Dividend Valuation and Securities Lending

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Abstract

We utilize dividend prices from securities lending contracts to present new evidence on the market's value of dividend payments. The contract stipulates what payment the borrower must make to the lender in lieu of the dividend while the stock is on loan. We find that dividend valuations reflect withholding taxes with clusters at $1, $0.85 and $0.70 in the US. In Australia, there is an additional cluster at $1.4286 that reflects the value of tax credits available to Australian resident investors. Increases in lending fees and the proportion of lendable supply borrowed are driven by loans with a low dividend price. Taxes matter for the pricing of dividends in the securities lending market.

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1. Introduction

An unresolved question in financial economics surrounds the market value that is placed upon a dividend payment. Prior empirical studies have generally failed to provide precise estimates of this value but have suggested both time-series and cross-sectional variation in such values (Eades, Hess and Kim (1994) and Boyd and Jagannathan (1994)). The source of much of the evidence on the value of dividends is the study of ex-dividend price movements in the stock market (see Elton and Gruber (1970), Kalay (1982), McDonald (2001) and Graham, Michaely and Roberts (2003), amongst others). One disadvantage of ex-dividend analysis is that the data is very noisy. It has also been argued that the price observed depends on which classes of traders are transacting and this can vary according to the dividend yield as in Boyd and Jagannathan (1994). One motivation of this paper, therefore, is to provide evidence on the value of dividends in a different setting where clean measurements can be obtained. The setting is the securities lending market. Securities lending contracts state how much the borrower of stock must pay the lender of the stock in lieu of the dividend if the stock is borrowed over the ex-dividend date. We term this substitute, or manufactured, dividend the dividend price. In terms of clean measurement, the microstructure explanations of ex-dividend pricing such as tick size and price discreteness are not applicable (Dubofsky (1992), Bali and Hite (1998) and Frank and Jagannathan (1998)). Transaction costs, however, remain relevant.

A key motivation for participating in the securities lending market is dividend arbitrage (D'Avolio (2002) and Christoffersen, Géczy, Musto and Reed (2005)). The presumption is that securities lending contracts price dividends at their face value. To date, no paper has shown that there are multiple prices for dividends across securities lending contracts. Our paper aims to fill this gap by showing that there are multiple dividend prices that exist at the same point in time. Dividend arbitrage in the securities lending leads to sharp jumps in demand for borrowed stock and

security lending fees about the ex-dividend date (Cohen, Diether and Malloy (2007), Moser, Van Ness and Van Ness (2013), Thornock (2013) and Blocher, Reed and Van Wesep (2013)).[1] However, these studies do not distinguish between contracts that have different dividend prices. Differences in the dividend price are likely to have a substantial impact on the extent of dividend arbitrage. The resulting changes in supply and demand will therefore lead to variation in the observed lending fee across contracts with different dividend prices.

The data used in this study is from Data Explorers and differs from the current vintage of Markit data that is commonly used in studies of security lending. Although Markit purchased Data Explorers in 2012, the data we have access to contain key information for understanding the value of dividends implicit in security lending contracts. That is, the dividend requirement is stipulated in the security lending contract and we can therefore place a value on the dividend. The database has multiple lending sources and covers the period from July 1, 2006 to June 30, 2011. This compares favourably with other studies that have focussed on ex-dividend effects in the securities lending market. The database also spans two countries with two quite different tax systems. The US has a classical tax system where dividends are taxed twice, whereas Australia operates an imputation tax system where dividends are only taxed once. Given that we expect differences in taxes to be a key factor in determining dividend prices, we believe contrasting the prices in these two markets will provide additional robustness to our conclusions.

[1] Other papers also touch on dividends and securities lending. Saffi and Sigurdsson (2011) study how short-selling constraints impact market efficiency and point out that fees and utilization increase markedly around the ex-dividend day. They remove observations that are within three weeks of the ex-dividend day from their sample. Aggarwal, Saffi and Sturgess (2015) focus on the curtailing of supply and recalls in the securities lending market around proxy record dates and point out in a footnote that supply in the securities lending market does not change, but rather there is a substantial increase in demand. This contrasts with Thornock (2013) who uses a smaller dataset from 12 lenders to find that supply declines around dividend dates.

The results indicate that there is not one single clearing price for dividends, but rather that on a given day there are several dividend prices for the same stock. There is clustering of dividend prices at specific values, with exactly $1 per dollar of face value being the modal price in the US, whereas in and Australia the mode is $1.4286.[2] The second largest price cluster in the US market is $0.85 and in Australia it is $1. The vast majority of observations are covered by three dividend price clusters in the US and four clusters in Australia consistent with differing tax clienteles providing the stocks for loan. This is consistent with the dividend clientele literature of Michaely and Vila (1995), Graham and Kumar (2006) and Rantapuska (2008), for example. The dividend prices reflect the differing exposure to withholding tax, and in the case of Australia, the tax credits that accompany the dividend. These findings support Callaghan and Barry (2003) who show that withholding taxes impact the value of dividends and trading behavior of ADRs in the stock market. More broadly, this heterogeneity reinforces the argument of Boyd and Jagannathan (1994) that the prices observed for dividends are likely to depend on which clienteles of traders are transacting.

We employ a variety of different weighting schemes to show that the average value of a $1 dividend ranges from $0.88 to $0.98 in the US and from $1.09 to $1.12 in Australia. Irrespective of the weighting measure employed the dividend price declines as the ex-day approaches, consistent with ex-dividend arbitrage, or borrowers seeking out contracts with lower dividend prices. However, when we examine demand and supply it is clear that borrowers are not taking advantage of the lower dividend prices, with considerable borrowing still occurring at higher prices. In the US, dividend prices fall more on the cum-dividend day for high yield, high dividend and small market capitalisation firms. In Australia, the results are mixed with high yield stocks

[2] This is the grossed up value of the dividend. With a 30% corporate tax rate $1 of cash dividends grosses up to $1/(1-0.3) = $1.4286. The face value of the franking credit is $0.4286.

having higher dividend prices. Fully franked dividends having lower prices, although we expected the opposite result. Small firms have lower dividend prices as in the US.

We also investigate demand and supply in the securities lending market, as well as the interaction of the two, as captured by the utilization rate. We do not find evidence that supply declines in the US, in contrast to Thornock (2013). What is clearly observable in both the US and Australia is that borrowing increases significantly around the ex-dividend day, as has been noted by Saffi and Sigurdsson (2011) and Aggarwal, Saffi and Sturgess (2015). In the US, we observe that these increases are of a relatively larger magnitude at dividend prices of 70% or 85% when compared to 100%. The ratio of stock borrowed to stock available for loan (i.e. the utilization rate) increases across all dividend prices but the rises are most stark at the lower priced dividends. For example, the utilization rate increase from 3% to 11.5% before the ex-dividend day for contracts with a 70% dividend price, whereas the increase for contracts with a 100% dividend price is from 11% to 14%.

Corresponding to this increase in demand is an increase in the lending fees. The Australian results are not as clear as the US, in line with the mixed results we find for changes in the utilization rate. In the US, the lending fee is inversely correlated with the dividend price. For contracts with a 100% dividend price do not deviate much from 10bp around the ex-dividend day. In contrast, the fee for a 70% dividend price contracts increases from 25bp to almost 100bp on the ex-day. Clearly, the increase in demand for contracts with lower dividend prices is driving the overall increase in the ex-dividend lending fee that is observed in aggregate. It is clear that lenders set the dividend price in the securities lending market. Borrowers appear to act as price takers, with limited competition meaning that supply at the lowest available dividend price is not exhausted before higher priced contracts are utilized. The contemporaneous existence of different prices for

dividends is consistent with significant search costs, as in Kolasinski, Reed and Ringgenberg (2013), and the demand for swift execution of transactions in a less than fully transparent securities lending market. Overall, our study finds that taxes matter for the pricing of dividends.

2. The Motivation for Ex-Dividend Securities Lending and Borrowing

Short sellers aim to extract profit from declining security prices by selling the stock short and later repurchasing the security at a lower price to return to the lender of the stock. Short selling creates a need to borrow the shares sold short so that delivery requirements can be met. In the ex-dividend setting, short-sellers can profit from prices declining by a greater amount than the dividend, after adjusting for the relevant taxes. Blau, Fuller and Van Ness (2011) find that this trading generates abnormal returns in the US whereas Mohamad, Jaafar, Hodgkinson and Wells (2013) do not find such profitable trading from this activity in the UK. Alternatively, price risk can be avoided by borrowing stock but not short selling. Investors who are tax-disadvantaged lend shares prior to the ex-date to avoid the dividend and tax-advantaged investors borrow during the cum-period to capture the dividend. The key factors driving this activity are tax rates each investor faces on dividends, the dividend requirement that the lender stipulates and the lending fee that is charged. Christoffersen, Géczy, Musto and Reed (2005) discuss this cross-border ex-dividend arbitrage in detail. We will delve further into the taxation details in the US and Australia that lead to this trading below.

A typical security lending transaction involves the transfer of stock ownership from the lender to the borrower. In return, the borrower must provide collateral in the form of other securities or cash, and a margin to cover for adverse price movements. The economic benefits, including dividend payments from the stock, flow directly to the borrower. Consequently, in case the security

is on loan over the ex-dividend date, the securities lending contract stipulates a compensation payment that the borrower must make to the lender. The compensation to be paid for dividends is set by the lender when they make their securities available for lending. This compensation payment represents an observable price for dividends. This price can differ depending on the lending contracts on offer – both across stocks and for the same stock. In accepting a stock loan, the borrower agrees to pay the dividend price if the stock is borrowed over the ex-day. This dividend price is often referred to as the manufactured dividend or substitute dividend. As securities lending is organised in an over-the-counter market where there is limited transparency, borrowers cannot simultaneously observe the full range of dividend prices available from different lenders at a point in time. Due to search costs and a demand for immediacy by borrowers, it seems plausible that there will be no single market clearing price for dividends, but rather that multiple prices can exist concurrently.

