Ex-Dividend Day Behavior in the Absence of Taxes and Price Discreteness*

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ABSTRACT

We examine the ex-dividend day behavior in a unique setting where (1) there are neither taxes on dividends nor on capital gains, (2) stock prices have been decimalized, (3) dividends are distributed annually, and (4) we have data that enable us to examine bid–ask bounce effects. In this economy, any price decline that is smaller than the dividends cannot be attributed to taxes and price discreteness. Like previous studies, we find that the stock price drops by less than the amount of dividends and there is a significant positive ex-day return. By examining abnormal volumes around the ex-dividend day, we find no evidence of short-term trading. We are able to account for our results using market microstructure models. When the impact of market microstructure is taken into account, the ex-dividend drop is not significantly different from the value of the dividend paid.

I. INTRODUCTION

In a frictionless market with no transaction costs and no taxes, the drop in stock price when a stock goes ex-dividend should equal the value of the dividend paid on that stock. However, it is well documented that on average stock prices do not drop by the full amount. In particular, numerous studies have shown that stock prices drop by less than the amount of the dividend. Several types of interpretations are advanced in the literature to explain the ex-dividend day behavior. For example, Elton and Gruber (1970) interpret this as a reflection of the tax differential between dividends and capital gains. Many other studies share the same interpretations. However, as discussed in Frank and Jagannathan (1998), the complexity of the US tax system makes it difficult to validate whether this interpretation is indeed correct.1

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1 For a description of how complex the US tax system is, see Callaghan and Barry (2003).

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Other interpretations include price discreteness, transaction costs, and bid-ask bounce. Bali and Hite (1998) suggest that tick sizes can explain ex-dividend price ratios that are not equal to one. They argue that the drop in price less than the dividend is due to discreteness in prices rather than taxes. According to them, because stock prices trade in discrete ticks but dividend amounts are continuous and, on average, fairly small in amount, the ex-day premium will be less than one even in the absence of differential tax rates. Because investors are not willing to pay more than the dividend amount for the dividend received, the ex-day price drop will be rounded down to the nearest tick, so that the change in stock price on the ex-dividend day is always less than the amount of the dividend. Similarly, when a dividend received is between ticks, there will be positive abnormal returns. Frank and Jagannathan (1998) offer another market microstructure interpretation where they argue that collection and reinvestment is bothersome for individual investors but not for market makers. In other words, market makers have a comparative cost advantage to collecting and reinvesting dividends, and so they buy shares before a stock goes ex-dividend and resell them after the stock goes ex-dividend. Most of the trades occur at the bid price before the stock goes ex-dividend and at the ask price on the ex-dividend day. The resulting shift from bid to ask causes positive ex-day returns. In their model, the resulting bid–ask bounce contributes to, if not totally explains, the ex-dividend day behavior.

The third interpretation concentrates on how the interaction of transaction costs, taxes, and risk impacts ex-dividend day return and trading volume (e.g., Kalay 1982; Lakonishok and Vermaelen 1986; Heath and Jarrow 1988; Karpoff and Walking 1988, 1990; Grammatikos 1989; Boyd and Jagannathan 1994; Michaely and Vila 1995, 1996; and Michaely et al. 1996; among others). A common prediction among these papers is that transaction costs and risk exposure inhibit arbitrage opportunities and dividend capture beyond some point, and consequently in equilibrium, the drop of stock price on the ex-dividend day may not be equal to the amount of dividends.

