employ a dataset that identifies the lender of the stock loan. These data are subject to two additional criteria. First, I require non-missing values for at least 10 observations for each lender per firm-event observation. This criterion removes observations characterized by infrequent lending for a given lender. Second, I remove small transactions, which I define as those of less than 20,000 shares, to mitigate the effect of small loans on *SPECIAL*. As noted in Geczy et al. (2002), small transactions are made on a contract-by-contract basis and are not likely to be representative of the average daily lending cost for a given stock.

The first hypothesis predicts that abnormal lending fees are positively associated with the sensitivity of the equity lender. I exploit variation in the tax-sensitivity in lenders to assess whether the abnormal increase in lending rates is associated with

[21] CRSP distribution code 1232. This excludes special dividends, which if they are sufficiently large, can have different tax consequences.

taxation. I identify tax-sensitive equity lenders as those that would prefer to avoid lending over the record date to keep the preferential tax treatment of qualified dividends. The lending database has loan data for two lenders that are tax-sensitive, a retail brokerage house and a mutual fund. For these lenders, an open stock loan over the dividend record date can significantly increase the rate at which the dividends are taxed. For these two lenders, I set an indicator variable, *TAXSENS*, equal to one. The other seven lenders, which are broker/dealers that loan and borrow from hedge funds, banks, endowments and pension funds, are characterized as tax-insensitive and thus, for these lenders, *TAXSENS* = 0.

H2 predicts that the decrease in short volume is particularly strong when short sellers face real costs of the cum-date trading position (i.e., when the price-drop ratio is less than one). Accordingly, I set the indicator variable *REIMBCOST* equal to one when the $PDR_{t-1} < 1$ and zero otherwise. I choose the lagged *PDR* as a proxy for the signal to short sellers that the price drop will be incomplete. In addition, I use the split-adjusted amount of the dividend, *DIV*, as a measure of the cost of reimbursement.

The specifications below include several controls that have been shown to affect either the short lending fee or the amount of short trading volume. D'Avolio (2002) and Duffie et al. (2002) show that loan supply is dominated by large, liquid stocks held by large institutions. D'Avolio (2002) also shows that loans fees are higher for growth firms. Diether et al. (2009a) document that Nasdaq firms have higher relative short volume than firms traded on other exchanges. Put options provide an alternate route to short selling when lending fees are high (e.g., Brent et al., 1990). As a result, I include controls for institutional ownership, *IO*, to control for loan supply, *SIZE* and *NANALYST* are included to proxy for firm size and *TURNOVER* is included to proxy for share turnover and liquidity. In addition, the specification includes *MB*, to capture to effects of growth firms and an indicator, *NASDAQ*, for firms traded on the Nasdaq. Finally, the specification includes an indicator for option availability, *OPTION*.

The controls are measured as follows. *DIV* is the split-adjusted quarterly dividend amount from CRSP. *SIZE* is the natural log of lagged market capitalization from CRSP. *MB* is market capitalization divided by total common equity. *IO* is institutional holdings from Thompson Financial over the prior calendar quarter scaled by shares outstanding from CRSP. *NANALYST* is the number of analysts following the firm in the prior quarter from I/B/E/S. *TURNOVER* is the mean daily trading volume in the prior quarter divided by shares outstanding from CRSP. *NASDAQ* is an indicator equal to one for firms traded on the Nasdaq. *OPTION* is an indicator equal to one if the firm has publicly traded options in the prior quarter according to OptionMetrics.

Panel A of Table 2 presents summary statistics for the stock lending and short selling variables during the non-event period. The average loan fee, *SPECIAL*, during the non-event period is 36 bp, with a median of 13 bp. These values are similar to those in other papers that find that lending fees are low on average, with a high degree of skewness in the distribution of fees (e.g., D'Avolio, 2002; Reed, 2007; Diether and Werner, 2009). The mean level of shares available for securities loans is 10 percent of shares outstanding. The median loan length is 23 days, and the median loan value is $317,135 (unreported).[22] Panel A of Table 1 reveals that about 20% of all trading

[22] By comparison, Diether and Werner (2009) find that median loan length is 6-8 days (depending on the sample) and the median loan size is $240,000.

volume is short volume, which is a similar level to that presented in other papers (e.g., Boehmer et al., 2008).

Panel B of Table 2 presents the summary statistics for the firms in the sample. The median price-drop to dividend ratio (*PDR*) is 0.79, which implies that the price drop is incomplete on average. The average dividend amount is 21 cents, and the (untabulated) dividend yield average is 0.6% of the cum-dividend day price. Institutions on average hold about two-thirds of the shares outstanding. Approximately ten analysts cover the firm during the prior quarter, and 62% of the firms in the sample have listed options. Finally, about 80% of the observations in the sample are NYSE and AMEX firms and the remaining 20% trade on the Nasdaq.

Pair-wise correlations are presented in Panel C of Table 2. Relative short volume, *RELSS*, is strongly negatively associated with the size of the firm (ρ = -0.39), the number of analysts following the firm (ρ = -0.27), and options listing (ρ = -0.14). These correlations suggest that relative short volume is less for large, visible firms and that some investors are substituting options trading for shorting. The cost to sell short, *SPECIAL*, is positively associated with short selling volume (ρ = 0.19).[23] The correlations also suggest that smaller firms (*SIZE*, ρ = -0.39) that are less visible (*NANALYST*, ρ = -0.32) and that turnover frequently (*TURNOVER,* ρ = 0.15) are more costly to sell short. Finally, the loan supply available to short sellers, *AVAIL*, is strongly

[23] Untabulated analysis reveals a concave relation between short volume and specialness: up to a certain point (about 100 bp), short selling is positively associated with specialness. As the cost to short continues to increase above this point, the relation turns negative, which suggests that at this point, shorting constraints are binding.

associated with institutional ownership (ρ = 0.52), size (ρ = 0.20), turnover (ρ = 0.25), and analyst following (ρ = 0.16).

4.2 Research Design

I implement an event study research design in which the event is the dividend record date for stock lenders and the cum-dividend date for short sellers. As mentioned above, once delayed settlement is accounted for, these two dates are equivalent. The first hypothesis predicts that the supply of lendable shares decreases and the cost of stock loans increases around the record date as tax-sensitive lenders respond to potential increased tax costs associated with lending over the record date. Following Cohen et al. (2007) and Dai et al. (2008), I use an equilibrium framework to examine how taxation is associated with a shift in the loan supply curve. That is, I examine combinations of changes in price and quantity to infer shifts in the supply and demand curves of the equity loan market. The event study specification as follows:

$$TESTVAR_{it} = \alpha_0 + \alpha_1 EVENT_{it} + \alpha_2 DIV_{it} + \alpha_3 SIZE_{it-1} + \alpha_4 MB_{it-1} + \alpha_5 IO_{it-1} + \alpha_6 NANALYST_{it-1} + \alpha_7 TURNOVER_{it-1} + \alpha_8 NASDAQ_i + \alpha_9 OPTION_i + e_{it}, \quad (4)$$

where *TESTVAR* is either the total quantity of shares available for lending, *AVAIL,* or the price of a stock loan, *SPECIAL*. *EVENT* is an indicator equal to one on days t = [-1, 0] relative to the record date, t = 0, and zero on during the estimation period, t = [-15, -5] ∪ [5, 15].

For H1a, the coefficient of interest in equation (4) is α_1. If $\alpha_1 < 0$ when the test variable is *AVAIL*, then I conclude that the quantity available for short selling has decreased on the record date, conditional on the other control variables. If $\alpha_1 > 0$ when the test variable is *SPECIAL*, then I conclude that the lending fee has increased to levels that are significantly higher than normal. The finding of price increases coupled with quantity decreases is consistent with a negative shift in the loan supply curve.

Second, I examine whether the increase in lending fees is greater for tax-sensitive lenders, following hypothesis H1b. H1b predicts that the shift in the loan supply curve around the record date is attributable to tax-sensitive lenders reducing supply and/or increasing loan fees. I augment equation (4) with a variable that captures the tax-sensitivity of the lender, *TAXSENS*, which is equal to one for tax-sensitive lenders (e.g., retail brokerages) and zero otherwise. The specification is as follows:

$$TESTVAR_{ijt} = \alpha_0 + \alpha_1 EVENT_{it} + \alpha_2 TAXSENS_j + \alpha_3 EVENT_{it} * TAXSENS_j + \alpha 4DIVit{+}\alpha 5SIZEit{-}1{+}\alpha 6MBit{-}1{+} \alpha_7 IO_{it-1} + \alpha_8 NANALYST_{it-1} + \alpha_9 TURNOVER_{it-1} + \alpha_{10} NASDAQ_i + \alpha_{11} OPTION_i + e_{it}\,, \quad (5)$$

where *TESTVAR* is either *SPECIAL* or *QTY* and *EVENT* is an indicator equal to one on days t = [-1, 0] relative to the record date, t = 0, and zero on during the estimation period, t = [-15, -5] ∪ [5, 15]. When the test variable is *SPECIAL*, $\alpha_3 > 0$ would suggest that tax-sensitive lenders charge an incrementally higher rate than other lenders on the record date. When the test variable is *QTY*, $\alpha_3 > 0$ suggests that tax-sensitive lenders reduce loan supply of stock loans for short selling. By examining changes in both prices and quantities, I can ascertain how the loan supply curve responds to taxation.