The US operates a classical system of taxation, where company profits are taxed at the company level and again when the profits are distributed as dividends they are taxed at the shareholder level. For the duration of the sample covered in this study the tax rate on dividends and long-term capital gains were equal for domestic US investors at 15%. Short-term capital gains are taxed at an investor's marginal income tax rate. Qualified dividends have to be paid by US domestic companies, or qualifying foreign companies, and investors have to satisfy holding period requirements to qualify for this reduction in tax. There was a minor change in the tax rate for qualified dividends from 2008 when it was reduced from 5% to zero for shareholders with income tax rates of 15% or less. Manufactured, or substitute, dividends are not treated as qualified dividends according to the IRS.[3] Thornock (2013) notes this effect and hypothesizes that it will

[3] See https://www.irs.gov/irb/2003-40_IRB#NOT-2003-67 and https://www.irs.gov/publications/p550#d0e12370.

reduce supply of stock in the securities lending market because of the adverse tax consequences for the lender. Under *Internal Revenue Code* Section 1058, there are no capital gain consequences from securities lending or borrowing subject to the dividend being reimbursed and the stock being recallable. As such, a primary focus for security lending is the taxation of the dividend. The other tax of relevance for investors receiving dividends is withholding tax. Foreign investors in the US have to pay withholding tax on dividends at 30% unless there is a double-tax treaty between the US and the country where the foreign investor is resident. In the latter case, the withholding tax is reduced to 15%. This creates a clear tax-related benefit if a domestic US investor can borrow stock from a foreign investor who would be liable for withholding tax. The US investor would receive a qualified dividend as they own the stock on the ex-day and the foreign investor would avoid having to pay withholding tax. In the case of a foreign investor facing a 30% withholding tax it would be a matter of what fee for the borrowing is charged to essentially share the 30% of tax that has been avoided.

Australia's tax system, with respect to dividends, is substantially different from the US. Under the imputation tax system in Australia, dividends from profits that have been subject to corporate tax carry a "franking credit" or "imputation tax credit". This is a tax credit for the Australian corporate tax paid by the corporation on the profits from which the dividends have been distributed. Australian resident investors are entitled to a tax offset of their personal tax liability corresponding to the amount of franking credits attached to the dividend. Any franking credits in excess of an individual's personal tax liabilities are refundable in cash. The net effect of the system is that a shareholder effectively pays tax at their own marginal income tax rate on the before corporate tax income from which the dividend was distributed. Any investor without and Australian tax liability is unable to use these franking credits, with one exception regarding withholding that will be detailed below. Companies can decide on the extent to which they frank their dividend

payments as they long as they have a sufficient balance of franking credits (i.e. cumulative balance of corporate tax paid less any distributed franking credits). As such, dividends can be either fully franked at 100%, partially franked at a percentage greater than zero but less than 100%, or unfranked at 0%. The total tax payable on a fully franked dividend can be represented by $t_dD(1+t_c/(1-t_c))$ where D is the dividend amount received, t_c is the corporate tax rate and t_d is the tax rate applicable on dividend income. In Australia, the dividend tax rate is the same as the investor's marginal income tax rate. The corporate tax rate is 30%. The dividend is first "grossed up" to reflect the corporate tax that has already been paid on the company profits from which the dividend is distributed. A $1 fully franked dividend is grossed up to a value $1.4286. The investor's marginal tax rate is then applied to this amount. The top marginal tax rate in Australia is 45%, leading to total tax of $0.6429. The company has already paid $0.4286 of the tax and investor pays the difference of $0.2143. In effect, this investor has a 15% tax rate of dividends. An investor with a marginal tax rate of 30% effectively has a 0% tax rate on fully franked dividends as all the required tax is paid at the company level.

Security lending does not lead to a capital gain tax liability under the *Income Tax Assessment Act 1936* Section 26BC, if certain, modest conditions are satisfied, such as having a written agreement and dealing at arm's length. In terms of dividend taxation the *Income Tax Assessment Act 1997* Division 216 states that any franking credit that is paid by the company when the lender has the shares out loan will be deemed to belong to the lender. The only condition is that the borrower must provide a statement to the lender indicating that they will pass through the franking credits. If the borrower does not provide such a statement, then presumably the lender can recall their stock. Australia operates a holding period requiring stocks to be held for 45 days at risk around the ex-dividend date. As long as lenders can satisfy Section 26BC then their eligibility to franking credits is not impacted.

As in the US, withholding taxes on dividends are 30% or 15% in Australia depending on whether a double tax treaty exists. A key difference between the two countries is that withholding taxes are waived for foreign investors where the Australian dividend payment is fully franked. That is, a foreign investor pays zero Australian tax on a fully franked dividend.

3. Dividend Pricing

3.1. Lender's Valuation of Dividends

What would be the price for dividends if security lenders set the price to reconstruct their position as if they had received the dividend themselves? Had there been no securities lending transaction, the lender would have held the stock until some point at time *t* and collected the dividends, less any withholding taxes, plus any tax credits up until this time. On the other hand, given a security lending transaction that concludes at the same time *t,* the lender will get their stock back and, to reconstruct their position, they would need to have received the face value of the dividends less the value of any withholding taxes, plus the value of any tax credits. Therefore, it is hypothesised that a lower bound on the lenders' price for the dividends foregone will be the face value of the dividends, less any withholding taxes, plus any tax credits attached to the dividend. This would characterise the lowest value that a lender should be willing to accept to enter a short selling contract.[4]

It is possible that some lenders may attempt to extract additional returns by setting a dividend price above their lower bound. However, the lender has a trade-off to make here, a higher dividend price may generate higher returns from lending but may also reduce the chance of the

[4] The implicit presumption here is that the lender is not in any way compensated for the dividend by the size of the lending fee.

stock being borrowed. Our discussion with a securities lending broker suggested that the returns to security lending were driven by the fee that is charged rather than the pricing of the dividend.

It is not expected the lender's valuations will reflect any of the capital gains tax effects that are typically incorporated into dividend valuation models like the Elton and Gruber (1970) model. This is because security lending transactions can be structured so that they do not alter the capital gains tax position for the lender. This is the way that security lending contracts are commonly arranged. For instance, under the US tax code, any loan of stock that is recallable and where dividends are reimbursed to the lender at the full-face value will not be considered an exchange with capital gains taxation implications for either party.[5]

In the light of the foregoing, we model the dividend compensation that the lender require as:

$$dD = D + cr(D) - w(D) \qquad (1)$$

$$d = 1 + cr - w$$

Where: d = the dividend price per dollar of dividend face value

D = the face value of the dividend

cr = tax credit rate

w = withholding tax rate.

Tax benefits from the receipt of dividends are captured in the tax credit variable *cr,* which includes any benefit arising from a concessional tax rate on dividends. For a US investor who obtains a qualified dividend cr is positive. If such an investor forgoes the qualified dividend by lending their stock they are expected to increase the dividend price to compensate. However, this

[5] See Title 26 U.S. Code Section 1058 of the Internal Revenue Code.

risks running foul of the capital gains tax exemption rules discussed above, so the lender may prefer to recall loaned stock before the ex-dividend date.

The dividend may not be known at the time the securities lending contracts is executed. Thus, in the contract the dividend price is expressed as a percentage of the face value of the dividend that is subsequently paid. For a US lender of a US stock who pays no withholding taxes and receives no tax credit, the dividend price is expected to be 100% of the dividend. While for an Australian lender of Australian stocks with a fully franked dividend, there is an imputation tax credit of $0.43 per dollar of dividends and no withholding tax, so the dividend price is expected to be 143% of the dividend. Variations about these values are expected depending on the level of withholding tax and the availability of tax credits for each particular lender of stock.

3.2. Borrower's Valuation of Dividends

A model for the borrowers' valuation of dividends could be developed in an analogous fashion to the ex-dividend model of Elton and Gruber (1970) by considering what the price of dividends should be to make investors indifferent to borrowing cum-dividend or ex-dividend. However, except where securities lending is for the purpose of dividend arbitrage, this seems unlikely to be the determinant of how much borrowers are willing to pay. In many cases, the borrowers will be motivated to transact for reasons other than the dividend. There is likely to be a demand for immediacy, either from a desire to reduce execution risk in a multi-leg transaction, or the need to trade before the opportunity to profit from shorting disappears. It seems unlikely that such borrowers of stock will be doing an Elton and Gruber style of analysis to decide whether to trade in the cum-dividend or the ex-dividend period. Such an approach seems particularly unlikely in cases where the ex-dividend date is quite distant.

A simple model of the profit from the short sale can be written as equation 1 below. To simplify the presentation, we omit present value operators. We assume all the variables are known,

except for the dividend and the price at which the shorted stock will be re-purchased. It is assumed that the compensation payment for the dividend is a tax-deductible expense and that the actual dividend and the dividend compensation payment are subject to the same income tax rate. Recall that any concessional tax rate on actual dividends is captured by the tax credit term.

$$\pi = (P_0 - \mathrm{E}\,(P_t))(1 - \tau_g) + (1 - \tau_i)(\mathrm{E}(D) - d\,\mathrm{E}(D)\,) + cr\mathrm{E}(D) - w\mathrm{E}(D) - (c + f\,) \quad (2)$$

Where:

π is the expected profit from the short sales transaction
P_0 is the price at which the stock was sold
$\mathrm{E}\,(P_t)$ is the expected repurchase price of the stock at time *t*
$E(D)$ is face value of the expected dividend
τ_g is the tax rate on capital gains
τ_i is the tax rate on income
d is the dividend price per dollar of face value
c is the after tax transactions costs of selling and buying back the stock
f is the stock lending fee after tax.

It seems plausible that borrowers will regard any excess in the price of the dividend over their dividend valuation as a transactions cost of executing their strategy.[6] Accordingly, where there is a profit to be made after transactions costs, the borrowers will agree to pay what is necessary to get execution of the short position and meet delivery requirements. From equation 2, the short sale transaction is expected to be profitable as long as the following inequality for the dividend price holds:

$$d < \frac{\big(P_0 - \mathrm{E}(\,P_t)\big)\big(1 - \tau_g\big) + \mathrm{E}(D)(1 - \tau_i) + cr\mathrm{E}(D) - w\mathrm{E}(D) - (c + f\,)}{\mathrm{E}(D)(1 - \tau_i)}$$

$$d < 1 + \frac{(P_0 - \mathrm{E}(\,P_t))(1 - \tau_g) + cr\mathrm{E}(D) - w\mathrm{E}(D) - (c + f\,)}{\mathrm{E}(D)(1 - \tau_i)}$$

In order to maximise trading profits, borrowers would prefer to pick the lending contract with the lowest combination of lending fee and dividend price. However, as previously suggested, this is

[6] Conversely, if the after tax value of the dividend is more than the after tax dividend price this adds to the profit of the trade.

not a fully transparent market. Thus, search costs coupled with a demand for immediacy of transactions are likely to restrict the effectiveness of competition in ensuring all transactions occur at the lowest combination of fee and price for dividends. If the borrower is confident that they will not be holding the stock over the ex-dividend date, then the price payable for dividends is irrelevant to them and the fee payable would then be the main factor for consideration. However, if it may be necessary to hold the stock over the ex-dividend date, then it is in the borrower's interest to agree to a dividend price that will fully compensate the lender for foregoing the dividend. Otherwise the lender has an incentive to recall the stock just before the stock goes ex-dividend.

