The Value of Dividends: Evidence from Short-Sales

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Abstract:

This paper examines the market values of dividends paid out from companies that are available to short-sell. This novel dataset provides a better estimate of dividend values as these are explicitly observable in the market through directly traded contracts whilst estimates from traditional ex-day studies are often complicated by noise. Other factors that might have an influence on the valuations are also considered. Consistent with the tax hypothesis, the tax status of market participants results in substantially different valuations when multiple prices can be transacted for the same security. These results hold under both a classical (US) and an imputation (Australia) tax system.

Keywords:
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The reported temporal and cross-sectional variation in valuations of dividends contributes to the discussion as to whether the value of a dollar of dividend is market priced at a premium or discount, which still largely remains unresolved.[1] The motivation of this paper is to improve the precision of valuation estimates of dividends. By utilising a new dataset in this study that explicitly details the agreed dividend values payable between two mutual parties, this may represent a market estimation of payouts that is less problematic than conventional ex-day studies. Order imbalances and adjustments to trading volumes influence price movements around the ex-date (Frank and Jagannathan, 1998). Price pressures around the ex-dividend day can also severely impact drop-off ratio metrics, such as the trading activities of retail and institutional investors trying to capture or avoid the impending dividend payment (Ainsworth *et al.*, 2009).

This study focuses on determining the valuations of dividends from a dataset that has not been previously studied – short-selling agreements. The repayable value of dividends and any associated franking rebates are explicitly stated in the legal contract between a lender and borrower. The market valuation of dividends can be ascertained from the agreed value of a dollar of dividends that needs to be repaid between the two counterparties if the securities are held short over the ex-dividend date as the lender still has legal ownership to the rights of the stock even though the short-seller may have already on-sold these shares on the market to a third party.

This paper will determine the market value of dividends using this novel dataset and then contrast this to other common approaches, which alternatively assesses the ex-date price change when a stock trades detached from the forthcoming dividend. The market values of dividends in two very distinct markets are determined – Australia,

[1] Refer to Eades *et al.* (1994) for a discussion of the time-series variation existing in dividend pricing.

which operates under an imputation tax system, and the US, which is characterised by a classical tax system. The differences in tax regimes allow a comparison of the effect this will have on the ex-day values that are derived.

This sample is highly granular with differing dividend requirements stipulated on a daily basis. This provides an alternative, and more precise, method of dividend valuation estimation than conventional studies that measure the stock price drop over the cum- to ex-dividend period or regression studies. Both of which can be highly variable and have been noted to be affected by different aspects, such as non-synchronous trading and event day clustering of observations (McKenzie and Partington, 2011). Thus, the limitations of these methods assessing shareholder-level dividend valuations can be circumvented.

If the lender does value the whole amount of the dividend, and any accompanying imputation credits, then they would require compensation from the borrower that is equal to or higher than the face value of the dividend. On the other hand, there may also be a counter competition effect as borrowers would prefer to enter into contracts which require them to be obligated to return the lowest amount and lenders may be willing to reduce their receivables, to an amount less than the face value, in order to successfully lend out stock to the market and also receive any short-selling fees in the process. Therefore, the taxation effects of any following cash flows to either party will have a strong influence on the repayable valuation.

The results are consistent with prior Australian and US studies where dividends are valued at greater than and less than their face values, respectively. However, there is much less variability in the estimates, which enhances the overall precision of these results. Valuations are consistent when partitioned based on dividend yield with a positive relationship with average repayable values. For Australian stocks that are

available to short, both lender and borrower are ascribing a positive value to the imputation credit even if it may not be fully utilisable by either party. Dividends paid out by US securities are constantly discounted by the market.

An immediate outcome from this study would be to gain a better understanding of the combined value of dividend payouts and any associated imputed tax benefits to the recipient. The valuations of these tax credits remain controversial; as such, a further application of these results is the use of these in corporate actions, such as capital budgeting decisions as well as in the chargeable prices of regulated industries. There has been more interest on securities lending and potential dividend-arbitrage trade in recent times of falling markets.

The remainder of this paper is structured as follows. Section I reviews the key literature on dividend valuations and taxation issues for both the Australian and US markets. Section II presents an overview of the securities lending market. Section III introduces the theoretical models applicable to this study. Section IV describes the sample data sources. Section V details the results of analyses and Section VI concludes the paper with a brief summary of the main findings.

I. Introduction

The price reaction of firms with and without an impending dividend attached has been the subject of numerous studies in an attempt to determine market valuations of dividends. Under the circumstances of a perfect capital market and an absence of taxes, the stock price reduction between the cum- and ex-date should be exactly equivalent to the face value of the distribution amount declared because this represents only a nominal transfer in nature of holding shareholder value in cash from dividends or

capital from retained earnings. However, the general observed response is that the ratio of the decline in the share price on the ex-dividend day as compared to the dividend per share, termed as the drop-off ratio, is usually less than the full amount of the dividend paid out on average. The argument stems from whether this price reduction on the ex-date is determined by short- or long-term market participants and also market frictions that may exist.

When dividends are subjected to taxation under a classical tax system and capital gains are tax advantaged relative to dividend income, the price decrease is documented to be less than the face value of the dividend per share, and thus, a positive abnormal return on the ex-day is detected. Elton and Gruber (1970) proposed that the existence of taxes do have an impact on investor choice and will affect the firm price near the ex-dividend date with a drop-off ratio less than one detected for firms paying out in a US setting. The tax clientele argument has been well-documented in many different markets and across time as well as with changes in tax regimes.[2]

The short-term trading hypothesis of Kalay (1982) suggests that in circumstances where the drop-off ratio is less than the full amount of the face value of the dividend, tax-neutral investors would attempt to acquire these abnormal returns whilst high/low tax investors would correspondingly avoid/capture the dividend. Therefore, the drop-off ratio at equilibrium should equate to one to prevent such activities. However, the actions of arbitrageurs who endeavour to dividend capture are restricted by ex-day price risk as well as transaction costs incurred in the process, and for this reason, prices cannot fully adjust by their face values (Kalay, 1982; Michaely, 1991).

[2] Some key papers testing the tax hypothesis in major markets – US: Michaely (1991); UK: Poterba and Summers (1984) and Japan: Hayashi and Jagannathan (1990).

Apart from the activities of short-term arbitrageurs and longer-term tax clienteles that may both be active around the ex-dividend date, a third feasible explanation is often suggested as well. Dubofsky (1992), Bali and Hite (1998) and Frank and Jagannathan (1998) propose market microstructure elements such as the bid-ask bounce, discreteness of tick sizes and adjustments to standing limit orders to explain the incomplete ex-dividend price drop without the need to evoke the tax argument. However, results by Graham *et al.* (2003) and Jakob and Ma (2004) refute microstructure explanations of ex-day price movements.