The second hypothesis predicts that taxes affect short sellers through the reimbursement effect. To test this prediction, I examine whether short volume decreases in the days during which the stock trades cum-dividend (i.e., the days leading up to and including the cum-date) and increases after the stock trades without the dividend (i.e., on and after the ex-date). The specification to test H2a is as follows:

$$RELSS_{it} = \alpha_0 + \alpha_1 EVENT_{it} + \alpha_2 DIV_{it} + \alpha_3 SIZE_{it-1} + \alpha_4 MB_{it-1} + \alpha_5 IO_{it-1} + \alpha_6 NANALYST_{it-1} + \alpha_7 TURNOVER_{it-1} + \alpha_8 NASDAQ_i + \alpha_9 OPTION_i + e_{it}, \quad (6)$$

where *RELSS* is the ratio of short volume to total volume, measured as a percentage. *EVENT* is either equal to one on days t = [-2, 0] relative to the cum-dividend date, t = 0, to capture trading in the last days during which the stock trades cum-dividend or equal to zero on days t = [1, 3] to capture short selling without the dividend. *EVENT* is equal to zero during the estimation period, t = [-15, -5] ∪ [5, 15] and set to missing for all other observations in the event period, t = [-5, +5].

For H2a, which predicts decreased short selling while the stock trades cum-dividend and increased short selling after the stock goes ex-dividend, the coefficient of interest is α_1. If $\alpha_1 < 0$ when the *EVENT* covers days t = [-2, 0], then I conclude that the short volume has significantly decreased leading up on the cum-date. If $\alpha_1 > 0$ when the *EVENT* covers days t = [1, 3], then I conclude that the short volume has increased to levels that are significantly higher than normal. This pattern of decreasing short volume before and increasing short volume after the cum-dividend date is consistent with H2A and suggests that short sellers delay trading in response to incremental shorting costs, such as the costs associated with the loan effect.

Finally, I test whether the abnormal decrease (increase) in short volume before (after) the cum-date is a function of the reimbursement cost faced by short sellers. To capture the effect of the costs, I augment the event-study approach of equation (6) with two measures of the reimbursement cost:

$$RELSS_{it} = \alpha_0 + \alpha_1 EVENT_{it} + \alpha_2 COST_{it} + \alpha_3 EVENT_{it} * COST_{it} + \alpha_4 DIV_{it} + \alpha_5 SIZE_{it-1} + \alpha_6 MB_{it-1} + \alpha_7 IO_{it-1} + \alpha_8 NANALYST_{it-1} + \alpha_9 TURNOVER_{it-1} + \alpha_{10} NASDAQ_i + \alpha_{11} OPTION_i + e_{it}, \quad (7)$$

where *EVENT* and control variables are as defined for equation (6) and $COST \in \{REIMBCOST, HIDIV\}$ is the reimbursement cost of the substitute dividend. *REIMBCOST* is an indicator variable equal to one when the prior quarter price-drop was less than the dividend and zero otherwise and *HIDIV* is an indicator equal to one if the split-adjusted amount of the dividend is in the highest quartile of the sample. I predict a negative relation between abnormal short selling and dividend reimbursement costs, $\alpha_3 < 0$, before the cum-date and a positive relation between short volume and reimbursement costs after the cum-date, $\alpha_3 > 0$. This pattern of decreasing short volume before and increasing short volume after suggests that short sellers delay trading in response to incremental shorting costs, consistent with H2b.

Following Dyreng and Lindsay (2009), I implement robust regression in all analyses to mitigate the influence of outliers.[24] Standard errors are clustered by firm to control for within-firm residual dependence. Prior research has shown that short selling and lending fees are different across industries (e.g., tech stocks) and across time; hence, all specifications include industry fixed effects based on two-digit SIC codes and year-quarter fixed effects.[25] In addition, I include control variables as defined above to control for systematic differences in short selling volume and fees.

[24] Robust regression mitigates the influence of outliers using iterated re-weighted least squares to reduce weights assigned to extreme observations. In some cases, extreme observations receive a weight of zero. I use this approach to mitigate the influence of outliers because it is less arbitrary than other methods such as winsorization or truncation. In general, the results are similar if I control for outliers using truncation or removing observations with high Cook's D values.

[25] The results are robust to the inclusion of firm fixed effects.

5. Results

5.1 Tests of Loan Effect (H1)

Table 3, Panels A and B presents results from event tests of abnormal lending fees and abnormal loan supply around the dividend record date. In tests of abnormal lending fees, the coefficient estimate on the event indicator, *EVENT*, is 0.032 (*t*-stat = 19.11), which suggests that lending fees charged to short sellers on stock loans significantly increased. There is also a significant decline in loan supply around the record date, as shown by the coefficient estimate on *EVENT* of -0.004 (*t*-stat = -21.70). The results hold after controlling for other determinants of loan supply and lending fees, such as size, growth, dividends, institutional holdings, visibility and liquidity. The price-quantity relation of decreasing loan quantity coupled with increasing loan fees suggests that the supply curve in the equity loan market shifts downward around the dividend record date.

The second part of H1 predicts that the shift in the loan supply curve shown above is a function of lender sensitivity to dividend taxation. Table 4 presents the results of estimating equation (5), which tests H1b. The results support the prediction that the negative shift in the supply curve is associated with lenders' sensitivity to the increased costs of dividend taxation. Specifically, in model (2), the coefficient on *EVENT*TAXSENS* is 0.01 (*t* = 3.21), which suggests lending fees around the record date are higher for tax-sensitive lenders than for tax-neutral lenders. In addition, in model (4), the coefficient on *EVENT*TAXSENS* is -0.092 (*t* = -5.81), which suggests lending quantities around the record date are lower for tax-sensitive lenders than for tax-neutral lenders. The increase in loan fees coupled with the decrease in loan quantities for tax-sensitive lender suggests that that dividend taxes on equity lenders is associated with a downward shift in the loan supply curve, which makes short selling more expensive around the dividend dates.

Figure 1 plots the abnormal lending fee on days $t-5$ through $t+5$ surrounding the dividend record date, after controlling for other determinates of lending fees. The results in the figure support the predictions in H1. Specifically, *SPECIAL* is at normal levels in the days leading up to the record date, followed by an upward spike in days $t-1$ to $t+1$ and a drop-off to normal after day $t+1$.[26] The results in the second panel show that when the sample is split into tax-sensitive and tax-neutral subsamples, the spike much greater for tax-sensitive lenders. Overall, the results in Tables 3 and 4, as well as the results in Figure 1, support the loan effect on short selling.

At this point, I discuss the economic significance of the increase in lending fees. The results from Table 3 suggest an average conditional increase in lending fees from 40 bp to about 44 bp. This amount is statistically significant, but economically trivial. However, these results are an estimate of the conditional mean. Higher conditional quantiles provide a better approximation of the economic significance. Untabulated results of quantile regression at the 90% percentile reveal an event-day increase in lending fees from 40 bp to 112 bp, which is much more economically meaningful. At this level of lending fees, the stock is considered "on special", as it is expensive to short.

[26] To reiterate, for stock lending, the spike occurs on the record date, which is the date on which settlement for cum-date short selling takes place.

Perhaps more importantly, stocks with lending fees this high are nearly impossible to borrow for borrowers that are not well-connected, such as small hedge funds and small institutions, and completely impossible to borrow for retail investors (Fabozzi, 2004; Lamont, 2005; Reed, 2007). Thus, the tax-induced increase in lending fees shown in Tables 3 and 4 is both statistically and economically significant.