3.3. Valuation in ex-dividend arbitrage

Traditional dividend arbitrage involves trading cum dividend and then reversing the trade ex-dividend. This creates exposure to ex-dividend price risk. Dividend arbitrage through securities lending has the attraction of eliminating the ex-dividend price risk. The expected profit for an investor undertaking dividend capture arbitrage via short sales is given by equation 3. The investor borrows the stock cum-dividend and then returns the stock ex-dividend.[7] We assume that standard securities lending contracts are used so no capital gains taxes apply. Again, we omit present value operators, all variables should be known at the time of the transaction:

$$\pi = (1 - \tau_i)(D - dD) + crD - wD - (c + f) \qquad (3)$$

The no arbitrage equilibrium for dividend capture has a profit of zero and the equilibrium dividend price is then given as:

$$d = \frac{(D(1 - \tau_i) + crD - wD) - f}{D\,(1 - \tau_i)}$$

$$d = 1 + \frac{crD - wD - f}{D(1 - \tau_i)}$$

[7] This may be some time after the ex-dividend date in order to meet holding period requirements to obtain tax benefits.

Compared to holding the stock, investors who lend the stock over the ex-dividend period avoid the dividend and instead receive the dividend compensation payment plus the lending fee. The profit from avoiding the dividend is given by equation 4:

$$\pi = d\,D(1-\tau_i) + (f - c_l) - (D(1-\tau_i) + crD - wD) \quad (4)$$

Where c_l is the after-tax brokerage cost of lending out the stock.

The no arbitrage dividend price for a dividend avoidance trade is:

$$d = \frac{(D(1-\tau_i) + crD - wD) + (f - c_l)}{D(1-\tau_i)}$$

$$d = 1 + \frac{crD - wD + (f - c_l)}{D(1-\tau_i)}$$

The equilibrium dividend price equations for dividend capture and dividend avoidance traders are almost identical. The only difference is the sign on the security lending fee and the extra brokerage cost that the lenders pay when avoiding the dividend, but this latter is expected to be small. Differences in the dividend price and hence gains from trade can arise when there are differences in income tax rates, tax credit rates and withholding tax rates between borrowers and lenders. Higher security lending fees make dividend avoidance more attractive and dividend capture less attractive.

4. Data and Sample Selection

The short selling data comes from the Data Explorers database. This database records the short-selling activity of about 30,000 equity securities worldwide and Data Explorers claimed to cover about 85% of the OTC market. In 2012, Data Explorers was acquired by IHS Markit. Transaction data is aggregated on a daily level and provides detailed information on lendable quantities of the security, fees chargeable, dividend requirement and the amounts actively being

borrowed per security. The dividend requirement is the percentage value of the dividend that the borrower needs to reimburse the lender if the stock is held over the ex-dividend day. We often refer to the dividend requirement as the dividend price. The Data Explorers data is grouped by dividend requirement for a given stock and day. For example, there are three observations for General Electric on Jan 12, 2007 as there are three different dividend requirements that existed – 70%, 85% and 100%. No details of the individual counterparties to each contract can be identified. Actual dividends, ex-dividend stock prices and dates, plus the level of franking for Australian stocks, are obtained from the Centre for Research in Security Prices (CRSP) for the US and from the Share Price and Price Relative database (SPPR) via Securities Industry Research Centre of Asia-Pacific (SIRCA) for Australia.

The stocks analysed were the US and Australian stocks available for lending in the Data Explorers database during the period July 1, 2006 to June 30, 2011. This period covers all the data that was made available to us. As noted above, Data Explorers was acquired by IHS Markit in 2012. The dividend requirement variable is not available in the Markit Securities Lending database and this is the reason we use the sample period ending in 2011. This time period is also free from any major tax code changes that may have impacted on investor behavior and dividend valuations.[8] The firms were required to have had their primary listing as either the New York Stock Exchange (NYSE) or the Australian Securities Exchange (ASX). The US sample was restricted to lendable stocks that had been a constituent of the S&P500 index during this period as this was the only data supplied. Australian stocks had to be a constituent of the S&P/ASX200. Firms were removed from the sample if firms could not be matched between CRSP and the Data Explorers database or if there was no price data on the ex-dividend date. This resulted in a total of 6,564 dividend payments from

[8] There was a minor change in the US. From 2008 the tax rate for qualified dividends was reduced from 5% to zero for shareholders with income tax rates of 15% or less.

442 distinct companies in the US and 1,024 dividend payments from 159 distinct companies in Australia. Ex-dividend events are less frequent in Australia as dividends are paid half yearly, whereas in the US dividends are generally paid quarterly. There are 41 distinct dividend prices in US securities lending market and 50 in Australia. Descriptive statistics on the dividend payments are reported in Table 1. The dividend size is similar in local currency terms, but the ex-day premium is higher in the US, on average. The median premium is larger in Australia. There is a substantial difference in dividend yields between Australia and the US. Part of this difference reflects the quarterly dividend payment frequency in the US and semi-annual frequency in Australia. After taking that into account the annual yield is about twice as high in Australia. The franking percentage is also reported for Australia. A franking level of 100% indicates that the dividend carries the most tax benefits for domestic investors. The median is 100% and the average is 60%.

[Insert Table 1 here]

5. Results

5.1. Price Clusters

Histograms displaying the frequency distributions of dividend prices for all US and Australian stocks are shown in Figure 1, panels A and B, respectively. The histogram reflects dividend prices where borrowing was greater than zero on the ex-dividend day. It is clear that prices cluster at a small number of specific values even though a wide range of dividend prices are observed. Three dividend prices for the US sample and four for the Australian sample represent the vast majority of the observed prices. We show below that these prices can be explained by tax credits and withholding taxes consistent with equation 1. Also consistent with the arguments advanced earlier, it appears that the borrowers largely act as price takers with respect to the

dividend. The prices observed reflect the compensation required to reconstitute the lender's position as if no stock lending transaction had taken place.

[Insert Figure 1 here]

Dividend prices cluster at 70, 85 and 100 cents per dollar of face value in the US, with the most frequently observed value being exactly at $1. The price of $1 is the face value of the dividend and is consistent with pricing by an investor who receives no tax credits and pays no withholding tax. A price of $0.70 per dollar of dividends is consistent with pricing by a foreign lender facing a full 30% withholding tax on dividends. In cases where the foreign investor is domiciled in a country that has a double tax agreement[9] with the US then the withholding tax rate is reduced to 15%, consistent with a dividend price of $0.85. There are a few values greater than $1, but these are only around 5% of all observations. Such prices can arise from lenders demanding compensation for the loss of the tax benefit associated with qualified dividends. Rather puzzling is the small number of observations with a value of $1.43. This valuation would be consistent with Australian stocks trading as American Depository Receipts (ADRs) and being offered by Australian lenders, but these observations are associated with US stocks. One possibility is that the stocks in question are on offer from Australian lenders who usually charge $1.43 for their Australian stock and the broker posting the offer has in error used the standard contract terms for the Australian lenders and omitted to update these to allow for the lenders offering to lend US rather than Australian stocks.

In the Australian sample, the most common observations are equivalent to $0.70, $0.85, $1 and $1.43 per dollar face value of dividends. The prices of $0.70 and $0.85 are congruent with withholding taxes of 30% and 15%, respectively, on unfranked dividends. Withholding taxes are waived for overseas investors where dividends are fully franked, corresponding to a dividend price

[9] Tax treaties are also referred to as tax conventions or double tax agreements (DTA). They aim to reduce or eliminate double taxation caused by overlapping tax jurisdictions.

of $1. Domestic shareholders in receipt of an unfranked dividend would also receive $1 for these dividends. The price of $1.43 matches a price set by a domestic investor who receives a fully franked dividend – with a face value of $1 for the cash dividend and a face value of $0.4286 for the imputation tax credit. An additional source of variation in the Australian data is that dividends may be fully franked, partially franked, or unfranked, dependent on the amount of corporate tax that has been paid by the company. This could range from full taxation at the corporate rate of 30% to zero. This helps explains some of the intermediate observations that do not occur at any one of the four main dividend price clusters. Overall, the histogram shows that a single underlying clearing price for dividends does not exist in the security lending market. The price variation is not simply due to random variation about a well-defined mean. Multiple dividend prices can, and do, co-exist on the same day both across stocks and for the same stock.

5.2. Mean Dividend Prices

Table 2 presents the summary statistics of the dividend prices for the US (Panel A) and Australia (Panel B) from t-45 to t+45, relative to the ex-dividend day. *All Contracts* is based on pooling the dividend price across all contracts for each day without any averaging at the stock level. The remaining dividend prices are averaged across each stock for each day using various weightings to take account of the multiple dividend prices. *Supply* is weighted by lendable quantity as a percent of shares outstanding, *Demand* is weighted by borrowed quantity as a percent of shares outstanding, *Utilization* is weighted by the percentage of available stock to borrow that is actually borrowed and *Realised* is an equal weighted measure for contracts that are held on the ex-dividend day. It is important to bear in mind the nature of the underlying distributions, as presented in Figure 1, when interpreting these results. Although the mean is a convenient summary statistic, it does not represent the price at which dividends commonly trade. Across all six different dividend price measures, the means are all significantly different from 100 cents per dollar of face value. The

results reflect most US prices being equal to or less than the face value of the dividend, while the majority of the Australian prices are equal to or greater than the face value of the dividend. The different measures do produce different dividend prices. In the US the *All Contracts*, *Equal* and *Realised* measures all produce a dividend price of 88 to 89 cents. The utilization-weighted dividend price is slightly higher at 93.6 cents and the demand- and supply-weighted prices are similar at around 98 cents. This indicates that there are smaller amounts being offered for lending at lower dividend prices. In Australia, dividend prices average around 112 cents for all measures, except the demand- and supply-weighted measures that are around 109 cents.