Prior empirical literature has attempted to determine the value of payouts and associated franking credits but their combined or discrete worth to market participants still remain indefinite. If the dividend has an imputation rebate attached, the price drop off could be larger than the distribution's face value implying that the value of the franking credit must be greater than zero. An interesting feature of Australian ex-day studies is the additional tax advantage of dividend income due to the existence of imputation tax credits to offset other assessable income sources. The introduction of the imputation taxation system on 1st July 1987 abolished the undesirable aspects of the classical system through the creation of a "franking credit" or "imputation rebate" to denote the tax already paid by the corporation on their earnings.[3] Australian resident investors and certain types of funds are entitled to a tax offset corresponding to the amount of franking credits attached to the distribution, which can substantially reduce or eliminate the tax liability on this and other income sources. Franking credits in excess

[3] Imputation rebates can also be essentially considered as a pre-payment of tax on the dividend income by the corporation on behalf of its investors.

of an individual's tax liabilities are refundable in cash.[4] Hence, the actual return on the dividend after company tax to an Australian investor is influenced by their own personal marginal tax rate.[5]

In distinct contrast, the US classical tax system requires company profits that are distributed as dividends to be subjected to taxation at both the corporation and shareholder level. Previously, differential taxation of income was also in existence with dividends at a disadvantage to capital gains and biasing specific clienteles to prefer one over the other.[6] There is also now a clear bifurcation of classifying dividends into ordinary dividends, which are taxable at the higher rate of an individual's ordinary income/short-term capital gains tax rate, or qualified dividends, which are taxed at the lower long-term capital gains tax rate.[7]

II. Securities Lending Market

Short sellers aim to extract profit from declining security prices when they are able to repurchase the security at a lower price to return to the lender. Proponents of securities lending state that this practice leads to price discovery and more efficient markets overall. Borrowers may be uninformed traders, mutual or hedge funds that are

[4] Since the company income tax rate is not aligned with the highest marginal tax level, it is possible that imputation credits are refunded in cash when there are insufficient tax liabilities to fully utilise these. This was one of the major reforms to business taxation resulting from the Ralph Review in 1999. Prior to this legislative change, surplus franking rebates were abandoned.

[5] The tax on the dividend payable by an individual can be represented by $(D/1\text{-}t_c)(t_d - t_c)$ 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, which, in Australia, is the same as the investor's marginal income tax rate.

[6] The Jobs and Growth Tax Relief Reconciliation Act of 2003 attempted to remove some of these aspects and normalised particular types of dividends to be taxed at the same rate as long-term capital gains. These dividends had to paid out by US domestic companies or qualifying foreign companies and investors had to satisfy holding periods prior to the ex-date to qualify for this reduction in tax.

[7] The highest tax rates on ordinary and qualified dividend tax rates were formerly 35% and 15%, respectively. From 2013 onwards, investors were subjected to higher rates of 39.6% and 20%.

not actively taking directional bets on asset prices but rather aim for exposure hedging or liquidity provision. Conversely, lenders may be motivated to offer securities in the market in order to earn incremental returns on securities already held in their portfolios or raise cash to invest in other assets.

Securities lending occurs when the transfer of stock ownership passes from the lender to the borrower, who may then sell these outright in the market or "on lend" to a third party. In return, the borrower must provide some collateral in the form of other securities, cash and/or a margin along with a shorting fee for the transaction. The realised profit for a borrower would be the variance between the buying and selling price of the underlying stock excluding any borrowing and transaction costs charged by the lender and/or broker. Since the title of the securities now resides with borrower, any economic benefits, including dividend payouts, would all flow to the borrower but the contract is structured so that the distribution amount is manufactured to be transferred back to the lender. If the shorted security is loaned over the ex-date then the borrower is liable for any forgone dividends of the lender; however, this need not necessarily be the face value of the distributed amount. The repayable value of dividends and associated franking rebates are explicitly stated in the legal contract between a lender and borrower. The market valuation of dividends can be determined from the agreed value of a dollar of dividends that needs to be repaid between the two counterparties if the securities are held short over the ex-dividend date.

Securities lending is organised in an over-the-counter arrangement where the market is less than transparent. The repayable values of dividends are established by the lenders making their securities on offer. The exact prices of dividends would be determined by the available contracts on offer by lenders at the time of the transaction.

Fragmentation of supply does exist such that it is likely that borrowers cannot simultaneously observe all prices on offer.

Another notable issue is the dividend arbitrage that often occurs in this market when investors exploit occasions where the stock price does not decrease by as much as the cash dividend paid out or if the cash receipts outweigh the dividend payable to the lender. This is a logical transaction if a tax differential is existent between lenders and borrowers, such that it is profitable to pursue this opportunity even on an after-tax and transaction costs basis. Lenders often react by increasing their lending fees to extract a proportion of the profits or restricting supply around the ex-dates. Thus, it is speculated that differences in tax rates applicable to various market participants result in varied valuations on dividends.

III. Theoretical models

The theoretical framework of Elton and Gruber (1970) is followed in an attempt to model the expected ex-distribution equilibrium for an "implicit" valuation. The condition without taxes and with the instantaneous action of borrowing securities, receiving dividends and then an instantaneous on-sale which would make investors indifferent to borrowing cum- or ex-dividend is given as:

$$Dividend\ component$$

$$= D(DVR)$$

$$= [P_{cum} - P_{ex}][1 - TC + (m)(i) - (m)(f)]$$

where D is the total face value amount of the cash dividend expected to be paid out on the payment date, DVR is the dividend valuation ratio stipulated in the contractual

agreement, P_{cum} is the price of the firm in the period preceding the loss of entitlements to the impending payout, P_{ex} is the price of the firm after it has gone ex-dividend, TC is the transaction costs of trading as a proxy for the spread and brokerage of buying/selling cum- and/or ex-, m is the margin posted by the borrower in return of securities to be lent, i is the interest rate on the margin collateral and f are the borrowing fees applicable on a transaction. $D(DVR)$ is the valuation of dividends by the market, $[P_{cum} - P_{ex}]$ represents the differential cost between purchasing the stock in the cum- and ex-period and related transaction costs and margins.

When taxes are involved then the transaction costs are tax deductible and any changes between P_{cum} and P_{ex} is also subjected to capital gain taxes on price appreciation. The equilibrium value of a dividend in a context with taxes applicable provides the after-tax value of dividends:

$$Dividend\ component$$

$$= D(DVR)$$

$$= [P_{cum} - P_{ex}][m + TC(1 - t_{ord}) + t_{CG} + [\big(m + (m)(i) - (m)(f)\big)(1 - t_{ord})]]$$

Investors with tax-liable incomes are more likely to appraise imputation rebates with positive values as they can be used to offset taxable obligations from other sources. At the same time, it is possible that if these imputation credits are not valued by the investor or are unable to be utilised, such as for non-domestic residents, then the short selling market may represent an avenue for them to recoup the face value and the value of any imputation credits if there is a restriction on trading franking credits rather than

letting franking credits expire unused.[8] Foreign investors in receipt of franked dividends from Australian companies will not be able to utilise the franking credits but could receive a tax offset on dividend income if their domiciled country has a Double Tax Avoidance Agreement with Australia. Hence, they are more likely to avoid the ex-date or on-loan stock to investors that can utilise these credits more effectively and structure a transaction to share in the benefits together.