5.2 Tests of Reimbursement Effect (H2)

Moving to H2, I examine whether short volume is abnormally low in the days leading up to the cum-dividend date and abnormally high in the days following the cum-date. Table 5 presents the results of the event study analysis. It shows that on average, short selling declines below normal levels on the days before the cum-date; the coefficient estimate on the *EVENT* indicator is -0.352 (t = -5.99). Panel B shows that after the cum-dividend date, there is a spike in short selling volume; the coefficient on the *EVENT* indicator is 0.201, which is statistically significant at the one percent level (t = 3.94). The decrease in short selling before the cum-date followed by the increase in shorting volume after the cum-date suggests that short sellers trade as if they are trying to avoid the dividend. The next tests examine whether they appear to do so in response to the reimbursement effect.

Tables 6 and 7 examine the hypothesis that the reimbursement effect contributes to the decline in short volume before the ex-date and increase in short volume after the ex-date. In table 6, the proxy for costly dividend reimbursement, *REIMBCOST*, is negative and marginally significant during the event-period ($\hat{\alpha}_3$ = -0.223, t = -1.97). Moreover, the total coefficient (i.e., $\alpha_1 + \alpha_3$) is negative and statistically significant (*p*-

value = 0.000). The results are weaker, but still significant, for the days following cum-date: the interaction coefficient on *EVENT*REIMBCOST* is insignificant and the total coefficient is significant at the 1% level.

Figure 2 presents the average relative short volume for the dates around the ex-dividend date. The figure shows a pattern of decreasing short volume before and increasing short volume after the ex-date. In untabulated results, days t = [-2, 0] are significantly negative at the 5% level, while days t = [+2, +3] are significantly positive at the 5% level.[27] These findings suggest that that short sellers delay trading until after the stock trades without the dividend.

The second panel of Figure 2 examines short volume around the cum-date, splitting on *REIMBCOST*. The figure shows that when short sellers face a potential reimbursement cost (i.e., *REIMBCOST* = 1), short volume decreases even further before the ex-date and spikes much higher following the ex-date. In statistical terms, when short sellers do not face a potential cost of reimbursing the dividend (i.e., *REIMBCOST*=0), the decrease in short volume before and increase in short volume after is not significant at the 5% level. However, when short sellers do face a potential reimbursement effect, the change in *RELSS* is significantly negative before the cum-date and significantly positive after the cum-date. These results support H2 that short trading is affected by the reimbursement effect.

In Table 7, the proxy for costly dividend reimbursement is an indicator for a high dividend amount, *HIDIV*. The results in Table 7 suggest that short selling declines

[27] Although the spike in short volume occurs two days after the cum-date, the increase from day 0 to day 1 is strongly significant. That is, there is a statistical difference between then the fixed effects for days 0 and 1, but no difference between any other two adjacent days' fixed effects.

incrementally further in the days leading up to the event date as a result of the reimbursement effect. Specifically, the coefficient on the interaction *EVENT*HIDIV* is negative and significant ($\hat{\alpha}_3$ = -0.276, *t* = -2.16). Moreover, an F-test of the significance of the total coefficient (i.e., $\alpha_1 + \alpha_3$) shows that it is significantly negative (*p*-value = 0.000). The results for the days following the event date, however, are insignificant; the *EVENT* main effect is positive and significant, but the interaction with the reimbursement cost *HIDIV* is not significant.

To assess economic magnitude, I sum the abnormal short volume coefficients presented in Figure 2. When *REIMBCOST*=0, there is still a significant decline in short volume—the total decrease is 5% below normal levels. When *REIMBCOST*=1, the decline is larger—the total decrease is 8% below normal levels, which is significantly below 0 and significantly below 5.9%. Following the cum-date, there is no change in abnormal short volume without the reimbursement effect (i.e., *REIMBCOST*=0), but when the reimbursement effect is in place, the increase in short volume is 4.2% above normal levels, which is statistically significant (p = 0.036).[28] Taken together, the results suggest that the reimbursement effect statistically and economically affects short selling. Short volume decreases in response to costly dividend reimbursement as measured by two different proxies and after controlling for several determinants of short selling activity.

[28] These figures are calculated as follows: the sum of the day coefficients from days *t* = [-5, -1] is -1.62% when *REIMBCOST*=1. The mean value of *RELSS* is 21%. Hence, the total decrease in short volume attributable to the reimbursement effect is thus -1.62%/21% = -7.7%.

6. Robustness Tests

In this section, I perform two tests of the robustness of the loan effect. First, I examine the robustness of the tax-sensitivity variable, *TAXSENS*, to stricter definitions of sensitivity to dividend taxation. Second, I examine how the results change when a measure of lender negotiating power is included in the model.

In the first robustness check, I exclude lenders whose sensitivity to taxation is difficult to identify, and retain those that are clearly tax-sensitive or tax-neutral. In Table 4, *TAXSENS* is set equal to one when lender *j* is a retail brokerage firm or a mutual fund and set equal to zero when lender *j* is a broker/dealer, banking institution, pension, endowment or hedge fund. However, as noted in Desai and Jin (2009), the tax-sensitivity of each of these types of institutions is sometimes unclear. This is particularly true for broker/dealers that manage the assets of high-net worth individuals, who are likely to be tax-sensitive, and the assets of all types of institutions, which vary in their tax-sensitivity. For this test, I reset *TAXSENS* to one if lender *j* is a retail brokerage firm or a mutual fund, which are both clearly tax-sensitive, and set *TAXSENS* equal to zero when lender *j* is banking institution, pension, or endowment, which are clearly tax-neutral. Four lenders that are broker/dealers are excluded from the analysis.

The results of this robustness check, which are presented in Table 8, are similar to the main results. Around the dividend record date, lending fees for tax-sensitive lenders are much higher than those of tax-neutral lenders, and loan quantities for tax-sensitive lenders are significantly less than those of tax-neutral lenders. Specifically, the coefficient on the event days for tax-sensitive lenders is strongly positive for lending fees ($\hat{\alpha}_3$ = 0.032, *t* = 8.88) and strongly negative for loan quantities ($\hat{\alpha}_3$ = -0.12, *t* = -6.00). These findings suggest that the loan effect is robust to stricter definitions of tax-sensitivity.

In the second robustness check, I include a measure of the lender's negotiating power. Duffie et al. (2002) predict that the lending fees charged by a given lender are increasing in the lender's bargaining power (proposition 5, p. 321). Following Cohen et al. (2007), I create the indicator variable, *POWER*, which is set to one when the ratio of non-event period loan quantity (*QTY*) to the prior month's short interest is in the top quartile of the sample. Since the stock lending market is incomplete and subject to search frictions, it is likely that the shift in the supply curve would be larger when the shares of a particular stock are mostly held by a tax-sensitive lender. Thus, I predict that the increase in lending fees is larger when the lender has significant negotiating power. I test this prediction by augmenting equation (5) with *POWER* and interacting *POWER* with *TAXSENS**EVENT*.

The results of the second robustness check support the prediction in Duffie et al. (2002)—lending fees around the dividend record date are positively associated with the negotiating power. In Table 9, for tax-sensitive lenders that lend a large portion of the total short interest, the coefficient on *EVENT*POWER*TAXSENS* is positive and significant ($\hat{\alpha}_7$ = 0.014, *t* = 2.04). Thus, the effect of dividend taxation on lending fees is even larger when the lender holds significant negotiating power in setting lending fees.

7. Conclusion

This paper presents empirical evidence on the effects of dividend taxation on short sellers. I employ a proprietary dataset of stock lending fees by multiple equity lenders who vary in their sensitivity to taxation. The findings suggest that variation in tax-sensitivity is positively associated with variation in lending fees and negatively associated with loan quantities. In addition, I consider the effects of dividend reimbursement, in which short sellers must reimburse the full amount of the dividend to the lender for short positions held open over the dividend record date. However, the price drop is on average incomplete, which some researchers have attributed to taxation. I predict and find evidence that short selling is delayed to avoid this incremental cost of short selling.

Thus, the empirical evidence presented here suggests that short selling is affected by two tax effects: the loan effect and the reimbursement effect. The preponderance of evidence in prior literature suggests that short sellers are informed investors who are important to the market. Short selling makes markets more efficient by preventing overpricing and asset bubbles and make prices more efficient by incorporating negative news into asset prices. To the extent that taxation increases short sales constraints, stock prices can become less efficient.

REFERENCES

Almazan, A., Brown, K., Carlson, M., Chapman, D., 2004. Why constrain your mutual fund manager? Journal of Financial Economics 73, 289-321.

Arnold, T., Butler, A., Crack, T., Zhang, Y., 2005. The information content of short interest: A natural experiment. Journal of Business 78, 1307-1335.

Bali, R., Hite, G., 1998. Ex-dividend day stock price behavior: Discreteness or tax-induced clienteles? Journal of Financial Economics 47, 127-159.

Barber, B., Odean T., 2004. Are individual investors tax savvy? Evidence from retail and discount brokerage accounts. Journal of Public Economics 88, 419-442.