[Insert Table 2 here]

Figure 2 plots dividend requirements from 45 days before the ex-day to 45 days after the ex-day. The daily dividend prices are calculated by taking a weighted averaging across each stock for each day using either equal weighting, lendable quantity as a percent of shares outstanding (*Supply*), borrowed quantity as a percent of shares outstanding (*Demand*) or the percentage of available stock to borrow that is actually borrowed (*Utilization*). In the US, the dividend price does not vary when weighted by supply. It remains around 98%. The other three measures of dividend price all vary considerably, reaching their lowest point on or around the ex-dividend day. The demand weighted price falls from 99% to 97%. Equal weighting prices decline from 90% to 88%. The utilization weighted price experiences the largest decline from over 95% to around 90%. The conclusion here is that supply does not change in any material way, but that there is increase in smaller amounts of supply at lower dividend prices. Demand increases for contracts with lower priced dividends. The results for Australian dividends are similar in terms of the trends over time. That is, dividend prices decline around the ex-day for all weighting schemes except the supply weighted price. Dividend prices overall, are substantially higher in Australia, as noted above.

[Insert Figure 2 here]

The dividend prices from t-5 to t+5 that correspond to Figure 2 are presented in Table 3. The results are similar in both Australian and the US. The daily price across all four weighting schemes are significantly lower than the average dividend price between t-45 to t-11 and t+11 to t+45. As noted above, the magnitude of the fall in the supply-weighted price is economically small, with the demand-weighted price slightly higher. The largest different is for the utilization-weighted prices with the dividend price declining by 4 to 5 cents per dollar in both countries. The results suggest that on average, borrowers are more likely to enter into contracts with lower dividend prices if the stock is borrowed over the ex-dividend period. This is consistent with some borrowers "shopping around", particularly where there is an expectation of holding the security over the ex-dividend date.

[Insert Table 3 here]

5.3. Dividend Prices and Characteristics

It is well established both theoretically and empirically in ex-dividend studies that higher dividend yields are associated with higher market values for dividends. This is consistent with the tax clientele argument of Elton and Gruber (1970) and the transaction cost hypothesis of Kalay (1982). We examine whether the dividend yield, dividend amount or market cap have any effect on dividend prices in the security lending market. Short-selling contracts utilized over the ex-date are sorted into quintiles each year based on dividend yield, dividend size and market capitalisation. We continue to sue the four different weighting schemes (equal, supply, demand and utilization). The results for the US are presented in Table 4. The sorts on dividend yield in panel A reveal that there is no difference in dividend price when equal weighting is used. High dividend yield stocks have slightly lower prices than low yield stocks, but they are not monotonically decreasing. The largest difference appears in the utilization-weighted prices. If we look at the abnormal prices in panel A for the utilization weighted measure, we can see that the dividend prices fall the most for

high yield and fall the least for low yield. Panel B presents dividend prices sorted by the size of the dividend payment. The results are slightly stronger than for yield. Larger dividend amounts have smaller value. Similarly, the market cap results in panel C show that larger firms have lower dividend prices. Our results indicate that larger stock paying larger dividend at a higher yield have lower dividend prices. At first, this might seem counterintuitive. But, when one considers that arbitrage that can occur via security lending it becomes clear that foreign investors in the US would require a dividend of 70% or 85% of face value. Domestic US investors who value the dividend at 100% would seek out the contracts with a lower price and try to capture the dividend. Given that supply is relatively stable, the decline in dividend prices indicate that US investors are likely to be searching out low priced dividend contracts to arbitrage.

[Insert Table 4 here]

The Australian results for the portfolio sorts and dividend prices are in Table 5. In addition to dividend yield, dividend size and market cap, results are also presented for the level of franking and gross dividend yield. Franking credits have also been shown to increase the value of dividends in some cases, as in Walker and Partington (1999). The sample is divided into three portfolios based on franking status – fully franked (100%), partially franked (< 0% to < 100%) and unfranked (0%). The gross dividend yield is defined as the cash dividend plus the value of the franking credits as a percent of the stock price on the cum-dividend day. Panel A presented the dividend prices for portfolios sorted by dividend yield. The highest group does have the highest dividend price and it is significantly higher than the low yield group. However, this result appears to be driven primarily by the highest yield quintile. It is important to point out that this is the opposite result found in the US where high yield stocks had lower dividend prices. Despite this difference in the levels of the dividend prices, the abnormal dividend prices are all significantly lower than normal, with the exception of the supply-weighted measure for high yield stocks. Panels B and C present dividend

amount and market cap results that generally mirror the conclusions for the US with some exceptions. The difference between the high and low groups are all monotonic for dividend amount and are very close to monotonic for market cap. The difference in the dividend prices are also much larger with the average dividend price 10 to 11 cents higher for smaller firms and those paying smaller dividends.

The results for portfolios sorted by franking in panel D are puzzling. All the means are significantly above $1 per dollar of face value. Unfranked dividends are expected to have the lowest value and be priced at close to $1, but instead have the highest price across all the means. As the ex-date approaches borrowers may seek to borrow stock at a lower dividend price and return stock carrying fully franked dividends with a dividend price of $1.43, while overseas investors not eligible to claim franking credits can gain by avoiding dividends and lending stock at dividend prices over $1.00. Some domestic lenders may also recall stock with fully franked dividends before the ex-date, so as to comply with the 45-day holding rule required to claim the franking credits. Such effects would depress the mean dividend price for fully franked stock, but do not explain why the mean dividend price for unfranked stock is over $1. The abnormal dividend prices show that the price of fully franked and partially franked dividends fall the greatest. The gross dividend yield portfolios have similar prices to the dividend yield results in panel A.

[Insert Table 5 here]

5.4. Demand and Supply in the Securities Lending Market

In studies of changes in stock trading volume around the ex-dividend day, such as Michaely and Vila (1996), tax heterogeneity across traders leads to increased volume. We anticipate that tax heterogeneity induced by either tax credits or withholding taxes should impact demand and supply in the security lending market. Demand is likely to be impacted because of ex-dividend arbitrage opportunities and supply could be impacted as lenders need to satisfy regulatory requirements to

be entitled to reduced tax rates and tax credits. Supply is measured as the lendable quantity as a percent of shares outstanding and demand is the borrowed quantity as a percent of shares outstanding. The mean demand and supply are shown in Figure 3 and Figure 4 for the US and Australia, respectively. The different panels reflect the common dividend prices observed in each country.

There are a number of interesting observations. First, the 100% dividend price has the largest supply and demand across dividend prices in both countries, when scaled by number of shares outstanding. Second, supply does not appear to vary greatly around the ex-day. This is in contrast to the findings of Thornock (2013) where tax sensitive lenders reduce supply. Although we do not observe lender details, in aggregate they do not appear sensitive to taxes on the supply side. Third, demand increases substantially around the ex-day. In the US this demand increase occurs in all three of the primary dividend prices (70%, 85% and 100%). The increase is somewhat muted at the 70% price in Australia (Panel A, Figure 4) but is prevalent at 85%, 100% and 142.86% of dividend face value. The question that naturally arises is why borrowers of stock would pay a higher dividend price than need be? It is well known that the security lending market is segregated and that is a likely reason for the existence of multiple dividend prices. The most puzzling is the increase in demand over the ex-day for the 142.86% dividend price in Australia. In this case, investors are over-paying considerably.

[Insert Figure 3 here]

[Insert Figure 4 here]

Figure 5 displays the proportion of lending supply that is borrowed during a 91-day window around the ex-dividend date. Increases in the utilization of supply, across all dividend price clusters, are clearly evident as the ex-day approaches and reverse thereafter. In the US market the utilization of the 70% price contracts increases from about fifteen days before the ex-dividend date and

declines in the fifteen days following the ex-dividend date. The 85% contracts also experience an increase in utilization but it is off a much lower base. The 100% contracts have a slight increase just before the ex-day. This pattern is expected if dividend arbitrage is taking place. In the Australian market (panel B) the changes in utilization tend to be concentrated in plus or minus five days about the ex-dividend date and they are much more modest when compared to the 70% contracts in the US. Overall, there is a considerable amount of supply that remains available to borrowers. Even though there is an increase around the ex-day suggesting that ex-dividend borrowing is occurring, profitable arbitrage opportunities appear to be foregone given the differences in tax rates that market participants face. However, this conclusion overlooks the fee that is charged for the borrowing of stock.

[Insert Figure 5 here]

5.5. Lending Fees

An important component of security lending is the fee charged for borrowing. Although generally a small amount, the fee is another cash flow in addition to the dividend price. Figure 6 contains the mean lending fee for all outstanding contracts across the common dividend prices for the US (panel A) and Australia (panel B). When comparing between panels it is apparent that borrowing Australian stocks is substantially more expensive than borrowing US stocks. Figure 6 reveals that the average fee differs across dividend prices and by proximity to the ex-day. In the US, the fee declines as the dividend price increases with the fees for the 70% and 85% dividend prices increasing as the ex-date approaches and then declining following the ex-date. The fee for contracts with a $1 dividend price area relatively stable at around 10bp. The fee for 85% dividend increases from 20bp to 50bp on the ex-day. The 70% dividend price experiences the sharpest fee increase, rising from 25bp to near 100bp on the ex-day. The combination of the cross-sectional and

time series behavior of fees indicate that dividend arbitrage is a key motivation for ex-dividend security lending. Demand increases while supply remains relatively stable. The result is an increase in the fee as the lender and the borrower split the surplus from the ex-dividend tax arbitrage.

The results for the Australian security lending market differ from those in the US. The increase in fees around the ex-day are delayed until just before the ex-day whereas the increase in the US begins earlier and is more gradual. The 85% dividend price generally has the lowest fees at around 40bp before increasing to 70bp just after the ex-day. The 70% dividend price usually fluctuates between 40 and 50bp but rises to 100bp near the ex-day. The 100% dividend price has the highest "normal" fee of around 60bp but experiences only a relatively modest increase to just under 90bp. The 142.86% dividend price has an average fee of around 55bp. It spikes very sharply just after the ex-day to almost 140bp. The difference between Australia and the US is stark. In the US, the low dividend prices have higher fees close to the ex-day as foreign investors want to avoid the dividend. In Australia, the fee for the highest dividend price has the largest increase in fees. It is difficult to reconcile this as Australian lenders who can utilize the franking credit are receiving full compensation for the credit. The increase in fee is related to an increase in demand, suggesting that ex-dividend arbitrage is not a primary motivation in Australia vis-à-vis the US.