IV. Sample Selection and Data Compilation

The Data Explorers database records the long and short daily trade flows as well as short-selling activity of over 20,000 international bond and equity securities. Transaction data is aggregated on a daily level and provides detailed information on lendable values, fee chargeable and amounts actively being borrowed per security; though no details of the individual counterparties to each contract are directly identifiable. It is possible to determine the positive and negative market sentiment for each instrument in different markets. The dividend requirement is taken as the value stipulated in the contractual agreement between the borrower and lender if the stock is lent over the ex-date. This amount would need to be repaid by the borrower to compensate the lender of the dividend receipts that they did not receive as a consequence of loaning the stock to them. There are multiple supply values of dividend requirements in the market for each stock and the valuation can be determined as the market clearing price where there is both demand and supply available.

[8] Previously, other potential lenders may have included non-taxable Australian residents and investors with taxable incomes that could not be reduced further with franking credits, however, with the legislative change in 1999 where excess franking credits are receivable as cash, they are less incentivised to sell their unutilised imputation rebates to others.

Information on prices at the cum- and ex-dates and level of franking attached to dividends are obtained from Securities Industry Research Centre of Asia-Pacific (SIRCA) and Bloomberg, which are valued in their home currency. The relevant tickers and SEDOL identifiers for Australian and US stocks are obtained from Thompson Reuters DataStream and The Center for Research in Security Prices (CRSP) database.

The initial Australian and US sample consists of all securities that have been made available for lending to market participants over the period 1st July 2006 to 30th June 2011, which avoids any tax code changes that may have impacted on investor behaviour and valuations. The firms must have the Australian Securities Exchange or New York Stock Exchange as their primary listing. However, the US sample is restricted to lendable stocks that are a constituent of the S&P500 index over the same time period, which is the most commonly utilised benchmark for US fund managers. A total of 1594 (Australian) and 567 (US) unique firms are identified.

The firms contained in the Data Explorers database do not have associated dividend payout information, such as face values and franking levels, and thus, these need to be merged with data from other sources. For observations where these could not be matched, they are omitted from further analysis. Likewise, firms where there is no price data on the cum- or ex-date are also excluded. Observations where the settlement date falls on a non-trading date of the ASX or NYSE are also removed.[9] The dividend events studied are only those classed as interim or final. The final combined sample contains 1655 firms with 88 different dividend requirement for a total of over 3.8 million daily observations on short-sales and dividend conditions with varying levels of franking spanning the five year sample.

[9] No statistical difference on results is noted with non-trading dates omitted for all analyses. The trade date is when the value of the dividend requirement is determined and the settlement date is when the contract is enforced.

V. Results

a. Dividend Valuations from Short-selling Contracts

The frequencies of the dividend amount required by lenders for all Australian and US stocks are shown in Figures 1a and 1b, respectively. The four dominating prices in the Australian sample corresponds to differing tax clienteles that may be present in this market. A price of 70 cents per dollar of dividend is an outcome of the tax incurred for foreign investors located in domiciles facing a 30% withholding tax on normal unfranked dividends. For foreign investors from countries with a double tax agreement with Australia then any received dividend income is taxed at a reduced rate of 15%, which results in a dividend valuation of 85 cents. The 100% dividend requirement is applicable to circumstances where there are no withholding taxes on dividends for some special classes of investors and also for dividends that are distributed fully franked to international investors. The 142.86 class corresponds to a domestic investor that fully prices the face value of the dividend paid out and any associated imputed tax credits.[10]

For the US sample, the dividend requirement at 142.86 is less pronounced though there are lenders that still demand this price. Interestingly, these observations cannot be attributable to stocks and their related American Depository Receipts. The most common price is 100 cents per dollar as under domestic IRS tax code any loan of stock that is recallable and where dividends are fully reimbursed back to the lender at

[10] The price drop-off per dollar of distribution and its associated franking credits should theoretically amount to $1.4286 with a corporate tax rate of 30% as for an Australian investor, who is taxed equally on both dividend and capital gain income, the ratio simplifies into $1/(1-t_c)$. This is equivalent to valuing the dividend at its face value in additional to the face value of the franking credit.

face value will not be considered an exchange with capital gains taxation implications for either party.[11]

This suggests that lenders offering securities set the dividend requirement by reconstructing their position as if they were to have received the dividend themselves. This implies the "cost" of loaning out stock over the ex-dividend date would only be the after-tax value of the dividend that they have had to forego. However, this ignores any ex-day price effects that the lender might have incurred from holding the underlying stocks, which is not parsimonious with the seminal results of Elton and Gruber (1970).[12] There might be a rational explanation for this issue as some types of transactions are only considered a transfer of securities rather than as an outright sale and purchase transaction for tax purposes; hence no capital gains/losses are incurred in the process and the drop-off is a less material issue.

The descriptive statistics of the dividend requirements under different circumstances are presented in Table 1a and 1b (Panel A) and are all statistically different from 100 cents per dollar (face value). Market valuations of dividends can be ascertained under three different circumstances: all contracts for inventory available to short, contracts that have both counterparties and are currently utilised as well as those agreements which are held over the ex-dividend day, and hence, are actually liable for the dividend payment. Multiple prices may be available for the same stock at identical times provided by various lenders; thus, averages will provide a mean market valuation

[11] Refer to Section 1 058 of the Internal Revenue Code.

[12] The borrower also faces ex-day price uncertainty in cases where the dividend requirement is higher than the price fall over the cum- to ex-period. For instance in the US where it is common to return the full dollar amount of the dividend to qualify as a non-taxable loan, a stock which has an incomplete price drop of 70 cents denotes that the borrower would suffer a 30 cents loss over the ex-date in addition to shorting fees and commissions that are payable. Refer to Graham (2003) for a survey of prior literature on the prevalence of an incomplete price drop.

as well as reduce the volatility and variability in results, which is consistent with the method used in conventional drop-off ratio analyses.

The average valuation is 116.88 cents for all contracts offered on stocks from the Australian market, which may represent what lenders are intending to receive for the forgone dollar of dividends. The utilisation rate of all contracts is 69.2% since not all stocks which are offered for lending may have ample borrower interest; thus, 109.71 may be interpreted as the average mutually agreed clearing price between lenders and borrowers. For stocks that have open short interest over the ex-day, then the covenanted repayment amount drops down to 106.60. These results, where market values are significantly greater than their face value, are consistent with Walker and Partington (1999), with a positive worth ascribed to the imputation tax rebate.