Boehmer, E., Jones, C., Zhang, X., 2008. Which shorts are informed? Journal of Finance 63, 491-527.

Blouin, J., Raedy, J., Shackelford, D., 2003. Capital gains taxes and equity trading: Empirical evidence. Journal of Accounting Research 41, 611-651.

Brent, A., Morse, D., Stice, E., 1990. Short interest: Explanations and tests. Journal of Financial and Quantitative Analysis 26, 273-89.

Bris, A., Goetzmann, W., Zhu N., 2007. Efficiency and the bear: Short sales and markets around the world. Journal of Finance 62, 1029-1079.

Charoenrook, A., Daouk, H., 2005. A study of market-wide short selling restrictions. Working Paper, Vanderbilt University. Available at: http://ssrn.com/abstract=687562.

Chetty, R., Rosenberg, J., Saez, E., 2007. The effects of taxes on market responses to dividend announcements and payments: What can we learn from the 2003 dividend tax cut? Taxing corporate Income in the 21st Century. Cambridge University Press, New York.

Christensen, T., Drake, M., Thornock, J., 2009. Optimistic reporting and pessimistic investing: Do pro forma earnings disclosures attract short sellers? Working Paper, Brigham Young University. Available at: http://ssrn.com/abstract=1398842.

Christoffersen, S., Geczy, C., Musto, D., Reed, A., 2005. Crossborder dividend taxation and the preferences of taxable and nontaxable investors: Evidence from Canada. Journal of Financial Economics 78, 121-144.

Christoffersen, S., Geczy, C., Musto, D., Reed, A., 2007. Vote trading and information aggregation, Journal of Finance 62, 2897 - 2929.

Christophe, S., Ferri, M., Angel. J., 2004. Short selling prior to earnings announcements. Journal of Finance 59, 1845-1875.
Cohen, L., Diether, K., Malloy, C., 2007. Supply and demand shifts in the shorting market, Journal of Finance 62, 2061–2096.

Daske, H., Richardson, S., Tuna, I., 2005. Do short sale transactions precede bad news events? Working Paper, University of Pennsylvania. Available at: http://ssrn.com/abstract=722242.

D'Avolio, G., 2002. The market for borrowing stock. Journal of Financial Economics 66, 271-306.

Dai, Z., Maydew, E., Shackelford, D., Zhang, H., 2008. Capital gains taxes and asset prices: Capitalization or lock-in? Journal of Finance 63, 709-742.

Dechow, P., Hutton, A., Meulbroek, L., Sloan, R., 2001. Short interest, fundamental analysis and market efficiency. Journal of Financial Economics 61, 77-106.

Desai, M., Dharmapala, D., 2009. Dividend Taxes and International Portfolio Choice. Review of Economics and Statistics (forthcoming).

Desai, M., Jin, L., 2009. Institutional tax clienteles and payout policy. Journal of Financial Economics (forthcoming).

Dhaliwal, D., Li, O., 2006. Investor tax heterogeneity and ex-dividend day trading volume – The effect of dividend yield and institutional ownership. Journal of Finance 61, 463–490.

Diamond, D., Verrecchia, R., 1987. Constraints on short-selling and asset price adjustment to private information. Journal of Financial Economics 18, 277–311.

Diether, K., Lee, K., Werner. K., 2009. Short-sale strategies and return predictability. Review of Financial Studies 22, 575-607

Diether, K., Lee, K., Werner. K., 2009. It's SHO Time! Short-sale price tests and market quality. Journal of Finance 64, 37-73.

Diether, K., Werner, I., 2009. When constraints bind. Working paper, Dartmouth College. Available at: http://ssrn.com/abstract=1445634.

Duffie, D. Garleanu, N., Pedersen, L., 2002. Securities lending, shorting and pricing. Journal of Financial Economics 66, 307-339.

Dyreng, S., Lindsay, B., 2009. Using financial accounting data to examine the effect of foreign operations located in tax havens and other countries on U.S. multinational firms' tax rates. Journal of Accounting Research 47, 1283-1316.

Elton, E., Gruber, M., 1970. Marginal stockholder tax rates and the clientele effect. Review of Economics and Statistics 52, 68-74.

Faulkner, M., 2008. An introduction to securities lending. 4th Edition, Spatialfield Advisors Ltd.

Fabozzi, F., 2004. Securities Lending and Repurchase Agreements. Frank J. Fabozzi Associates, New Hope Pennsylvania.

Frank, M., Jagannathan, R., 1998. Why do stock prices drop by less than the value of the dividend? Evidence of a country without taxation. Journal of Financial Economics 47, 161-188.

Geczy, C., Musto, D., Reed, A., 2002. Stocks are special too: An analysis of the equity lending market. Journal of Financial Economics 66, 241-269.

Graham, J., 2006. A Review of Taxes and Corporate Finance, Foundations and Trends in Finance 7, 573-691.

Graham, J., Michaely, R., Roberts, M., 2003. Do price discreteness and transactions costs affect stock returns? Comparing ex-dividend pricing before and after decimalization. Journal of Finance 58, 2613-2637.

Graham, J., Kumar, A., 2006. Do dividend clienteles exist? Evidence on dividend preferences of retail investors. Journal of Finance 61, 1305–1336.

Hanlon, M., Heitzman, S., 2009. A Review of Tax Research. Working paper, MIT. Available at: http://ssrn.com/abstract=1476561.

Ivkovich, Z., Poterba, J., Weisbenner, S., 2005. Tax loss trading by individual investors. American Economic Review 95, 1605-1630.

Jin, L., Kothari, S., 2008. Effect of personal taxes on managers' decisions to sell their stock. Journal of Accounting and Economics 46, 23-46.

Kalay, A., 1982. The ex-dividend day behavior of stock prices: A re-examination of the clientele effect. Journal of Finance 37, 1059-1070.

Kolasinksi, A., Reed, A., Ringgenberg, M., 2009. A multiple lender approach to understanding supply and search in the equity lending market. Working Paper, University of Washington. Available at: http://public.kenan-flagler.unc.edu/faculty/reeda/krr.pdf.

Lamont, O. 2005. Short sale constraints and overpricing. Working Paper. Yale University.

McDonald, R., 2001. Cross-border investing with tax arbitrage: the case of German dividend tax credits. Review of Financial Studies 14, 617–658.

Michaely, R., Vila, J., 1996. Trading volume with private valuation: Evidence from the ex-dividend day. Review of Financial Studies 9, 471-509.

Nagel, S., 2005. Short sales, institutional investors and the cross-section of stock returns. Journal of Financial Economics 78, 277-309.

Reed, A. 2007. Costly short-selling and stock price reactions to earnings announcements. Working Paper, University of North Carolina. Available at: http://public.kenan-flagler.unc.edu/faculty/reeda/reed.pdf.

Shackelford, D., Shevlin, T., 2001. Empirical tax research in accounting. Journal of Accounting and Economics 31:321-387.

Shackelford, D., Verrecchia, R., 2002. Intertemporal tax discontinuities, Journal of Accounting Research 40, 205-222.

Shevlin, T., 2007. The future of tax research: From an accounting professor's perspective. Journal of the American Tax Association 29, 87-93.

Sikes, S., 2009. The January Effect and institutional investors: Tax-loss-selling or window-dressing? Working Paper, Duke University.

Zhang, Y., Farrell, A., Brown, T., 2008. Ex-dividend day price and volume: The case of 2003 dividend tax cut. National Tax Journal 61, 105-127.

TABLE 1
Sample Selection

Quarterly dividend observations with available short volume, availability and lending fees	7,871
Less observations with the following criteria:	
Time between cum-date and record date greater than three days	(600)
Missing Price-Drop Ratio *(PDR)*	(169)
Missing lagged Price-Drop Ratio *(REIMBCOST)*	(239)
Missing control variables (*SIZE, MB, IO, NANALYST, TURNOVER, NASDAQ, OPTION*)	(325)
Full sample of record date observations	6,538
Subset that identifies the lender of the stock loan	6,538
Less observations with the following criteria:	
Less than 10 lender observations during the event period	(1,639)
Trade quantity less than 20,000 shares	(653)
Sub-sample of record date observations with lender identification	4,246

The sample is composed of quarterly dividend distributions of common stocks from the CRSP distribution files. These observations are matched to return and volume observations from the CRSP daily files and short sales volume collected from TAQ (NYSE) and from the exchange websites (AMEX and NASDAQ). These data are combined with a proprietary dataset that includes shares available for stock loans and short lending fees. The control variables, which are defined in Table 2, are from COMPUSTAT (*MB*), CRSP (*SIZE*, *MB*, *TURNOVER*), I/B/E/S (*NANALYST*), OptionMetrics (*OPTION*) and Thompson Financial (*IO*). The full sample consists of 6,538 dividend record date observations for 1,265 unique firms. The subsample covers 4,246 ex-dividend dates for 950 unique firms across nine lenders, two of which are tax-sensitive. The sample period begins in January 2005 and runs through May 2007, during which the SEC Regulation SHO required stock exchanges to publicly disclose daily short volume data.