[Insert Figure 6 here]

To understand whether the fee is related to dividend yield, and therefore, dividend arbitrage, we estimate a cross-sectional regression each day for each dividend price in each country. The dependent variable is fee and the independent variable is the dividend yield, measured on the cum-dividend day. Figure 7 presents the daily regression coefficients for each dividend price across both countries. In the US we can see that higher yield stocks have higher fees. It is clear that the sensitivity of fees to yield does not vary with proximity to the ex-day for stocks having a dividend

price of 100%. In contrast the fee becomes increasingly sensitive to dividend yield for the 70% and 85 dividend prices as the ex-day approaches. The coefficient is around 0.1 25 trading days before the ex-day and peaks at just under 0.9 for the 70% price and over 0.5 for the 85% price on, or just before the ex-day. To put this into context consider two stocks – one with a yield of 1% and the other with a yield of 2%. On day t-25, there is a 10bp difference in the fee that becomes 88bp and 55bp for the 70% and 85% dividend price, respectively. These are substantial increases. All the coefficients are statistically different from zero at the 5% level for the 70% and the 85% prices and 80% are significant for the 100% price. The average daily adjusted R^2 is 2.3%, 2.8% and 0.5% for the 70%, 85% and 100% dividend prices, respectively. The adjusted R^2 ranges from essentially zero to 10%, 12% and 1.2% for the 70%, 85% and 100% dividend prices, respectively. We interpret the strength of these results as indicating that dividend arbitrage is driving the fees for the contracts with the lower dividend prices.

[Insert Figure 7 here]

In Australia, the results are, again, not as strong. This suggests that dividend arbitrage is less prevalent in the Australian security lending market. The impact of yield on fees is not as pronounced as in the US with the 70% and 85% dividend prices having a maximum coefficient of 0.4. At the 100% and 142.86 dividend price the coefficients are statistically significant on nearly all days, although their magnitude is relatively small. However, only 56% of days have a significant relationship between yield and fee for the 70% dividend price. This drops dramatically to 19% for the 85% dividend price. The average daily adjusted R^2 is 1.4%, 2.2%, 3.2% and 4.3% for the dividend prices increasing from 70% to 142.86%. The adjusted R^2 has a minimum of zero and a maximum up to 4.6%, 15.9%, 6.8% and 8.6%. When contrasted with the US results, it is clear that these two security lending markets behave differently around the ex-dividend day for the time

period we study. The US market has ex-dividend arbitrage taking place whereas the Australian market has much more muted evidence of arbitrage, if any is taking place at all.

6. Conclusion

A consensus on the value of dividends has proved elusive. Taxes, transaction costs and microstructure frictions have all been put forward as potential explanations as to why one dollar worth of dividends might not be worth one dollar. To contribute to this debate we direct our attention to the securities lending market, where it has been shown that dividends are an important driver of trading. The contract between the borrower and the lender stipulates the payment that the lender must make to the borrower if the stock is on loan over the dividend date. This provides us with a novel and direct measure of the value of a dividend.

We examine the dividend prices in the securities lending contracts in Australia and the US as these two countries operate very different tax systems with respect to dividends. Our results show that there are multiple prices for dividends, with different prices existing for the same firm on the same day. The dividend prices cluster at values consistent with the tax rates faced by the investor. In the US, prices cluster at \$1, \$0.85 and \$0.70. The latter two prices reflect valuations from investors that need to pay either 15% or 30% withholding tax. In addition to these three prices, we find a fourth cluster in Australia at \$1.4286. This value incorporates the tax credits that Australian resident investor receive as a result of the imputation tax system where dividends are only taxed once.

On average, US dividends are priced at less than \$1 and Australian dividends are priced at greater than \$1. However, as the ex-dividend day approaches the prices of dividends decline as borrowers seek out the contracts with the lowest dividend prices. Demand increases substantially, but supply remains relatively constant. We observe that the utilization of lendable shares increases

markedly for contracts with lower prices, consistent with dividend arbitrage. Despite these tax-motivated decisions, the supply of lower priced dividends is not exhausted by demand. In effect, money is being left on the table by borrowers in the securities lending market. The interaction of demand and supply also has substantial impact on the lending fee. The lending fee remains unchanged around the ex-dividend day in the US for loans with dividend prices at 100%, whereas contracts with a 70% dividend price experience a significant increase in the lending fee. In summary, lenders appear to act as the setters of dividend prices in this market. Security lenders, or brokers, lift fees as the ex-dividend day approaches in an attempt to capture some of the potential gains from dividend arbitrage. Overall, we can conclude that taxes are the main drivers of dividend valuation in the securities lending market.

References

Aggarwal, R., P.A.C. Saffi, and J. Sturgess, 2015, The role of institutional investors in voting: Evidence from the securities lending market, *The Journal of Finance* 70, 2309-2346.

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

Blau, B.M., K.P. Fuller, and R.A. Van Ness, 2011, Short selling around dividend announcements and ex-dividend days, *Journal of Corporate Finance* 17, 628-639.

Blocher, J., A.V. Reed, and E.D. Van Wesep, 2013, Connecting two markets: An equilibrium framework for shorts, longs, and stock loans, *Journal of Financial Economics* 108, 302-322.

Boyd, J.H., and R. Jagannathan, 1994, Ex-dividend price behavior of common stocks, *Review of Financial Studies* 7, 711-741.

Callaghan, S.R., and C.B. Barry, 2003, Tax-induced trading of equity securities: Evidence from the ADR market, *Journal of Finance* 58, 1583-1612.

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

Cohen, L., K.B. Diether, and C.J. Malloy, 2007, Supply and demand shifts in the shorting market, *The Journal of Finance* 62, 2061-2096.

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

Dubofsky, D.A., 1992, A market microstructure explanation of ex-day abnormal returns, *Financial Management* 21, 32-43.

Eades, K.M., P.J. Hess, and E.H. Kim, 1994, Time-series variation in dividend pricing, *Journal of Finance* 49, 1617-1638.

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

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

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

Graham, J.R., R. Michaely, and M.R. Roberts, 2003, Do price discreteness and transactions costs affect stock returns? Comparing ex-dividend pricing before and after decimalization, *Journal of Finance* 58, 2611-2636.

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

Kolasinski, A.C., A.V. Reed, and M.C. Ringgenberg, 2013, A multiple lender approach to understanding supply and search in the equity lending market, *The Journal of Finance* 68, 559-595.

McDonald, R.L., 2001, Cross-border investing with tax arbitrage: The case of German dividend tax credits, *Review of Financial Studies* 14, 617-657.

Michaely, R., and J.L. Vila, 1995, Investors' heterogeneity, prices, and volume around the ex-dividend day, *Journal of Financial and Quantitative Analysis* 30, 171-198.

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

Mohamad, A., A. Jaafar, L. Hodgkinson, and J. Wells, 2013, Short selling and stock returns: Evidence from the UK, *The British Accounting Review* 45, 125-137.

Moser, S.M., B.F. Van Ness, and R.A. Van Ness, 2013, Securities lending around proxies: Is the increase in lending due to proxy abuse or a result of dividends?, *Journal of Financial Research* 36, 1-17.

Rantapuska, E., 2008, Ex-dividend day trading: Who, how, and why?: Evidence from the Finnish market, *Journal of Financial Economics* 88, 355-374.

Saffi, P.A.C., and K. Sigurdsson, 2011, Price efficiency and short selling, *The Review of Financial Studies* 24, 821-852.

Thornock, J., 2013, The effects of dividend taxation on short selling and market quality, *The Accounting Review* 88, 1833-1856.

Walker, S., and G. Partington, 1999, The value of dividends: Evidence from cum-dividend trading in the ex-dividend period, *Accounting & Finance* 39, 275-296.

Table 1
Descriptive Statistics

This table presents descriptive statistics for 6,564 US dividend payments and 1,024 Australian dividend payments between July 1, 2006 and June 30, 2011. All dollar amounts are in local currency.

	Mkt Cap ($m)	Ex-Day Price ($)	Dividend ($)	Ex-Day Premium	Dividend Yield (%)	Franking (%)
Panel A: US						
Mean	25,440	47.09	0.246	0.825	0.604	
Median	11,415	40.31	0.210	0.808	0.508	
Std Dev	43,876	43.51	0.206	13.026	0.452	
Panel B: Australia						
Mean	8,473	11.31	0.221	0.695	2.578	60.77
Median	2,901	5.27	0.115	0.872	2.145	100.00
Std Dev	16,969	16.00	0.287	2.037	2.423	46.39

Table 2
Descriptive Statistics of Dividend Prices in Short-Sales Contracts

This table presents the summary statistics of the dividend prices for the US (Panel A) and Australia (Panel B) from t-45 to t+45, relative to the ex-dividend day. Values are expressed as cents per dollar of cash dividend. *All Contracts* is based on pooling the dividend price across all contracts for each day without any averaging at the stock level. The remaining dividend prices are averaged across each stock for each day using various weightings to take account of the multiple dividend prices. *Supply* is weighted by lendable quantity as a percent of shares outstanding, *Demand* is weighted by borrowed quantity as a percent of shares outstanding, *Utilization* is weighted by the percentage of available stock to borrow that is borrowed and *Realised* is an equal weighted measure for contracts that are held on the ex-dividend day.

	All Contracts	Equal	Supply	Demand	Utilization	Realised
Panel A: US						
Mean	89.41	88.44	98.08	98.56	93.64	88.18
Median	85.00	85.00	97.89	99.66	96.38	85.00
Std Dev	5.47	13.18	1.23	2.88	8.81	4.82
Min	78.33	65.00	70.00	69.11	70.00	80.00
Max	125.00	170.00	105.54	138.66	142.63	107.50
Panel B: Australia						
Mean	112.60	113.77	108.71	109.17	112.31	111.44
Median	100.00	113.93	108.53	105.75	110.37	109.29
Std Dev	26.77	10.85	8.36	10.78	14.73	11.33
Min	70.00	82.75	85.00	70.11	70.01	85.00
Max	150.00	143.00	142.86	143.00	142.86	142.86

Table 3
Dividend Prices around the Ex-Dividend Date

This table presents the daily dividend price and abnormal dividend price for the US (Panel A) and Australia (Panel B) from t-5 to t+5, relative to the ex-dividend day. Values are expressed as cents per dollar of cash dividend. Daily dividend prices are calculated by taking a weighted averaging across each stock for each day using either equal weighting, lendable quantity as a percent of shares outstanding (*Supply*), borrowed quantity as a percent of shares outstanding (*Demand*) or the percentage of available stock to borrow that is actually borrowed (*Utilization*). The abnormal dividend price is the difference between the daily dividend prices and the dividend price averaged over t-45 to t-11 and t+11 to t+45. ** indicates statistical significance at 1%.