In this paper, we use a unique data set from Oman where the above factors are either absent or limited. These data offer significant advantages over data used by previous studies. First, the absence of taxation of dividends and capital gains in Oman provides an ideal opportunity to examine the ex-dividend behavior without any ambiguity regarding effective marginal tax rates on dividends and capital gains. Hence, these data allow us to avoid the complexities of the US tax system where the population of US investors includes many different types of traders subject to a variety of tax structures. In Oman, the marginal trader is not subject to taxes on dividends and capital gains, which make this economy a promising laboratory to test the ex-dividend day behavior. Second, another major advantage of examining the ex-dividend behavior in Oman is that the confounding effects of stock price discreteness on ex-day behavior are much smaller compared with other markets where prices are not decimalized (until recently, the minimum tick size was one-eighth in the
United States). Kadapakkam (2000, p. 2843) states that the ‘coarseness in US price data hinders the evaluation of the magnitude of ex-dividend day price drop relative to the typically small quarterly dividends.’ Price discreteness is less of a problem in Oman, because stock prices are decimalized. In addition, dividends are usually paid once a year in Oman, whereas in many other countries (e.g., United States, United Kingdom, and Australia) dividends are paid quarterly or semi-annually. These factors increase the size of the dividends relative to the minimum tick size for the stock compared with other countries, and this reduces the importance of the tick size as a driver of the ex-day behavior. Third, transaction costs become more important when dividends are relatively small, and act like a barrier against short-term trading. However, because dividends are usually distributed annually rather than quarterly, this would suggest that transaction cost models may not be as important in Oman. Fourth, in addition to the daily stock prices, the data set contains intraday data that allow us to test the Frank and Jagannathan (1998) market microstructure model directly. Because of these data advantages, we can examine the ex-dividend day behavior in a less noisy and a more powerful manner than previous studies.

We find that stock prices on the ex-dividend days fall by significantly less than the amount of dividends and ex-day abnormal returns are significantly positive. We examine whether transaction costs and risk inhibit arbitrage. Our results show that neither is significant. We also examine abnormal volume around the ex-days and find a reduction in volume around the ex-day. These results do not support the short-term trading hypothesis, which predicts a positive abnormal volume around the ex-days. We also test Frank and Jagannathan’s (1998) model, which argues that the ex-day premium deviates from one due to the effects of bid–ask bounce. This is what we find. In particular, we find that when midpoint prices are used instead of transaction prices, stock prices drop by the full amount of the dividend on the ex-day. We also find that the ex-day abnormal return is insignificantly different from zero. Similar results emerge from using bid-to-bid and ask-to-ask prices. In general, our results demonstrate that the microstructure of the stock market explains the ex-day pricing anomaly. This finding supports the views of Kalay (1982), Miller and Scholes (1982), Frank and Jagannathan (1998), and Liano et al. (2003), who question the importance of taxes as a key factor driving ex-dividend day pricing.

The remainder of the paper is organized as follows: Section II discusses the relevant theories and empirical literature for this study. The theories considered are (A) tax explanations, (B) transaction cost models, and (C) market microstructure models. This section also develops testable hypotheses about what should happen on the ex-day according to these theories. Section III describes the institutional settings in Oman. It also discusses the specific data sources used in this paper, describes our data sample, and provides summary statistics. Section IV presents the empirical results and Section V concludes the paper.

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II. THEORY AND EMPIRICAL HYPOTHESIS

As described in Graham et al. (2003), the explanation of the ex-dividend day return can be categorized into three groups: pure tax explanation, transaction costs and risk, and market microstructure. We next review each group in detail.

A. Tax explanations

An investor who has decided to sell his stock in a corporation faces a timing decision of whether to sell on the cum-day or the ex-dividend day. If a US investor decides to sell his stock on the cum-day, he receives the cum dividend price \( P_{\text{cum}} \) and he pays tax at the capital gain tax rate \( t_g \) on excess of the cum dividend price over the original purchase price of the stock \( P_o \). If he were to sell on the ex-dividend day, he receives the ex-dividend price \( P_{\text{ex}} \) and pays tax on the excess of the ex-dividend price over the original purchase price of the stock at the capital gains tax rate. In addition, on the ex-dividend day, he will receive the dividend \( D \) and pays tax at the ordinary tax rate \( t_o \). For him to be indifferent between selling the stocks on or before the ex-dividend date, Elton and Gruber (1970) show that

\[
P_{\text{cum}} - t_g(P_{\text{cum}} - P_o) = P_{\text{ex}} - t_g(P_{\text{ex}} - P_o) + D(1 - t_o).
\]

Rearranging equation (1), we obtain

\[
\frac{P_{\text{cum}} - P_{\text{ex}}}{D} = \frac{1 - t_o}{1 - t_g}.
\]

The left-hand side of this expression is called the ex-day premium or the dividend drop-off ratio. This ratio will be referred to as the ex-day premium henceforth. The right-hand-side variable captures the differential tax treatment of dividends versus capital gains and is called the ex-day tax preference ratio (Chetty et al. 2005). Elton and Gruber (1970) argue that equation (2) can be used to infer clientele effects [originally proposed by Miller and Modigliani (1961)]: if investors with high marginal tax brackets hold low-dividend-yield stocks, then these stocks should have relatively small premiums, reflecting the tax bracket of their median shareholder. Equation (2) predicts that the higher the dividend yield, the higher the premium. This is the intuition underlying the tax clientele hypothesis.