TABLE 2
Descriptive Statistics

Panel A: Short Selling Variables

Variables	*N*	*Mean*	*Median*	*Std. Dev.*	*Skew.*	*P25*	*P75*
RELSS	6,538	0.21	0.21	0.06	0.34	0.17	0.25
SPECIAL	6,538	0.36	0.13	0.78	3.96	0.01	0.38
AVAIL	6,538	0.10	0.10	0.05	0.12	0.07	0.13

Panel B: Firm-Level Variables

Variables	*N*	*Mean*	*Median*	*Std. Dev.*	*Skew.*	*P25*	*P75*
PDR	6,538	0.66	0.79	5.97	-0.02	-1.17	2.52
REIMBCOST	6,538	0.54	1.00	0.50	-0.17	0.00	1.00
DIV	6,538	0.21	0.16	0.17	1.38	0.08	0.29
SIZE	6,538	21.98	21.80	1.47	0.45	20.87	23.05
MB	6,538	3.09	2.32	2.70	3.59	1.67	3.53
IO	6,538	0.65	0.68	0.25	-0.65	0.48	0.84
NANALYST	6,538	9.85	8.08	7.34	0.89	3.92	14.42
TURNOVER	6,538	0.01	0.01	0.01	2.01	0.00	0.01
OPTION	6,538	0.62	1.00	0.49	-0.48	0.00	1.00
NASDAQ	6,538	0.20	0.00	0.40	1.47	0.00	0.00

TABLE 2 (continued)

Panel C: Correlation Matrix (Spearman above/Pearson below)

	RELSS	*SPECIAL*	*AVAIL*	*PDR*	*REIMBCOST*	*DIV*	*SIZE*	*MB*	*IO*	*NANALYST*	*TURNOVER*	*OPTION*	*NASDAQ*
RELSS		0.19	-0.21	0.01	0.01	-0.04	-0.39	-0.11	-0.01	-0.27	0.09	-0.14	0.07
SPECIAL	0.09		-0.17	-0.04	0.01	-0.04	-0.39	-0.10	0.03	-0.32	0.15	-0.23	0.17
AVAIL	-0.20	-0.29		-0.02	0.02	-0.13	0.20	0.05	0.52	0.16	0.25	0.12	-0.11
PDR	0.01	-0.02	-0.01		0.01	0.05	0.03	-0.01	-0.02	0.02	-0.02	0.02	-0.03
REIMBCOST	0.01	0.00	0.02	0.00		0.00	-0.02	0.03	0.03	-0.02	-0.01	-0.01	0.02
DIV	-0.02	0.02	-0.12	0.03	-0.01		0.25	-0.04	-0.20	-0.03	-0.27	-0.03	-0.21
SIZE	-0.40	-0.31	0.18	0.03	-0.02	0.22		0.29	-0.01	0.75	-0.08	0.39	-0.32
MB	-0.08	0.01	0.02	0.00	0.02	0.00	0.16		-0.03	0.20	0.00	0.16	0.05
IO	-0.03	-0.11	0.51	-0.01	0.03	-0.14	0.03	0.03		0.02	0.55	0.14	-0.13
NANALYST	-0.28	-0.24	0.15	0.02	-0.02	-0.07	0.75	0.09	0.05		0.06	0.37	-0.10
TURNOVER	0.09	0.12	0.09	0.00	-0.02	-0.20	-0.11	0.02	0.37	0.06		0.16	-0.01
OPTION	-0.13	-0.17	0.11	0.01	-0.01	-0.05	0.36	0.11	0.17	0.32	0.11		-0.19
NASDAQ	0.07	0.15	-0.11	-0.01	0.02	-0.20	-0.30	0.02	-0.13	-0.09	0.03	-0.19	

This table presents descriptive statistics for short selling variables (Panel A) and firm-level variables (Panel B), as well as pair-wise correlations among the variables (Panel C). The short selling variables in panel A are all measured during the estimation period, t = [-15, -5]∪[5, 15] relative to the dividend record date, t = 0. *RELSS* is the mean daily relative short volume, measured as the ratio of total short selling volume to total trading volume. *SPECIAL* is the daily stock loan fee for a short sale, measured as the daily federal funds rates less the value-weighted loan rebate rate. *AVAIL* is the ratio of shares available for stock loans to total shares outstanding. *PDR* is the price-drop to dividend ratio, measured as the cum-dividend day stock price less the ex-dividend day stock price, all divided by the split-adjusted dividend amount, *DIV*. The rest of the variables are measured for a given firm in the prior quarter. *REIMBCOST* is an indicator variable equal to one if the prior quarter *PDR* is less than one and zero otherwise. *SIZE* is the natural log of lagged market capitalization, *MB* is market capitalization divided by total common equity, *IO* is total institutional holdings scaled by shares outstanding, *NANALYST* is the average number of analysts following the firm, and *TURNOVER* is the mean daily trading volume in the prior quarter divided by shares outstanding. *OPTION* is an indicator variable equal to one if a firm has listed options and zero otherwise and *NASDAQ* is an indicator variable equal to one if the firm is traded on the Nasdaq, and zero otherwise.

TABLE 3
Event Study of Lending Fees and Shares Available around the Dividend Record Date

	Short Lending Fees (SPECIAL)						Shares Available (AVAIL)					
	(1)			(2)			(3)			(4)		
	Coef.	*t-stat*		*Coef.*	*t-stat*		*Coef.*	*t-stat*		*Coef.*	*t-stat*	
INTERCEPT	-0.003	-15.23	***	0.400	8.06	***	0.126	78.78	***	-0.083	-5.20	***
EVENT	0.036	21.08	***	0.032	19.11	***	-0.004	-21.60	***	-0.004	-21.70	***
DIV				0.063	3.12	***				-0.024	-5.26	***
SIZE				-0.017	-7.12	***				0.006	7.28	***
MB				0.000	-1.03					0.000	-0.72	
IO				0.013	1.50					0.139	40.43	***
NANALYST				-0.001	-2.46	**				0.000	-0.08	
TURNOVER				3.972	10.31	***				-1.601	-10.73	***
NASDAQ				0.020	3.30	***				0.001	0.32	
OPTION				-0.039	-8.28	***				-0.003	-1.85	*
N	80,507			80,527			134,600			133,689		
Adj. R^2	0.029			0.116			0.079			0.528		

This table presents the results of estimating the equation (4):

$$TESTVAR_{it} = \alpha_0 + \alpha_1 EVENT_{it} + \alpha_2 DIV_{it} + \alpha_3 SIZE_{it-1} + \alpha_4 MB_{it-1} + \alpha_5 IO_{it-1} + \alpha_6 NANALYST_{it-1} + \alpha_7 TURNOVER_{it-1} + \alpha_8 NASDAQ_i + \alpha_9 OPTION_i + e_{it} ,$$

where *TESTVAR* is either *SPECIAL* or *AVAIL*. Models (1) and (2) present the event study results for *SPECIAL* and models (3) and (4) present the event study results for *AVAIL*. *SPECIAL* is the stock loan rate for firm *i* for a short sale on day *t* and *AVAIL* is the number shares available for stock loans of firm *i* on day *t* divided total shares outstanding. The event date, date $t = 0$, is the dividend record date. Since settlement takes place three days following a transaction, stock lending on the dividend record date corresponds to cum-date short selling. The indicator variable, *EVENT*, is set to one on days $t = [-1, 0]$ and zero during the estimation period, $t = [-15, -5] \cup [5, 15]$; all observations in the event period, $t = [-5, +5]$, are set to missing. The regression includes control variables as defined in Table 2, year-quarter and industry fixed effects (unreported) and White standard errors clustered by firm. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

TABLE 4
Analysis of Effect of Tax-Sensitive Stock Lending on Loan Fees and Quantities around the Dividend Record Date