	Dividend Price				Abnormal Dividend Price			
Day	Equal	Supply	Demand	Utilization	Equal	Supply	Demand	Utilization
Panel A: US								
-5	88.49	97.91	97.46	90.58	-1.336**	-0.248**	-1.616**	-4.311**
-4	88.35	97.88	97.50	90.71	-1.468**	-0.274**	-1.576**	-4.179**
-3	88.23	97.86	97.33	90.55	-1.599**	-0.299**	-1.749**	-4.342**
-2	88.15	97.85	97.22	90.36	-1.673**	-0.305**	-1.860**	-4.539**
-1	88.02	97.83	97.37	90.53	-1.804**	-0.332**	-1.712**	-4.371**
0	88.18	97.85	97.10	90.25	-1.637**	-0.310**	-1.980**	-4.637**
1	88.27	97.86	97.05	90.16	-1.551**	-0.300**	-2.030**	-4.724**
2	88.32	97.86	96.99	90.36	-1.506**	-0.302**	-2.085**	-4.531**
3	88.36	97.86	97.08	90.52	-1.461**	-0.293**	-2.003**	-4.382**
4	88.43	97.87	97.17	90.68	-1.391**	-0.283**	-1.908**	-4.203**
5	88.51	97.89	97.31	90.97	-1.311**	-0.271**	-1.767**	-3.932**
Panel B: Australia								
-5	112.56	108.56	107.77	110.09	-1.850**	-0.346**	-2.059**	-3.354**
-4	112.30	108.41	107.37	108.89	-2.110**	-0.500**	-2.458**	-4.567**
-3	111.83	108.34	107.03	108.16	-2.575**	-0.563**	-2.797**	-5.285**
-2	111.38	108.16	106.72	107.64	-3.025**	-0.735**	-3.112**	-5.784**
-1	111.32	108.21	106.73	107.92	-3.110**	-0.717**	-3.120**	-5.529**
0	111.44	108.23	107.29	108.73	-2.977**	-0.698**	-2.548**	-4.705**
1	111.64	108.35	108.02	109.99	-2.751**	-0.579**	-1.791**	-3.446**
2	111.32	108.22	107.04	108.51	-3.070**	-0.699**	-2.766**	-4.915**
3	111.34	108.29	107.04	108.24	-3.060**	-0.626**	-2.769**	-5.172**
4	111.86	108.37	107.22	108.83	-2.540**	-0.548**	-2.583**	-4.574**
5	112.07	108.28	107.53	109.28	-2.248**	-0.607**	-2.262**	-3.945**

Table 4
Dividend Prices and Characteristics: US

This table presents the dividend price for contracts held at the close on the cum-day across different stock characteristics. Stocks are sorted into quintile based on dividend yield, dividend amount and market cap. Values are expressed as cents per dollar of cash dividend. Daily dividend prices are calculated by taking a weighted averaging across each stock for each day using either equal weighting, lendable quantity as a percent of shares outstanding (*Supply*), borrowed quantity as a percent of shares outstanding (*Demand*) or the percentage of available stock to borrow that is actually borrowed (*Utilization*). The abnormal dividend price is the difference between the dividend price and the dividend price averaged over t-45 to t-11 and t+11 to t+45. *H-L* is the difference between the average of the high and low portfolios. * and ** indicate statistical significance at 5% and 1%, respectively.

	Cum-Day				Abnormal			
	Equal	Supply	Demand	Utilization	Equal	Supply	Demand	Utilization
Panel A: Dividend Yield								
Low	88.18	97.97	98.26	92.30	-2.262**	-0.342**	-1.057**	-3.522**
2	88.00	97.86	97.63	90.87	-1.963**	-0.327**	-1.554**	-4.173**
3	87.98	97.80	96.87	89.71	-1.638**	-0.360**	-2.068**	-4.488**
4	87.84	97.77	96.70	89.38	-1.484**	-0.356**	-2.175**	-4.434**
High	88.22	97.74	97.39	90.55	-1.550**	-0.270**	-1.683**	-5.013**
H-L	*0.04*	*-0.23***	*-0.88***	*-1.75***				
Panel B: Dividend Amount								
Low	88.23	97.99	98.36	92.47	-2.069**	-0.275**	-1.005**	-3.375**
2	87.94	97.76	97.73	91.24	-1.949**	-0.362**	-1.462**	-3.821**
3	88.29	97.93	97.47	90.74	-1.764**	-0.375**	-1.660**	-4.425**
4	87.89	97.74	96.23	88.78	-1.503**	-0.322**	-2.522**	-4.875**
High	87.82	97.69	96.94	89.35	-1.578**	-0.324**	-1.973**	-5.241**
H-L	*-0.41**	*-0.30***	*-1.42***	*-3.11***				
Panel C: Market Cap								
Low	88.97	98.48	98.88	93.19	-2.069**	-0.210**	-0.687**	-3.193**
2	88.23	98.01	98.50	92.57	-2.071**	-0.366**	-1.068**	-3.746**
3	88.08	97.79	97.84	90.82	-1.809**	-0.385**	-1.446**	-4.399**
4	87.69	97.56	96.94	89.52	-1.620**	-0.406**	-1.996**	-4.661**
High	87.25	97.30	94.68	86.71	-1.324**	-0.288**	-3.346**	-5.636**
H-L	*-1.72***	*-1.18***	*-4.21***	*-6.48***				

Table 5
Dividend Prices and Characteristics: Australia

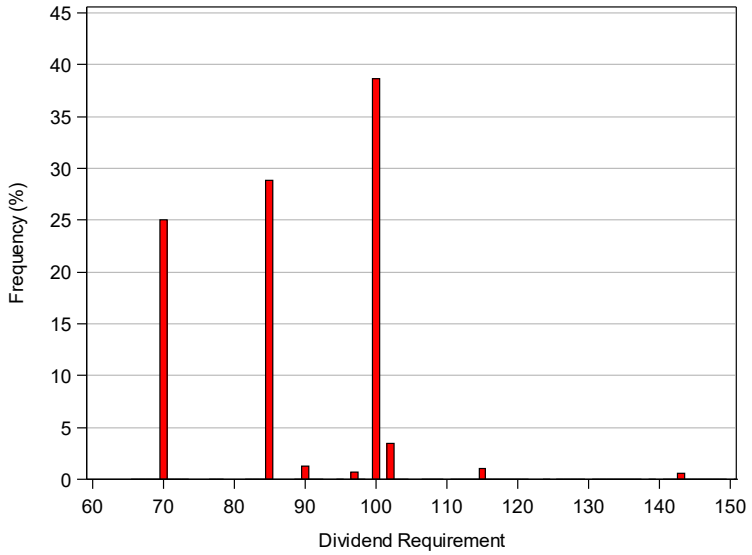
This table presents the dividend price for contracts held at the close on the cum-day across different stock characteristics. Stocks are sorted into quintile based on dividend yield, dividend amount, market cap and gross dividend yield. The gross dividend yield is the after-tax dividend yield that incorporates the face value of the franking credits. Stocks are sorted by franking level into full, partial and zero franking groups. Dividend prices are expressed as cents per dollar of cash dividend. Daily dividend prices are calculated by taking a weighted averaging across each stock for each day using either equal weighting, lendable quantity as a percent of shares outstanding (*Supply*), borrowed quantity as a percent of shares outstanding (*Demand*) or the percentage of available stock to borrow that is actually borrowed (*Utilization*). The abnormal dividend price is the difference between the dividend price and the dividend price averaged over t-45 to t-11 and t+11 to t+45. *H-L* is the difference between the average of the high and low portfolios. * and ** indicate statistical significance at 5% and 1%, respectively.

	Cum-Day				Abnormal			
	Equal	Supply	Demand	Utilization	Equal	Supply	Demand	Utilization
Panel A: Dividend Yield								
Low	108.60	106.07	104.47	105.41	-3.891**	-0.956**	-3.852**	-5.572**
2	112.64	107.94	106.41	107.88	-3.197**	-0.755**	-3.247**	-5.400**
3	110.47	108.19	105.69	106.82	-3.554**	-0.950**	-3.053**	-6.230**
4	110.12	107.72	106.11	106.86	-3.168**	-0.632*	-2.853**	-5.723**
High	114.74	111.13	110.95	112.61	-1.741**	-0.295	-2.601**	-4.723**
H-L	*6.14***	*5.06***	*6.47***	*7.20***				
Panel B: Dividend Amount								
Low	116.54	111.57	112.43	114.13	-2.100**	-0.586	-2.065**	-3.857**
2	112.37	109.19	108.54	110.29	-3.135**	-0.969**	-3.282**	-4.584**
3	112.33	108.30	105.57	106.66	-3.004**	-0.549*	-4.197**	-6.686**
4	109.35	106.86	104.09	104.64	-3.531**	-0.784*	-3.346**	-6.501**
High	105.87	105.17	102.85	103.92	-3.799**	-0.694**	-2.714**	-6.012**
H-L	*-10.66***	*-6.40***	*-9.58***	*-10.21***				
Panel C: Market Cap								
Low	119.67	113.22	115.94	115.73	-1.411*	-0.619	-2.505**	-2.107**
2	115.87	110.14	107.82	110.29	-1.524**	-0.168	-3.332**	-5.036**
3	110.68	108.05	104.45	105.43	-3.014**	-0.670*	-3.821**	-7.842**
4	105.74	105.51	102.60	104.15	-4.643**	-0.979**	-3.020**	-6.478**
High	104.71	104.47	102.96	104.49	-4.940**	-1.142**	-2.913**	-5.962**
H-L	*-14.97***	*-8.75***	*-12.98***	*-11.24***				
Panel D: Franking								
Zero	114.01	111.15	112.09	115.89	-2.073**	-0.074	-1.351**	-2.892**
Partial	107.07	105.68	102.64	101.90	-4.925**	-0.975*	-4.029**	-8.895**
Fully	110.60	107.01	104.41	104.48	-3.348**	-1.042**	-3.977**	-6.381**
H-L	*-3.41***	*-4.15***	*-7.68***	*-11.40***				
Panel E: Gross Dividend Yield								
Low	109.82	106.58	105.35	107.25	-3.616**	-0.832**	-3.583**	-5.249**
2	111.59	108.28	106.58	107.48	-2.946**	-0.396	-2.732**	-5.467**
3	110.22	108.10	106.02	106.95	-4.142**	-1.092**	-3.336**	-5.957**
4	110.51	107.18	105.76	106.83	-2.850**	-0.784*	-2.701**	-5.880**
High	114.44	110.94	109.93	111.11	-2.001**	-0.484	-3.260**	-5.091**
H-L	*4.62***	*4.36***	*4.57***	*3.86**				

Figure 1
Dividend Price Histogram from Securities Lending Contracts

These figures present the frequency that different dividend prices are observed as a percentage of the total number of observations. The histogram reflects dividend prices where borrowing was greater than zero on the ex-dividend day.