For the case of Oman, there are neither taxes on dividends nor on capital gains; therefore, \( t_g \) and \( t_o \) in equation (1) are zero and it simplifies to:

\[
P_{\text{cum}} = P_{\text{ex}} + D.
\]

Rearranging terms:

\[
\frac{P_{\text{cum}} - P_{\text{ex}}}{D} = 1.
\]

Based on the above equation, the premium is expected to be equal to one: the price drops by the exact amount of dividends.
Equation (1) can be rewritten as follows to express the effect of differential taxation on ex-day pricing in terms of ex-day returns:

\[ \text{Return} = \frac{P_{\text{cum}} - P_{\text{ex}} + D}{P_{\text{cum}}} = \frac{t_0 - t_g}{1 - t_g} \frac{D}{P_{\text{cum}}}. \]  

Again, for the case of Oman, capital gains tax and ordinary income taxes are zero and so equation (5) simplifies to

\[ \text{Return} = \frac{P_{\text{cum}} - P_{\text{ex}} + D}{P_{\text{cum}}} = 0. \]  

From this expression, it can be seen that the ex-day return is expected to be equal to zero for the case of Oman.

**Hypothesis 1:** We expect the ex-dividend day premium to be one and the ex-day returns to be zero in the case of Oman.

**B. Interactions among taxes, transaction costs, and risk**

Kalay (1982) argues that the tax hypothesis has a major flaw because it is consistent with positive trading profits for various short-term traders. By focusing on the impact of transaction costs, Kalay shows that, in a world of certainty, investors not subject to differential taxation of dividends and capital gains, referred to as short-term traders, will capture dividends and eliminate any excess returns on the ex-dividend day.\(^2\) In this case, ex-day returns, if any, will reflect the transaction costs of short-term traders. Kalay argues that ex-dividend day premium is bounded by transaction costs

\[ 1 - 2\alpha \left( \frac{D}{P_{\text{cum}}} \right) \leq \frac{P_{\text{cum}} - P_{\text{ex}}}{D} \leq 1 + 2\alpha \left( \frac{D}{P_{\text{cum}}} \right) \]  

where \(2\alpha\) represents the transaction costs of a round trip. The above equation gives the range, in the presence of transaction costs, in which the ex-day premium can be situated without profitable arbitrage opportunities arising for any investor. As can be seen, if transaction costs are zero, the premium would be constrained to unity. The allowable range of the premium that is consistent with the no-profit opportunities is inversely proportional to the dividend yield, with the range of variation being narrower when the dividend yield is greater. Consequently, the presence of transaction costs might result in the ex-dividend premium deviating from one without the possibility of arbitrage. Koski (1996, p. 318) succinctly observes that ‘Short-term traders can eliminate abnormal

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\(^2\) Elton et al. (1984) argue that when Kalay estimated the transaction costs of trading securities, he omitted several important components, including transfer taxes, registration fees, clearance costs, and bid-ask spreads. They claim that when all costs are considered, transaction costs prevent even the lowest costs traders from affecting the ex-dividend day price through short-term trading.
ex-dividend returns caused by tax clientele trading only up to the bounds imposed by transaction costs.

Another factor that may inhibit arbitrage is the uncertainty about the ex-dividend day price. In this regard, Heath and Jarrow (1988) demonstrate that when the arbitragers are uncertain as to whether the change in price from the cum-day to ex-day will be above or below the dividend, then the equilibrium premium may deviate from one. They argue that the actual ex-day price drop is unknown and short-term trading around the ex-day is risky. Michaely and Vila (1996) show that this risk is not trivial. Their analysis implies that ex-dividend day returns must include risk premium. Boyd and Jagannathan (1994) allow for the risk by adding a risk premium to the discount rate when they model the ex-dividend day return.