	Short Lending Fees (SPECIAL)						*Shares on Loan (QTY)*					
	(1)			(2)			(3)			(4)		
	Coef.	*t-stat*		*Coef.*	*t-stat*		*Coef.*	*t-stat*		*Coef.*	*t-stat*	
INTERCEPT	-0.061	-13.87	***	0.047	1.77	*	0.505	0.15		2.578	13.45	***
EVENT	0.010	10.63	***	0.010	10.43	***	0.000	-0.07		-0.006	-1.13	
TAXSENS	0.032	20.61	***	0.030	18.99	***	-0.074	-5.31	***	-0.060	-4.61	***
*EVENT*TAXSENS*	0.009	3.09	***	0.010	3.21	***	-0.127	-7.36	***	-0.092	-5.81	***
DIV				0.031	4.01	***				0.165	3.03	***
SIZE				-0.005	-4.07	***				-0.103	-11.53	***
MB				0.000	1.90	*				0.000	-1.96	*
IO				-0.006	-1.07					0.392	10.66	***
NANALYST				0.000	1.32					-0.002	-1.14	
TURNOVER				1.257	6.11	***				6.829	4.04	***
NASDAQ				0.001	0.36					0.048	1.96	*
OPTION				-0.008	-3.05	***				-0.024	-1.33	
N	55,189			55,225			54,577			54,608		
Adj. R^2	0.082			0.101			0.081			0.234		

This table presents the results of estimating the equation (5):

$$TESTVAR_{ijt} = \alpha_0 + \alpha_1 EVENT_{it} + \alpha_2 TAXSENS_j + \alpha_3 EVENT_{it} * TAXSENS_j + \alpha_4 DIV_{it} + \alpha_5 SIZE_{it-1} + \alpha_6 MB_{it-1} + \alpha_7 IO_{it-1} + \alpha_8 NANALYST_{it-1} + \alpha_9 TURNOVER_{it-1} + \alpha_{10} NASDAQ_i + \alpha_{11} OPTION_i + e_{it},$$

where *TESTVAR* is either *SPECIAL* or *QTY*. Models (1) and (2) present the event study results for *SPECIAL* and models (3) and (4) present the event study results for *QTY*. *SPECIAL* is the stock loan rate charged by lender *j* for a short sale on stock *i* on day *t*. *QTY* is the number of shares of stock *i* loaned by lender *j* on day *t* scaled by total shares outstanding. *TAXSENS* is an indicator variable equal to one if lender *j* is sensitive to taxation on substitute dividends and equal to zero otherwise. Tax-sensitive lenders include a retail brokerage house and a mutual fund, while tax-neutral lenders include pension funds, endowments and others who cannot be classified as either tax-sensitive or tax-insensitive. The event date, date $t = 0$, is the dividend record date. Since settlement takes place three days following a transaction, stock lending on the dividend record date corresponds to cum-date short selling. The indicator variable, *EVENT*, is set to one on days $t = [-1, 0]$ and zero during the estimation period, $t = [-15, -5] \cup [5, 15]$; all observations in the event period, $t = [-5, +5]$, are set to missing. The regression includes control variables as defined in Table 2, year-quarter and industry fixed effects (unreported) and White standard errors clustered by firm. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. The sample used in this table is a subset of the full sample that identifies the actual loan fee and quantities charged by nine different equity lenders. The sample covers 4,246 ex-dividend dates for 950 firms across nine lenders, two of which are tax-sensitive.

TABLE 5
Analysis of Abnormal Short Volume around the Cum-Dividend Day

	Event Days t = [-2, 0]						Event Days t = [1, 3]					
	(1)			(2)			(3)			(4)		
	Coef.	*t-stat*		*Coef.*	*t-stat*		*Coef.*	*t-stat*		*Coef.*	*t-stat*	
INTERCEPT	20.256	41.33	***	62.543	27.59	***	20.205	28.87	***	62.353	27.70	***
EVENT	-0.336	-5.73	***	-0.352	-5.99	***	0.201	3.49	***	0.226	3.94	***
DIV				2.564	4.69	***				2.570	4.73	***
SIZE				-1.901	-17.53	***				-1.897	-17.61	***
MB				0.005	1.66	*				0.005	1.68	*
IO				-0.128	-0.34					-0.139	-0.37	
NANALYST				0.081	3.83	***				0.081	3.86	***
TURNOVER				13.745	1.68	*				14.948	1.79	*
NASDAQ				-1.030	-3.91	***				-1.022	-3.90	***
OPTION				0.415	2.10	**				0.413	2.10	**
N	156,752			156,911			156,761			156,863		
Adj. R^2	0.021			0.088			0.021			0.088		

This table presents the result of estimating the equation (6):

$$RELSS_{it} = \alpha_0 + \alpha_1 EVENT_{it} + \alpha_2 DIV_{it} + \alpha_3 SIZE_{it-1} + \alpha_4 MB_{it-1} + \alpha_5 IO_{it-1} + \alpha_6 NANALYST_{it-1} + \alpha_7 TURNOVER_{it-1} + \alpha_8 NASDAQ_i + \alpha_9 OPTION_i + e_{it} ,$$

where *RELSS* is the ratio of short volume to total volume, measured as a percentage. The event date, date $t = 0$, is the cum-dividend date (i.e., the last day the stock trades with the dividend). The indicator variable, *EVENT,* is equal to one on days $t = [-2, 0]$ for models (1) and (2) and days $t = [1, 3]$ for models (3) and (4), and equal to zero during the estimation period, $t = [-15, -5] \cup [5, 15]$. All other observations in the event period, $t = [-5, +5]$, are set to missing. The regression includes control variables as defined in Table 2, year-quarter and industry fixed effects and White standard errors clustered by firm. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

TABLE 6
Effect of Dividend Reimbursement Cost on Short Volume around the Cum-Dividend Day

	Event Days t = [-2, 0]			Event Days t = [1, 3]		
	Coef.	*t-stat*		*Coef.*	*t-stat*	
INTERCEPT	62.487	27.61	***	62.383	27.63	***
EVENT	-0.290	-3.49	***	0.154	1.80	*
REIMBCOST	0.049	0.46		0.005	0.04	
*EVENT*REIMBCOST*	-0.223	-1.97	**	0.135	1.15	
DIV	2.566	4.70	***	2.568	4.72	***
SIZE	-1.900	-17.57	***	-1.898	-17.60	***
MB	0.005	1.67	*	0.005	1.68	*
IO	-0.133	-0.36		-0.137	-0.37	
NANALYST	0.081	3.84	***	0.081	3.86	***
TURNOVER	14.273	1.73	*	14.637	1.77	*
NASDAQ	-1.028	-3.91	***	-1.024	-3.91	***
OPTION	0.415	2.10	**	0.414	2.10	**
N	156,889			156,875		
Adj. R^2	0.088			0.088		
F-test [$(\alpha_1 + \alpha_3)$ = 0]	13.04			7.12		
p-value	0.000	***		0.008	***	

This table presents the result of estimating the equation (7):

$$RELSS_{it} = \alpha_0 + \alpha_1 EVENT_{it} + \alpha_2 REIMBCOST_{it} + \alpha_3 EVENT_{it} * REIMBCOST_{it} + \alpha_4 DIV_{it} + \alpha_5 SIZE_{it-1} + \alpha_6 MB_{it-1} + \alpha_7 IO_{it-1} + \alpha_8 NANALYST_{it-1} + \alpha_9 TURNOVER_{it-1} + \alpha_{10} NASDAQ_i + \alpha_{11} OPTION_i + e_{it},$$

where *RELSS* is the ratio of short volume to total volume, measured as a percentage and *REIMBCOST* is an indicator variable set to one when the lagged Price-Drop to Dividend ratio (PDR_{t-1}) is less than one, and zero otherwise. The event date, date t = 0, is the cum-dividend date (i.e., the last day the stock trades with the dividend). The indicator variable, *EVENT,* is equal to one on days t = [-2, 0] for the left column and days t = [1, 3] for the right column specification, and equal to zero during the estimation period, t = [-15, -5]∪[5, 15]. All other observations in the event period, t = [-5, +5], are set to missing. The regression includes control variables as defined in Table 2, year-quarter and industry fixed effects and White standard errors that are clustered by firm. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

TABLE 7
Effect of Dividends on Short Volume around the Cum-Dividend Day

	Event Days t = [-2, 0]			Event Days t = [1, 3]		
	Coef.	*t-stat*		*Coef.*	*t-stat*	
INTERCEPT	61.803	27.14	***	61.819	27.06	***
EVENT	-0.340	-5.03	***	0.230	3.49	***
HIDIV	0.788	3.52	***	0.755	3.32	***
*EVENT*HIDIV*	-0.276	-2.16	**	-0.018	-0.14	
SIZE	-1.835	-17.11	***	-1.838	-17.09	***
MB	0.005	1.72	*	0.005	1.71	*
IO	-0.372	-1.01		-0.361	-0.97	
NANALYST	0.071	3.38	***	0.071	3.38	***
TURNOVER	18.723	2.09	**	17.156	1.95	*
NASDAQ	-1.082	-4.16	***	-1.085	-4.15	***
OPTION	0.377	1.92	*	0.378	1.93	*
N	156,837			156,855		
Adj. R^2	0.087			0.087		
F-test [$(\alpha_1 + \alpha_3) = 0$]	14.92			0.55		
p-value	0.000 ***			0.459		