Panel A: US



Panel B: Australia

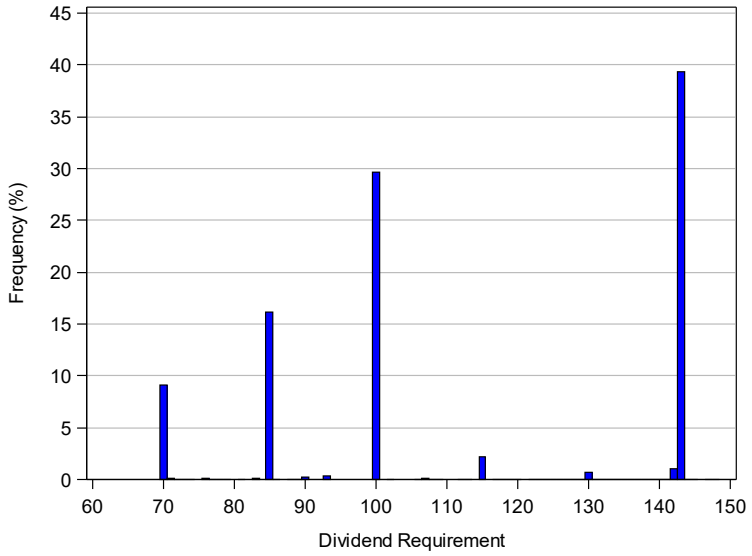
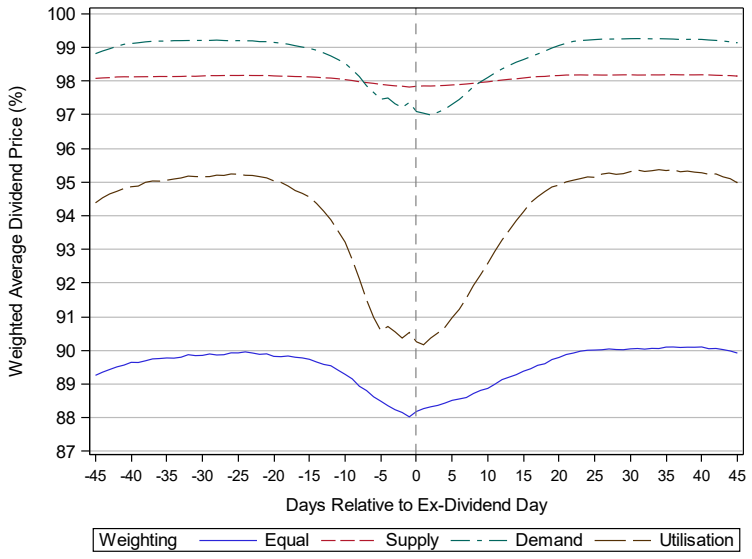


Figure 2
Dividend Prices around the Ex-Dividend Day

This figure presents the daily dividend price from t-45 to t+45, relative to the ex-dividend day (t=0). Values are expressed as cents per dollar of cash dividend. Daily dividend prices are calculated by taking a weighted averaging across each stock for each day using either equal weighting, lendable quantity as a percent of shares outstanding (*Supply*), borrowed quantity as a percent of shares outstanding (*Demand*) or the percentage of available stock to borrow that is actually borrowed (*Utilization*).

Panel A: US



Panel B: Australia

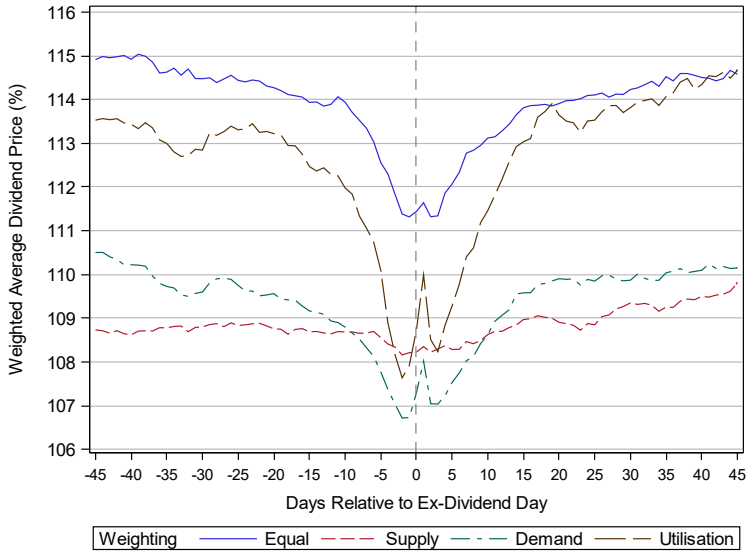
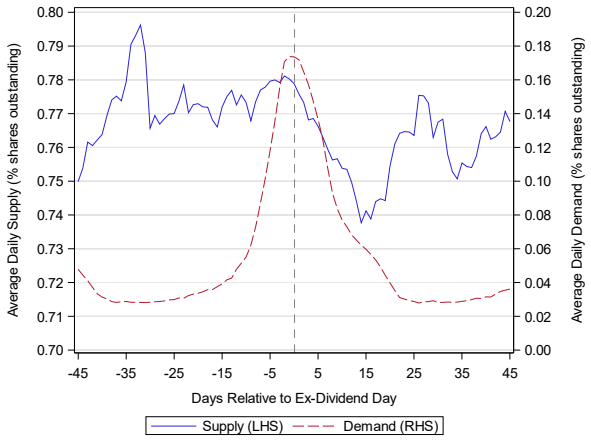


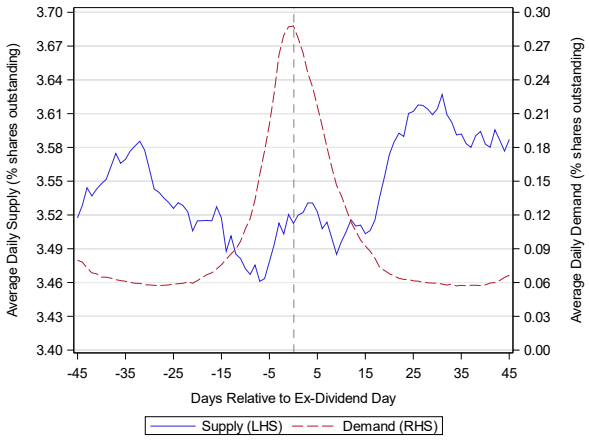
Figure 3
US Demand and Supply by Dividend Price around the Ex-Dividend Day

The figures present demand and supply for security lending around the ex-dividend date grouped by the most common dividend prices (70%, 85% and 100%). Event days are expressed relative to the ex-date (t = 0) from t = -45 to t = +45. Supply is measured as the lendable quantity as a percent of shares outstanding and demand is the borrowed quantity as a percent of shares outstanding.

Panel A: Dividend Price = 70%



Panel B: Dividend Price = 85%



Panel C: Dividend Price = 100%

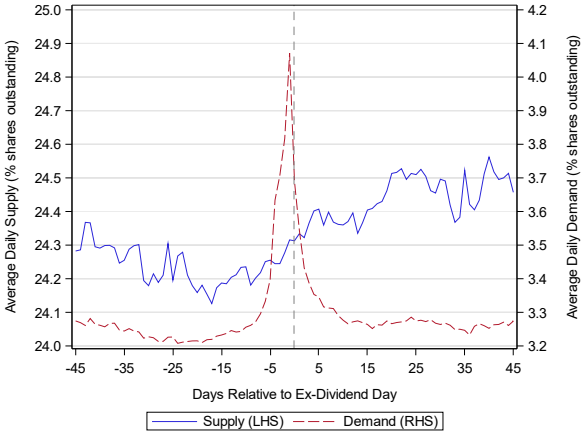
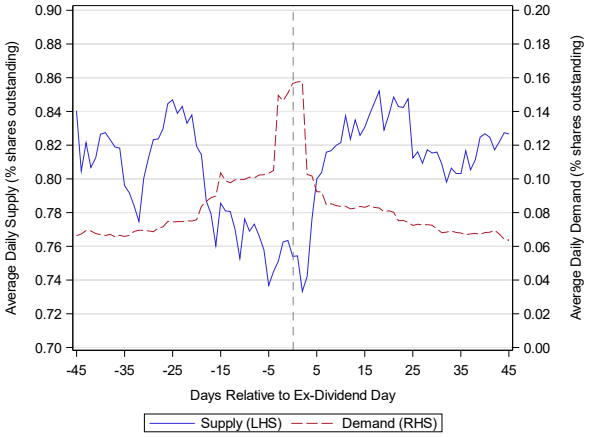


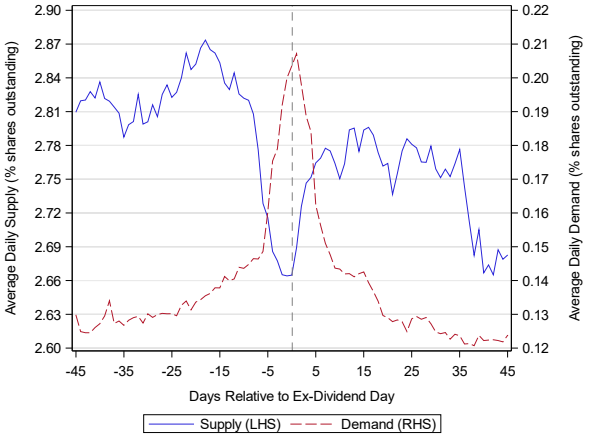
Figure 4
Australian Demand and Supply by Dividend Price around the Ex-Dividend Day

The figures present demand and supply for security lending around the ex-dividend date grouped by the most common dividend prices (70%, 85%, 100% and 142.86%). Event days are expressed relative to the ex-date (t = 0) from t = -45 to t = +45. Supply is measured as the lendable quantity as a percent of shares outstanding and demand is the borrowed quantity as a percent of shares outstanding.