For the US sample, their mean valuations are significantly not equivalent to a dollar of face value, which is in accordance with prior literature on drop-off ratios of US stocks that price it at a discount to face value. There is a higher utilisation rate on US stocks with over 91.1% of all available contracts on offer over this period taken up by borrowers. Again, it is possible to segment the dividend valuations into three different contexts: an average offer price (89.15 cents), a contingent price that will only be realised if securities are shorted over the ex-date (88.94 cents) and also an actual transaction price over the ex-day (87.38 cents). These results of a discounting in market values to face value are robust irrespective of the circumstances under which they are determined. In particular for each market, the marginal transaction appears to be consistent with pricing a dollar of dividend according to the valuations of a domestic investor.

Temporal variations are also analysed in Table 1a and 1b (Panel B) to observe whether there may have been a change in investor sentiment over the Global Financial

Crisis since traders may be motivated to borrow stocks during bearish activity and place less consideration into the dividend requirement if they are able to generate higher returns from shorting strategies. It should be noted that a short-selling ban was sanctioned by ASIC for Australian securities from late 2008 to mid-2009.[13] This may have attributed to the significant drop in availability of Australian securities for shorting in 2009 as compared to prior periods; yet, dividend requirements do not seem to be affected as a result of this and are all still statistically significant.

The short-selling contracts which are active over the ex-day are further partitioned into different categories based on dividend yields and also the franking status of Australian dividends to investigate whether the dividend requirement are influenced by each of these characteristics. Table 2 summarises the univariate statistics for the sub-samples. There is an observable gradual increase in the amount payable as dividend yield escalates for both the Australian and US samples. All classifications of Australian stocks have average valuations greater than the face value of the dividend but with some lenders willing to receive 70 cents in return, consistent with long-term investors valuing dividends that are received unfranked, whilst others are collecting 143 cents, which represents the grossed up equilibrium value of a fully-franked dividend. Similarly, this positive relationship between yield and dividend requirement is noted for US stocks but with only a more modest increase between groupings. These results are in accord with prior studies, which have been recognised since Elton and Gruber (1970) who find a positive association between dividend yields and drop-off ratios though Boyd and Jagannathan (1994) propose a non-linear relationship between these two

[13] The Australian and Securities Investment Commission placed a restriction on both naked and covered short selling of securities on 21st September 2008 given the volatile market conditions experienced around that time. Approximately two months later, the ban on covered short-selling of non-financial securities was removed for market participants. On 25th May 2009, the limitation on covered short selling of financial securities was also revoked.

variables as diverse investor classes preferentially favour different dividend yields and trade accordingly.

For the Australian sub-samples separated according to franking percentages, there is an inverse association with the dividend requirements, though again all repayable amounts are statistically greater than their face values. The unfranked dividends are actually priced the highest by the market and more so than fully franked dividends paid on the underlying stock. However, this relationship is in direct contrast to former Australian evidence. Walker and Partington (1999) suggest that franking credits are valuable for an investor as the market worth of a fully franked dividend is larger than its face value even net of any transaction costs. Hathaway and Officer (2004) find that franking credits are positively valued by the market but that on average 30% of these are withheld from shareholders by Australian firms. Studies by Bellamy (1994) record a clear relationship for the franking proportion. It examines drop-off ratios of firms paying franked and unfranked dividends and detects a significantly higher price reduction for the former, though both significantly less than one reflecting dividends that are not being fully valued by the market. A possible explanation for this result disparity could arise from institutional differences between equity markets as compared to the short-selling market, such as the nature of competition. Lenders that have sufficient supply may be prepared to lessen their dividend requirements in order to successfully offer their stock out and at least re-coup the shorting fees and interest chargeable on the borrower.

b. Other Influences on The Market Value of Dividends

Fees payable is a potential factor that has an influence on the dividend valuations as both represent income return for the lender. An inverse relationship would be expected as a lower dividend requirement could be compensated by a higher fee

charged on the borrower. The clustering of data into prominent groupings make regressions to analyse this potential relationship problematic; hence, an analysis of variance (ANOVA) is undertaken for the most common categories to observe whether there is a difference in the means of the value-weighted average fees across the groupings.[14] Tests for differences between groups show that all are statistically different from each other.

For the Australian sample presented in Table 3a, the highest fees are required by borrowers requiring 100 cents for a dollar of dividends. There is a reversal of the franking effect with an increased fee required as dividends are paid out with higher franking proportions attached. Discussion with market practitioners relates this association of an increasing fee percentage for highly franked dividends on Australian stocks as a method to share dividend arbitrage profits with the borrower.[15] Borrowed stocks with high fees, as with the fully-franked dividends, are termed as "on special" in practice. For the US data presented in Table 3b, the mean fee required is lower as the dividend requirement set by borrowers is increased, consistent with our initial expectations. It is also noticeable in the dataset that there is a marked escalation in fees charged by lenders close to the ex-date, potentially suggesting the extraction of potential gains by them. Gallagher *et al.* (2013) also find evidence that the average lending fee spikes up over the ex-day on ASX200 stocks around the same time period as this study.

[14] Results are reported for observations on the full sample of Australian and US stock. Analysis of contracts held over the ex-date yield similar results.

[15] Cross-border dividend arbitrage may occur when the lender cannot utilise the imputation credits or is subjected to higher taxation rates. Securities lending facilitates exchange with borrowers that can use the franking rebates more effectively or are in lower taxation regimes to divide the gains from the transaction between both parties.

c. Dividend Valuations from Traditional Ex-day Analyses

A matched-sample comparison is made between the valuations of dividends from short-sales contracts to alternative but commonly employed methods on the identical set of events. The descriptive statistics of the dividend characteristics and ex-dividend day variables are displayed in Table 4 (Panel A) for the 1 733 Australian ex-dividend events and Table 5 (Panel A) for the 4 725 US ex-date events spanning the five year period. The drop-off ratio is calculated using the traditional Elton and Gruber (1970) method of the price decline over the cum- to ex-dates normalised by the size of the payout for a direct comparison to the valuations obtained using the short-selling data. For the Australian sample, the mean values are both significantly different from a dollar of face value and indicates that the relevant dividends are in fact discounted by the market instead of being fully valued as with the short-sales valuations. An incomplete price drop is identified for the US sample, which is uniform with the short-selling data. However, these values might be skewed by the presence of firms with zero price movement over the cum-ex period, which makes up approximately 10% of the total ex-day sample for Australian observations and 2% of the US data. McKenzie and Partington (2011) contend that non-synchronous trading confounds the dividend signal as the next price is a combination of old information and dividend value which is then impounded together in the subsequent trade. When cases with stale prices are excluded, the ratios are slightly higher but both still strongly signifying that dividends are only partially valued. The authors also recommend the measurement of dividend value utilising various price points to validate the robustness of the conclusions. The choice

between the use of either cum-close to ex-open or cum-close to ex-close prices is shown to not substantially alter these conclusions in the current datasets.[16]

It is also worth noting that drop-off ratio studies are commonly known to be affected by negative values in the absence of any value-changing event, which is theoretically counterintuitive as shareholder value being transformed into dividends that are paid out should have a positive worth for investors. Even in the current dataset, the range of drop-off ratios fluctuates from -25.00 to +11.59 for Australian stocks and -53.89 to +29.10 for US stocks. Therefore, a clear potential benefit from deriving valuations from contractual agreements is the ability to circumvent the problem with non-positive values. Furthermore, the observed standard deviation of the drop-off ratios is larger than the dispersion of the average valuation for any short-selling contract, which exposes the variability in drop-off studies and the potential of enhanced precision with valuations employing this new dataset.