This table presents the result of estimating the equation (7):

$$RELSS_{it} = \alpha_0 + \alpha_1 EVENT_{it} + \alpha_2 HIDIV_{it} + \alpha_3 EVENT_{it} * HIDIV_{it} + \alpha_4 SIZE_{it-1} + \alpha_5 MB_{it-1} + \alpha_6 IO_{it-1} + \alpha_7 NANALYST_{it-1} + \alpha_8 TURNOVER_{it-1} + \alpha_9 NASDAQ_i + \alpha_{10} OPTION_i + e_{it} ,$$

where *RELSS* is the ratio of short volume to total volume, measured as a percentage and *HIDIV* is an indicator set to one if the event's split-adjusted dividend amount is in the highest quartile of dividends for the sample. The event date, date $t = 0$, is the cum-dividend date (i.e., the last day the stock trades with the dividend). The indicator variable, *EVENT,* is equal to one on days $t = [-2, 0]$ for the left column and days $t = [1, 3]$ for the right column, and equal to zero during the estimation period, $t = [-15, -5] \cup [5, 15]$. All other observations in the event period, t = [-5, +5], are set to missing. The regression includes control variables as defined in Table 2, year-quarter and industry fixed effects and White standard errors that are clustered by firm. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

TABLE 8
Robustness Test of *TAXSENS* variable

	Short Lending Fees (SPECIAL)						Shares on Loan (QTY)					
	(1)			(2)			(3)			(4)		
	Coef.	t-stat		Coef.	t-stat		Coef.	t-stat		Coef.	t-stat	
INTERCEPT	-0.073	-20.96	***	-0.052	-1.80	*	0.435	0.18		4.582	18.10	***
EVENT	-0.010	-4.12	***	-0.010	-4.24	***	0.109	5.99	***	0.059	4.12	***
TAXSENS	0.020	8.60	***	0.020	8.69	***	0.171	8.35	***	0.171	10.40	***
*EVENT*TAXSENS*	0.032	9.06	***	0.032	8.88	***	-0.235	-9.60	***	-0.120	-6.00	***
DIV				0.010	1.45					0.117	1.78	*
SIZE				-0.001	-0.46					-0.185	-14.78	***
MB				0.000	0.72					0.000	-3.14	***
IO				-0.008	-1.75	*				0.250	5.71	***
NANALYST				0.000	-0.27					-0.003	-1.15	
TURNOVER				0.071	0.40					3.566	1.88	*
NASDAQ				-0.002	-0.68					0.014	0.47	
OPTION				0.000	0.09					-0.034	-1.60	
N	14,607			14,611			14,507			14,380		
Adj. R^2	0.081			0.083			0.089			0.368		

In this table, I create an alternate measure of *TAXSENS* that includes only stock lenders that are clearly tax-sensitive or tax-neutral with regard to substitute dividends. In this table, *TAXSENS* is an indicator variable equal to one if lender *j* is sensitive to taxation on substitute dividends and equal to zero otherwise. Tax-sensitive lenders include a retail brokerage house and a mutual fund, while tax-neutral lenders include pension funds, endowments and institutional owners. Lenders that are broker-dealers are excluded from the analysis. I estimate the following regression using the alternate measure of *TAXSENS*:

$$SPECIAL_{ijt} = \alpha_0 + \alpha_1 EVENT_{it} + \alpha_2 TAXSENS_j + \alpha_3 EVENT_{it} * TAXSENS_j + \alpha_4 DIV_{it} + \alpha_5 SIZE_{it-1} + \alpha_6 MB_{it-1} + \alpha_7 IO_{it-1} + \alpha_8 NANALYST_{it-1} + \alpha_9 TURNOVER_{it-1} + \alpha_{10} NASDAQ_i + \alpha_{11} OPTION_i + e_{it},$$

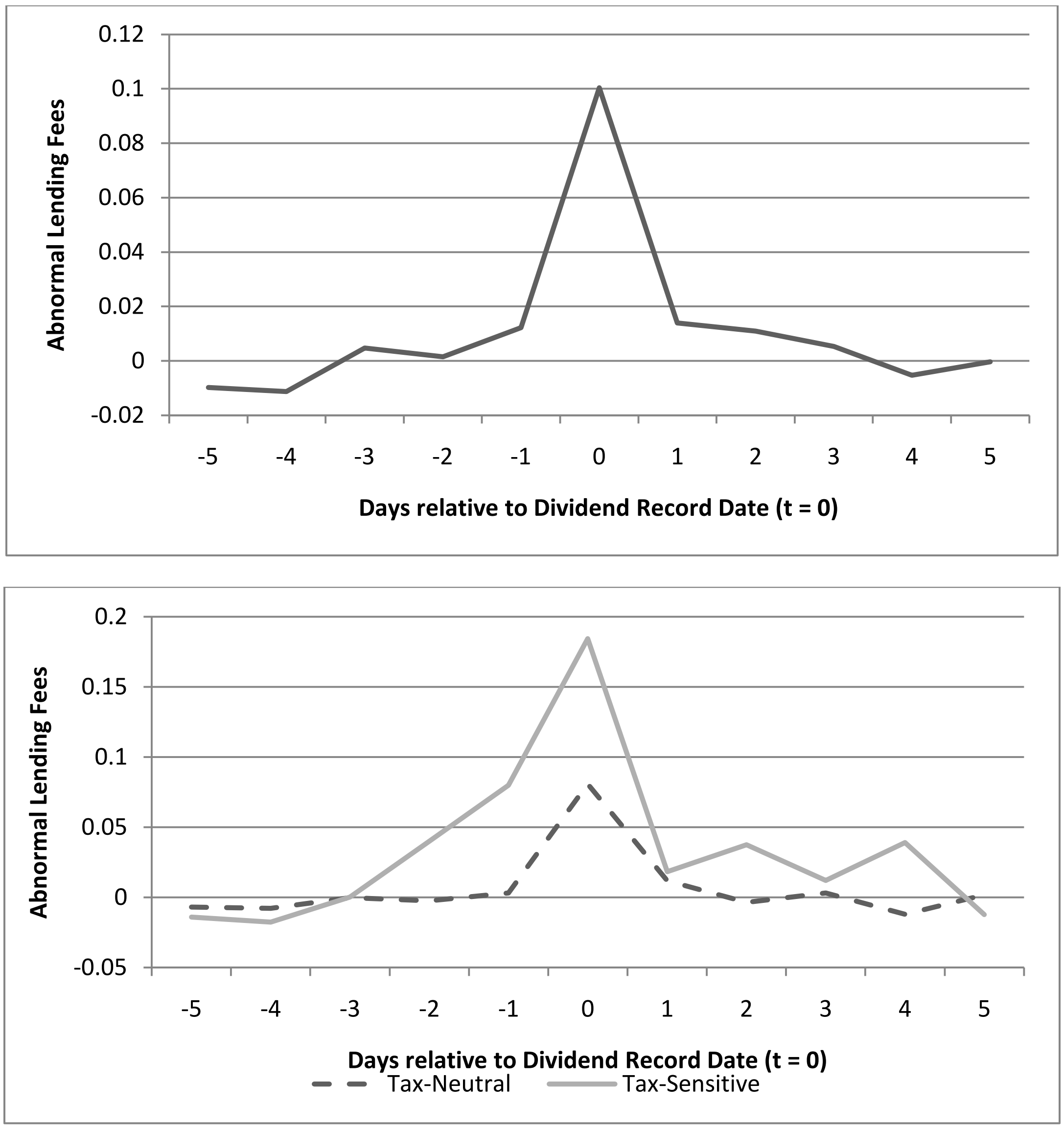
where *SPECIAL* is the stock loan rate charged by lender *j* for a short sale on stock *i* on day *t*. The event date, date $t = 0$, is the dividend record date. Since settlement takes place three days following a transaction, stock lending on the dividend record date corresponds to cum-date short selling. The indicator variable, *EVENT*, is set to one on days t = [-1, 0] and zero during the estimation period, t= [-15, -5]∪[5, 15]; all observations in the event period, t = [-5, +5], are set to missing. The regression includes control variables as defined in Table 1, year-quarter and industry fixed effects (unreported) and White standard errors that are clustered by firm. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