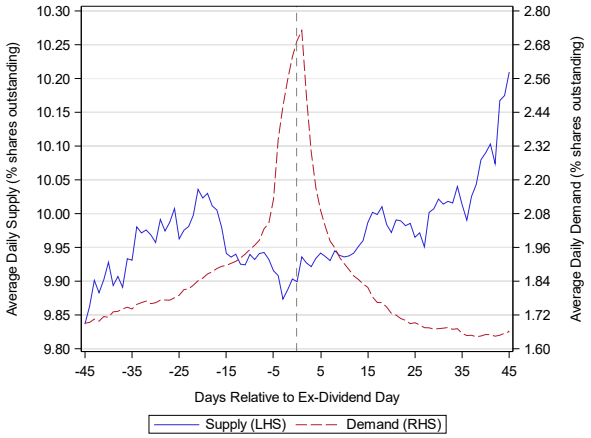
Panel A: Dividend Price = 70%



Panel B: Dividend Price = 85%



Panel C: Dividend Price = 100%



Panel D: Dividend Price = 142.86%

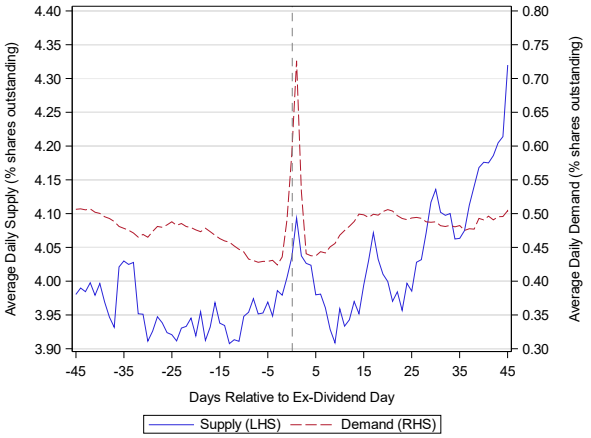
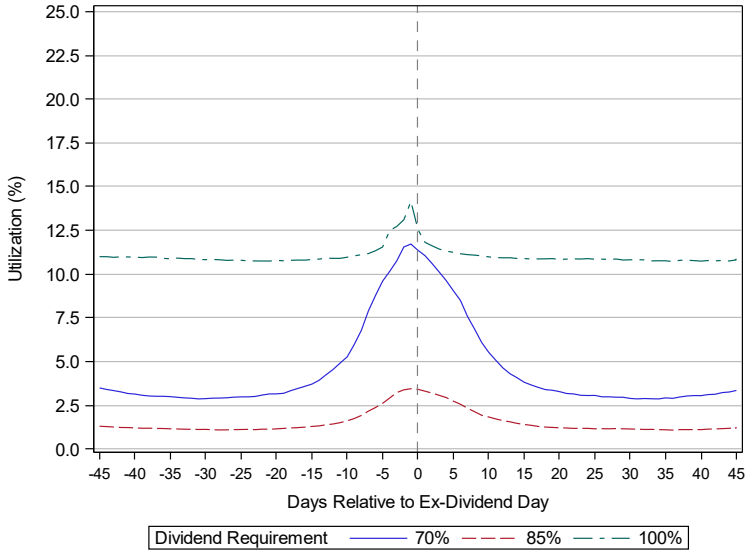


Figure 5
Utilization around the Ex-Dividend Day

The figures present the utilization of security lending around the ex-dividend date grouped by dividend prices. Utilization is calculated as the value of assets on loan from lenders divided by the value of stocks offered for loan. Event days are expressed relative to the ex-date (t = 0) from t = -45 to t = +45.

Panel A: US



Panel B: Australia

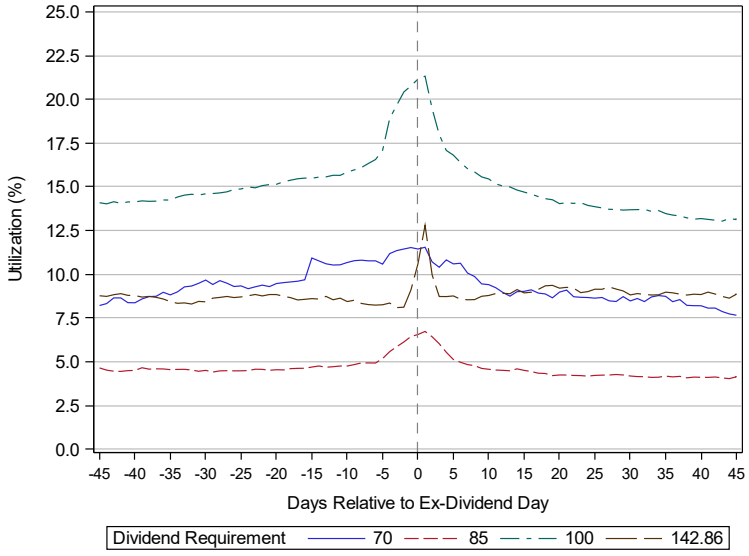
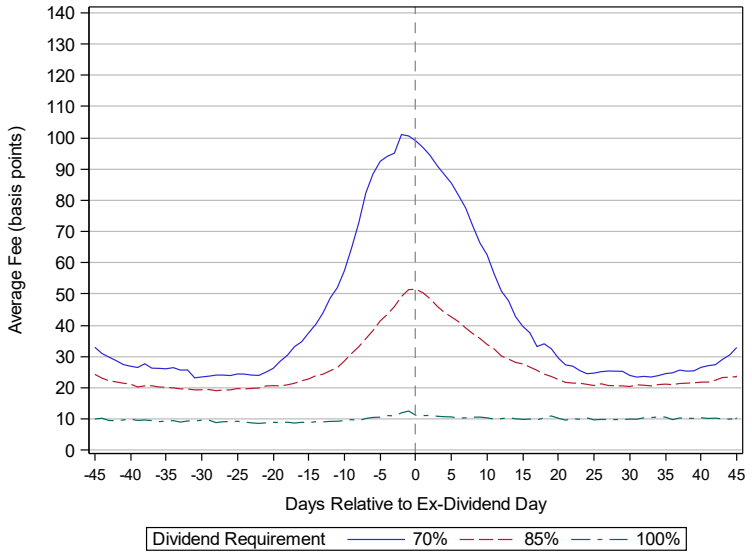


Figure 6
Average Daily Fees around the Ex-Dividend Day

The figures present the average fee in basis points for all outstanding contracts around the ex-dividend date grouped by the most common dividend prices. Event days are expressed relative to the ex-date (t = 0) from t = -45 to t = +45.

Panel A: US



Panel B: Australia

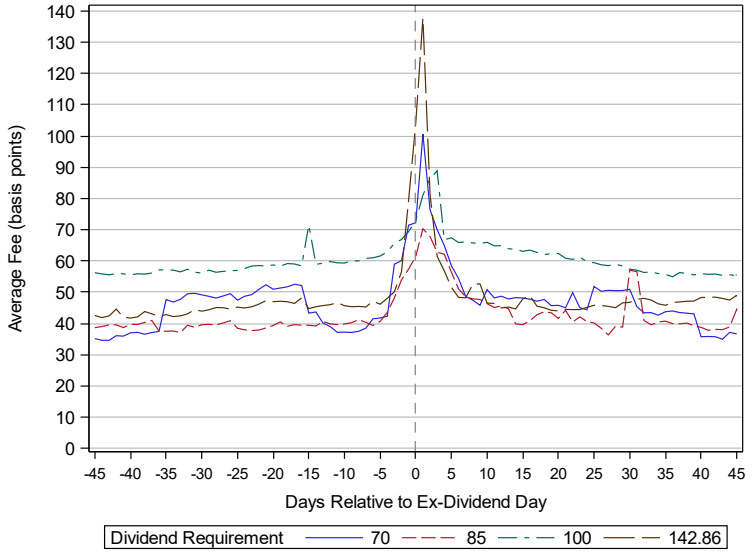
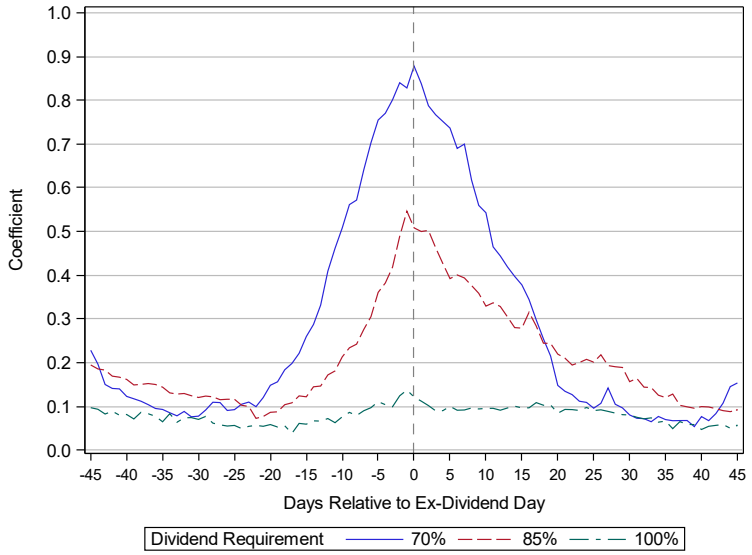


Figure 7
Fees, Yield and Dividend Prices

The figures present the coefficient from a cross-sectional regression of the daily security lending fee against the dividend yield around the ex-dividend date. The regression is estimated each day for each dividend price.

Panel A: US



Panel B: Australia