The drop-off ratio sample is then sub-partitioned according to dividend yield classes and also franking status to facilitate comparison with the short-selling data, which is presented in Tables 4a and 4b (Panel B).[17] There is a monotonic increase in the mean drop-off ratio as dividend yields escalate and with both distributions showing a negative skew. The highest categories (>3%) for Australian stocks are statistically insignificant from one and dividends are being valued at their face values. US stocks are more concentrated at lower dividend yields and with all averages less than face value. The fully franked dividends have an average drop-off ratio that is priced at a discount to face value but which are valued higher than dividends that are partially and unfranked

[16] Since it has been previously reported that measures where adjustments are made to prices for systematic market-wide movements between the cum-ex period provide statistically similar drop-off ratios, these are not reported within this paper.

[17] Only the results for drop-off ratios computed using close-to-close prices without stale prices are reported as the other potential variants do not alter the obtained conclusions. Close-to-close prices are chosen to be consistent with the majority of reported ex-day studies.

dividends, suggesting that the imputation rebate has some value for investors even if it is not totally valued. The median and mode of fully imputed dividends are both equal to one. Bellamy (1994) examined drop-off ratios of firms paying franked and unfranked dividends and detects a significantly higher price reduction for the former, though both significantly less than one reflecting dividends that are not being fully valued by the market. Beggs and Skeels (2006) claims cash drop-off ratios of approximately one post-imputation but franking credit values of less than one.

The other common approach in prior literature for estimating market values of dividends is to utilise regression analyses. The framework of Boyd and Jagannathan (1994) is followed in an attempt to model the drop-off ratio under a different methodology. This is given by:

$$\frac{P_{cum} - P_{ex}}{P_{cum}} = \alpha + \beta \frac{Div}{P_{cum}} + \varepsilon$$

where the resultant slope (β) of the dividend yield variable represents the drop-off ratio.

The dividend valuations are estimated using ordinary least squares method but with robust variance estimates to address issues with heterogeneity of variance. Results presented Table 5a for Australian stocks are lower than those analysing the price drop and considerably less than those from contractual agreements, whereby all coefficients are reflecting valuations priced at a discount. The removal of stocks with non-synchronous trading provides a better fit of the model but only marginally increases the estimates when close-to-close prices are considered. Instead, the use of close-to-open prices is more sensitive to stale prices as there is a more prominent escalation of the coefficient from 0.390 to 0.477. The obtained results are similar in range to those previously measured in other Australian studies (Brown and Clarke, 1993; Beggs and Skeels, 2006).

A test of the robustness of these models to potential downward bias arising from the presence of outliers, which is often prevalent in ex-day studies, is also attempted by re-weighing observations based on the amount of their deviation. Robust regressions consistently produce higher dividend valuations for the Australian sample and which are more similar in magnitude to those obtained from the dividend requirements in the short-selling dataset. Drop-off ratios range between 0.90 to 1.04, which is reflective of dividends that are close to or fully valued by the market. Moreover, measurements using close-to-close prices appear to impound the extra value provided in the franking credits.

Across all regressions for US stocks in Table 5b, the slope estimate coefficients are significantly different from one and valued at a discount. The OLS estimates with robust standard errors are again all lower than the robust regression estimates though more alike to the drop-off ratios. By using robust regressions, the valuations all increase with the most marked improvement from 0.52 to 0.85 per dollar of dividend using close-to-close prices. This suggests the presence of severe outliers in the distribution. The coefficients range between 0.69 to 0.85 with none being priced at the face amount and are similar to the valuations determined from the short-selling contracts.

VI. Conclusion

The results using this unique dataset suggest that market participants consistently value dividends and imputation tax rebates at amounts greater than (Australian stocks) and less than (US stocks) its face value with evidence that valuations increase with higher dividend yields. This implies that franking credits are positively valued by the market though not at their full implicit worth. Using traditional ex-day analysis methods revealed that dividends can be concluded to be both partially and fully

valued based on the same ex-date event set. Different robustness checks by changing the time of the price measurement (open/close) and model specification (OLS/robust regressions) seemed to make the conclusions more inconsistent. This highlights the variable nature of dividend estimates and may be one of the contributing factors giving rise to the mixed evidence presented in prior literature. In this paper, the average valuation of dividends is determined across a much broader cross-section of Australian and US securities with higher precision using what can be considered to be actual transacted prices. Ex-dividend day studies can only infer the value from price movements and estimates are most often noisy; hence, this market provides a method of ascertaining the prices paid for a dollar of dividend that are observable in a contract price. Valuation of dividends using short-selling contractual agreements allows for a direct measurement of the face value and also any associated tax credits.

As multiple prices for dividends may exist simultaneously in the market, these valuations are suggested to be driven by different tax clienteles whereby the short-selling market only represents an avenue for some investors to recoup the face value and any imputation credits which they would not have received if the stocks were directly owned. Multiple marginal investors may exist in this market as there is not a single clearing dividend requirement in a market characterised by lower price transparency and with higher search costs. The tax status of different market participants plays an important role in their valuations as clienteles could value the same dollar of dividends differently. Various parties could be transacting at different prices; hence multiple prices can exist in the same time period for identical securities that are borrowed. However, the results are consistent with dividends being valued by a domestic investor in both the Australian and US markets.