TABLE 9
Robustness Test: Tests of Lender Negotiating Power

DEPVAR: *SPECIAL$_{it}$*	(1)			(2)		
	Coef.	*t-stat*				
INTERCEPT	0.087	3.07	***	0.067	2.43	**
EVENT	0.001	0.80		0.006	6.27	***
POWER	0.005	5.44	***	0.010	4.40	***
*EVENT*POWER*	0.004	6.09	***	0.008	4.10	***
TAXSENS				0.028	17.34	***
*EVENT*TAXSENS*				0.008	2.37	**
*POWER*TAXSENS*				0.002	0.73	
*EVENT*POWER*TAXSENS*				0.014	2.04	**
DIV	0.034	4.23	***	0.031	4.04	***
SIZE	-0.007	-4.95	***	-0.006	-4.59	***
MB	0.000	1.55		0.000	1.16	
IO	-0.005	-0.99		-0.006	-1.13	
NANALYST	0.000	1.29		0.000	1.24	
TURNOVER	1.660	7.54	***	1.376	6.54	***
NASDAQ	0.003	0.83		0.003	0.79	
OPTION	-0.010	-3.64	***	-0.008	-3.11	***
N	75,675			75,940		
Adj. R^2	0.079			0.101		

In this table, I examine the effect of dividend taxation on lending activity based on the lender's ability to negotiate lending fees. Following Cohen et al. (2007), I create an indicator variable, *POWER*, that is set to one when ratio of the mean estimation period loan quantity to the lagged short interest of lender *j* for stock *i* during event *t* is in the highest quartile of the sample. The dependent variable is *SPECIAL,* which is the stock loan rate charged by lender *j* for a short sale on stock *i* on day *t*. The independent variables are defined as follows. *TAXSENS* is an indicator variable equal to one if lender *j* is sensitive to taxation on substitute dividends and equal to zero otherwise. Tax-sensitive lenders include a retail brokerage house and a mutual fund, while tax-neutral lenders include pension funds, endowments and others who cannot be classified as either tax-sensitive or tax-insensitive. The event date, date $t = 0$, is the dividend record date. Since settlement takes place three days following a transaction, stock lending on the dividend record date corresponds to cum-date short selling. The indicator variable, *EVENT*, is set to one on days t = [-1, 0] and zero during the estimation period, t= [-15, -5]∪[5, 15]; all observations in the event period, t = [-5, +5], are set to missing. The regression includes control variables as defined in Table 2, year-quarter and industry fixed effects (unreported) and White standard errors that are clustered by firm. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

FIGURE 1
Abnormal Short Lending Fees Around the Dividend Record Date

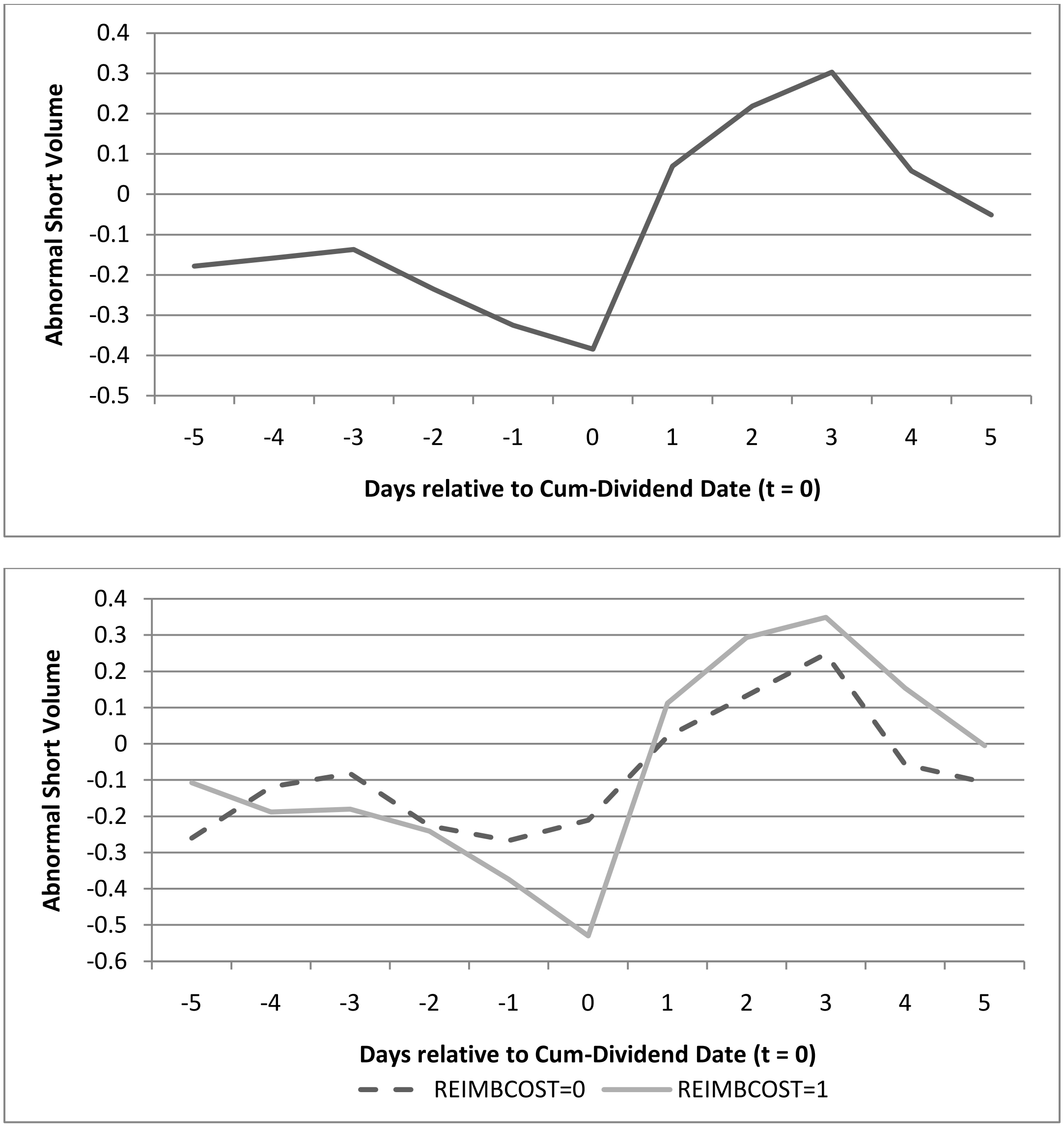


This figure plots the coefficient estimates for event-time indicator variables from a regression of short lending fees, SPECIAL, on indicator variables for each day relative to the dividend record date and control variables as follows:

$$SPECIAL_{it} = \delta_0 + \sum_{k=-5}^{5} \gamma_k DAY_k + \delta_1 DIV_{it} + \delta_2 SIZE_{it-1} + \delta_3 MB_{it-1} + \delta_4 IO_{it-1} + \delta_5 NANALYST_{it-1} + \delta_6 TURNOVER_{it-1} + \delta_7 NASDAQ_i + \delta_8 OPTION_i + \varepsilon_{it}.$$

The coefficient estimates, γ_k, represent abnormal short lending fees relative to other days in the sample period, which covers days t = [-15, 15] relative to the record date, t = 0. The top panel includes the full sample, while the bottom panel splits the sample based on tax-sensitivity. All control variables are defined in Table 2. The estimation includes year-quarter and industry fixed effects and White standard errors clustered by firm. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

FIGURE 2
Abnormal Short Volume Around the Cum-Dividend Date



This figure plots the coefficient estimates from a regression of relative short volume, *RELSS*, on indicator variables for each day relative to the cum-dividend date and control variables as follows:

$$RELSS_{it} = \delta_0 + \sum_{k=-5}^{5} \gamma_k DAY_k + \delta_1 DIV_{it} + \delta_2 SIZE_{it-1} + \delta_3 MB_{it-1} + \delta_4 IO_{it-1} + \delta_5 NANALYST_{it-1} + \delta_6 TURNOVER_{it-1} + \delta_7 NASDAQ_i + \delta_8 OPTION_i + \varepsilon_{it}.$$

The coefficient estimates, γ_k, represent abnormal short volume relative to other days in the sample period, which covers days *t* = [-15, 15] relative to the cum-dividend date, *t* = 0. The top panel includes the full sample, while the bottom panel splits the sample based on *REIMBCOST*. *REIMBCOST* is an indicator variable set to one when the lagged Price-Drop to Dividend ratio (PDR_{t-1}) is less than one and zero otherwise. All control variables are defined in Table 2. The estimation includes year-quarter and industry fixed effects and White standard errors clustered by firm. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.