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Figure 1a

Frequency of Dividend Requirements for All Available Contracts on Australian Stocks

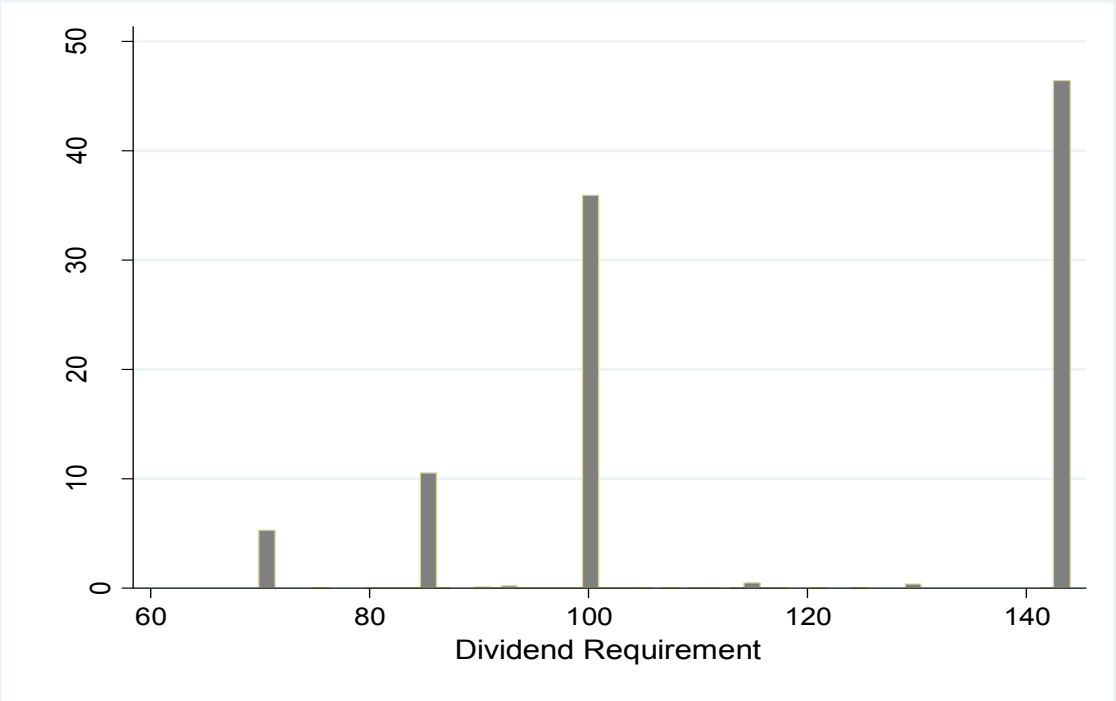

Figure 1b

Frequency of Dividend Requirements for All Available Contracts on US Stocks

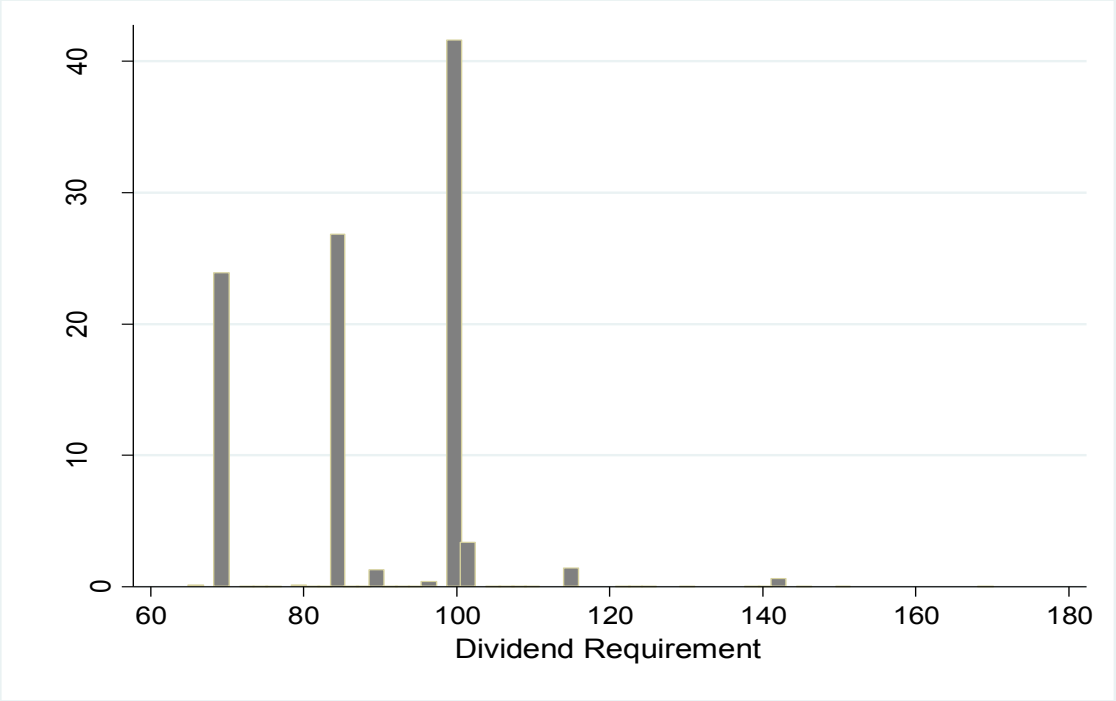

Table 1a

Summary Statistics of Dividend Requirements for Contracts on Australian Stocks

Values expressed as cents per dollar of cash dividend.

	N	Mean	Median	Mode	SD	Min	Max
Panel A: Descriptive statistics of dividend requirements for total sample							
All Available Contracts	1 012 488	116.88***	100.00	100.00	25.26	70.00	157.86
Actively Utilised Contracts	700 336	109.71***	100.00	100.00	24.04	70.00	150.00
Contracts Open Over the Ex-date	3 186	106.60***	100.00	100.00	24.81	70.00	143.00
Panel B: Descriptive statistics of dividend requirements for sample partitioned based on year							
2006							
All Available Contracts	106 774	121.93***	142.85	100.00	25.14	70.00	157.85
Actively Utilised Contracts	35 455	103.55***	100.00	100.00	21.62	70.00	143.00
Contracts Open Over the Ex- date	160	96.69**	100.00	100.00	19.17	70.00	143.00
2007							
All Available Contracts	261 225	120.63***	142.50	100.00	24.93	70.00	157.86
Actively Utilised Contracts	147 260	108.56***	100.00	100.00	23.85	70.00	142.86
Contracts Open Over the Ex-date	672	105.13***	100.00	100.00	24.16	70.00	142.86
2008							
All Available Contracts	223 851	114.63***	100.00	100.00	25.60	70.00	150.00
Actively Utilised Contracts	175 854	110.31***	100.00	100.00	24.98	70.00	150.00
Contracts Open Over the Ex-date	796	108.13***	100.00	100.00	25.48	70.00	142.86
2009							
All Available Contracts	144 022	111.93***	100.00	100.00	25.04	70.00	150.00
Actively Utilised Contracts	123 455	110.27***	100.00	100.00	24.34	70.00	150.00
Contracts Open Over the Ex-date	561	107.42***	100.00	142.86	25.37	70.00	142.86
2010							
All Available Contracts	173 792	115.10***	100.00	100.00	24.84	70.00	143.00
Actively Utilised Contracts	140 497	110.82***	100.00	100.00	23.88	70.00	142.86
Contracts Open Over the Ex-date	637	106.98***	100.00	100.00	24.94	70.00	142.86
2011							
All Available Contracts	102 824	116.90***	100.00	100.00	24.09	70.00	148.85
Actively Utilised Contracts	77 815	110.43***	100.00	100.00	22.59	70.00	142.86
Contracts Open Over the Ex-date	360	108.42***	100.00	100.00	24.62	70.00	142.86

** Statistically significant at the 5% level. *** Statistically significant at the 1% level.

Table 1b

Summary Statistics of Dividend Requirements for Contracts on US Stock

Values expressed as cents per dollar of cash dividend.

	N	Mean	Median	Mode	SD	Min	Max
Panel A: Descriptive statistics of dividend requirements for total sample							
All Available Contracts	1 747 624	89.15***	85.00	100.00	13.36	65.00	170.00
Actively Utilised Contracts	1 591 497	88.94***	85.00	100.00	13.15	65.00	142.86
Contracts Open Over the Ex-date	19 375	87.38***	85.00	100.00	12.51	65.00	142.86
Panel B: Descriptive statistics of dividend requirements for sample partitioned based on year							
2006							
All Available Contracts	170 178	89.57***	100.00	100.00	15.38	65.00	170.00
Actively Utilised Contracts	131 597	89.92***	100.00	100.00	15.63	65.00	142.86
Contracts Open Over the Ex- date	2 196	85.83***	85.00	100.00	13.12	70.00	142.86
2007							
All Available Contracts	413 100	89.46***	97.00	100.00	15.22	65.00	150.00
Actively Utilised Contracts	357 746	88.47***	90.00	100.00	15.23	65.00	142.86
Contracts Open Over the Ex-date	4 812	86.51***	85.00	100.00	13.11	70.00	142.86
2008							
All Available Contracts	365 164	89.21***	85.00	100.00	13.23	65.00	150.00
Actively Utilised Contracts	333 543	88.75***	85.00	100.00	12.93	65.00	142.86
Contracts Open Over the Ex-date	4 020	86.86***	85.00	100.00	12.64	70.00	142.86
2009							
All Available Contracts	378 318	87.12***	85.00	100.00	12.47	65.00	130.00
Actively Utilised Contracts	371 028	86.99***	85.00	100.00	12.25	65.00	130.00
Contracts Open Over the Ex-date	3 997	86.29***	85.00	100.00	12.16	65.00	100.00
2010							
All Available Contracts	311 388	89.45***	85.00	100.00	11.25	65.00	130.00
Actively Utilised Contracts	297 140	89.38***	85.00	100.00	10.95	65.00	115.00
Contracts Open Over the Ex-date	3 254	89.14***	85.00	100.00	11.48	65.00	115.00
2011							
All Available Contracts	109 476	93.37***	100.00	100.00	9.64	65.00	115.00
Actively Utilised Contracts	100 443	94.46***	100.00	100.00	8.97	65.00	115.00
Contracts Open Over the Ex-date	1 096	95.04***	100.00	100.00	8.43	70.00	115.00

*** Statistically significant at the 1% level.

Table 2

Dividend Requirements for Contracts with Active Utilisation Carried Over The Ex-Dividend Date

Values expressed as cents per dollar of cash dividend.

	Australia				*US*			
	N	**Mean**	**Min**	**Max**	**N**	**Mean**	**Min**	**Max**
Contracts Open Over the Ex-date	3 186	106.60**	70.00	143.00	19 375	87.38***	65.00	142.86
Dividend Yield								
0 – 1%	288	105.28***	70.00	143.00	15 716	87.36***	65.00	142.86
>1 – 2%	1 151	106.48***	70.00	143.00	3 130	87.50***	70.00	142.86
>2 – 3%	1 002	107.70***	70.00	143.00	315	87.07***	70.00	142.86
>3 – 4%	462	108.45***	70.00	143.00	56	88.16***	70.00	100.00
>4%	283	112.07***	70.00	143.00	158	88.24***	70.00	142.86
Franking Level								
Fully Franked (100%)	1 982	107.52***	70.00	143.00				
Partially Franked	430	104.45***	70.00	143.00				
Unfranked (0%)	774	111.69***	70.00	143.00				

*** Statistically significant at the 1% level.

Table 3a

Fees Payable on Australian Stock

Fees payable expressed in basis points of the total transaction value borrowed.

Panel A: Fees payable for all available contracts on Australian stock

Australia	N	Mean	Median	Mode	SD	Min	Max
All Available Contracts	1 012 488	82.50	33.10	25.00	94.22	0.01	595.23

	Fee Charged	
Dividend Requirements	**Mean**	**SD**
70	44.76	24.71
85	50.75	24.86
100	113.93	67.25
142.86	70.22	25.63
Total	82.50	33.10

Panel B: Fees payable for contracts with active utilisation carried over the ex-dividend date partitioned based on franking status.

	Unfranked (n = 774)		*Partially Franked (n = 430)*		*Fully Franked (n = 1 982)*	
	Mean	***SD***	***Mean***	***SD***	***Mean***	***SD***
70	30.45	44.76	42.87	56.45	44.53	55.09
85	44.42	50.75	49.74	62.31	50.47	58.79
100	63.77	113.93	102.96	99.78	118.75	105.57
142.86	51.48	70.22	69.44	82.09	78.73	88.43
Total	52.37	82.50	75.78	87.12	86.54	93.57

Table 3b

Fees Payable on US Stock

Fees payable expressed in basis points of the total transaction value borrowed.

Panel A: Fees payable for all available contracts on US stock

US	N	Mean	Median	Mode	SD	Min	Max
All Available Contracts	1 747 624	24.05	10.39	10.03	43.85	0.01	430.52

	Fee Charged	
Dividend Requirements	**Mean**	**SD**
70	40.25	62.48
85	25.42	36.58
100	12.47	27.61
Total	24.05	43.85

Table 4a

Summary Statistics of Traditional Drop-off Ratio Studies on Australian Stocks

The ex-day variables of dividend events where there is matching short interest for that security. The total sample size is 1 733 over the period July 2006 to June 2011. Drop-off ratios are calculated as the difference between the cum-price and ex-price scaled by the cash amount of the distribution using cum-close as well as ex-open and ex-close prices. Dividend and $price_{cum}$ are expressed in Australian dollars. Dividend yield is computed as the face value of the dividend as a proportion of cum-close price and are expressed as a percentage. The significance level is a test evaluating H_0: Mean = 1.

Panel A: Full Sample							
	N	**Mean**	**Median**	**Mode**	**SD**	**Min**	**Max**
Dividend	1 733	0.22	0.11	0.10	0.30	0.002	2.64
Cum-day Price	1 733	11.50	5.22	1.90	16.53	0.11	176.50
Dividend Yield (%)	1 733	2.51	2.13	2.50	3.31	0.15	62.70
$(P_{cum\text{-}close} - P_{ex\text{-}open})$/Dividend	1 733	0.70***	0.75	0.00	1.26	-12.50	11.59
$(P_{cum\text{-}close} - P_{ex\text{-}close})$/Dividend	1 733	0.71***	0.88	0.00	1.94	-25.00	9.63
Removal of Stale Prices							
$(P_{cum\text{-}close} - P_{ex\text{-}open})$/Dividend	1 547	0.74***	0.80	0.99	1.28	-12.50	11.59
$(P_{cum\text{-}close} - P_{ex\text{-}close})$/Dividend	1 605	0.74***	0.93	0.99	1.97	-25.00	9.63

*** Statistically significant at the 1% level.

Drop-off ratios are calculated for the sub-sampled ex-dividend events classified based on dividend yield and franking levels using close-to-close prices with the removal of stale prices.

Panel B: Partitioned Drop-off Ratios							
			Dividend Yield				
	N	**Mean**	**Median**	**Mode**	**SD**	**Min**	**Max**
0 – 1%	154	-0.11***	0.88	1.33	5.08	-25.00	9.63
>1 – 2%	564	0.67***	0.86	1.00	1.55	-6.91	5.80
>2 – 3%	492	0.89***	0.90	1.00	1.03	-6.85	4.00
>3 – 4%	236	0.98	1.02	0.71	0.88	-3.35	3.33
>4%	159	0.95	1.00	0.50	0.56	-0.94	4.00
			Franking Level				
Fully Franked (100%)	1 099	0.83***	1.00	1.00	1.80	-19.00	9.63
Partially Franked	182	0.73***	0.75	0.60	1.25	-6.15	3.65
Unfranked (0%)	324	0.41***	0.69	0.50	2.70	-25.00	7.50

*** Statistically significant at the 1% level.

Table 4b

Summary Statistics of Traditional Drop-off Ratio Studies on US Stocks

The ex-day variables of dividend events where there is matching short interest for that security. The total sample size is 4 725 over the period July 2006 to June 2011. Drop-off ratios are calculated as the difference between the cum-price and ex-price scaled by the cash amount of the distribution using cum-close as well as ex-open and ex-close prices. Dividend and $price_{cum}$ are expressed in US dollars. Dividend yield is computed as the face value of the dividend as a proportion of cum-close price and are expressed as a percentage. The significance level is a test evaluating H_0: Mean = 1.

Panel A: Full Sample							
	N	**Mean**	**Median**	**Mode**	**SD**	**Min**	**Max**
Dividend	4 725	0.30	0.21	0.25	0.71	0.0001	21.35
Cum-day Price	4 725	48.27	43.43	45.02	16.53	1.25	763.49
Dividend Yield (%)	4 725	1.75	1.52	1.25	2.51	0.002	97.18
$(P_{cum\text{-}close} - P_{ex\text{-}open})/Dividend$	4 725	0.56***	0.62	0.00	2.39	-29.02	23.03
$(P_{cum\text{-}close} - P_{ex\text{-}close})/Dividend$	4 725	0.58***	0.65	0.00	2.78	-53.89	29.10
Removal of Stale Prices							
$(P_{cum\text{-}close} - P_{ex\text{-}open})/Dividend$	4 633	0.58***	0.69	0.87	2.14	-29.02	23.03
$(P_{cum\text{-}close} - P_{ex\text{-}close})/Dividend$	4 708	0.60***	0.93	0.99	2.42	-53.89	29.10

Drop-off ratios are calculated for the sub-sampled ex-dividend events classified based on dividend yield using close-to-close prices with the removal of stale prices.

Panel B: Partitioned Drop-off Ratios							
	Dividend Yield						
	N	**Mean**	**Median**	**Mode**	**SD**	**Min**	**Max**
0 – 1%	1 237	0.35***	0.27	0.88	2.12	-53.89	29.10
>1 – 2%	1 072	0.58***	0.56	0.45	0.85	-7.37	3.46
>2 – 3%	933	0.58***	0.52	0.76	1.49	-5.69	3.54
>3 – 4%	967	0.65***	0.59	0.93	1.88	-1.91	3.33
>4%	499	0.79***	0.60	0.45	2.16	-0.94	4.00

*** Statistically significant at the 1% level.

Table 5a

Regression Analysis of the Ex-Dividend Day Drop-off Ratio on Australian Stocks

The coefficients and standard errors estimated using ordinary least squares regression with robust standard errors of White (1980) and robust regression of Huber (1973). The dependent variable is the price difference between the cum-date and ex-date scaled by the cum-date closing price. Separate regressions are modelled for ex-date open and closing prices and with the removal of observations with zero price movements.

	Close-to-Open	Close-to-Close
Variable	**Regression Coefficient**	**Regression Coefficient**
OLS with Robust Standard Errors		
Intercept	0.009 *	0.011 **
Dividend Yield	0.390 *	0.373 *
R^2	18.08%	13.68%
Sample size	1 733	1 733
Removal of Stale Prices		
Intercept	0.008 **	0.012 ***
Dividend Yield	0.477 *	0.372 *
R^2	22.68%	13.70%
Sample size	1 547	1 605
Robust Regressions		
Intercept	- 0.003 ***	- 0.004 ***
Dividend Yield	0.898 ***	1.035 ***
R^2	19.27%	18.14%
Sample size	1 726	1 726
Removal of Stale Prices		
Intercept	- 0.003 ***	- 0.003 ***
Dividend Yield	0.911 ***	1.041 ***
R^2	20.32%	18.60%
Sample size	1 544	1 601

* Statistically significant at the 10% level.

** Statistically significant at the 5% level.

*** Statistically significant at the 1% level.

Table 5b

Regression Analysis of the Ex-Dividend Day Drop-off Ratio on US Stocks

The coefficients and standard errors estimated using ordinary least squares regression with robust standard errors of White (1980) and robust regression of Huber (1973). The dependent variable is the price difference between the cum-date and ex-date scaled by the cum-date closing price. Separate regressions are modelled for ex-date open and closing prices and with the removal of observations with zero price movements.

	Close-to-Open	Close-to-Close
Variable	**Regression Coefficient**	**Regression Coefficient**
OLS with Robust Standard Errors		
Intercept	- 0.004 **	0.001 ***
Dividend Yield	0.515 *	0.512 *
R^2	13.50%	10.02%
Sample size	4 725	4 725
Removal of Stale Prices		
Intercept	- 0.001 **	0.001 ***
Dividend Yield	0.581 **	0.516 *
R^2	16.87%	11.20%
Sample size	4 633	4 708
Robust Regressions		
Intercept	0.003 **	0.005 ***
Dividend Yield	0.694 ***	0.783 ***
R^2	13.72%	13.48%
Sample size	4 718	4 718
Removal of Stale Prices		
Intercept	0.004 ***	0.003 **
Dividend Yield	0.721 ***	0.846 ***
R^2	17.17%	14.46%
Sample size	4 631	4 704

* Statistically significant at the 10% level.

** Statistically significant at the 5% level.

*** Statistically significant at the 1% level.