C. Market microstructure theories

These theories argue that taxes are not the main driver of ex-dividend day behavior. Rather, ex-dividend day behavior can be explained by market frictions such as price discreteness and bid–ask bounce. Focusing on price discreteness, Bali and Hite (1998) argue that if share prices are constrained to trade in discrete ticks while dividend amounts are continuous, then the ex-dividend premium cannot, in most cases, be equal to the dividend amount. They claim that the market will always round down the value of the dividend to the tick just below the dividend. Bali and Hite argue that differential taxation is not necessary to explain why observed ex-day premium are, on average, less than one. According to them, price discreteness can explain premium less than one and positive ex-day returns.

The Bali and Hite argument implies that the greater the tick size, the further from one the premium will be. This suggests that the tick size is not important in Oman as stock prices have been decimalized; the tick size is RO 0.01. In fact, Graham et al. (2003) tested the Bali and Hite argument after decimalization and they report evidence that the tick size is not an important driver of ex-dividend day behavior. Kadapakkam and Martinez (2005) also suggest that the tick size effect is not applicable in countries where stock prices are decimalized.

Another market microstructure model is proposed by Frank and Jagannathan (1998). In their model, buyers and sellers find dividends to be a nuisance because of their collection and reinvestment and therefore of less value than they are to market makers. Market makers, for whom collection costs are lower, will buy shares cum-dividend at the bid price and resell them on the ex-dividend date at the ask price. This results in stock prices rising on average on ex-dividend days quite independent of the amount of dividend, with the rise being related to the magnitude of the bid–ask spread. In other words, the

3 Jakob and Ma (2004a) find that the ex-day price drop is just as likely to be the tick above the dividend as to be the tick below the dividend, which is inconsistent with the Bali and Hite model, which predicts that the ex-day price drop will always equal the tick below the dividend.
bid–ask price movement can lead to premiums less than one and positive ex-dividend day returns that are positively associated with the magnitude of the bid–ask spread.\textsuperscript{4} As described in Graham et al. (2003) and Cloyd et al. (2004), the Frank and Jagannathan model implies that, if prices are measured at the midpoint of the bid–ask spread, the premium should be one or close to one compared with when it is measured with closing prices.

**Hypothesis 2:** We expect the premium to be closer to one when we measure it using midpoint bid–ask spread. Likewise, we expect the ex-day returns to be closer to zero when measured using midpoint bid–ask spread.

## III. OMAN STOCK MARKET: INSTITUTIONAL ASPECTS

### A. Trading rules and practices

Trading in the MSM was computerized in 1997. MSM is a pure auction market where trades are affected through brokerage firms. It is very different from the NYSE in that there are no specialists or market makers. Trading in the market is conducted by stockbrokers, who cannot trade on their own account, which means that they have no role in setting cum- and ex-day prices. Orders are initiated from brokerage firms via computer terminals in their offices or on the exchange floor. Brokerage firms match buy and sell orders. Investors intending to buy or sell stocks execute their transactions through these brokerage firms, which charge them a commission or transaction fees. The minimum fee that can be charged by a brokerage firm is 0.4% and the maximum is 0.75% (0.015% of the fee is revenue for the MSM).

As Oman is a petroleum-producing country, taxes play a minor role in generating income for the economy. As a result, shareholders are not subject to any taxes on dividends. Likewise, there are no taxes on capital gains. The only taxes are the 12% flat tax rate on corporate income. This makes Oman’s taxing system one of the simplest in the world.

During the period of study, a number of trading rules and practices were effective. (1) Trades are cleared in 3 days after the day of transaction, (2) a tick size of RO 0.01 for all shares traded, (3) short selling of securities is not permitted, and (4) there are no derivative securities such as options and futures.

\textsuperscript{4} Frank and Jagannathan (1998) report evidence consistent with their argument on Hong Kong, where the average premium was approximately one-half during 1980–1993, even though there are no taxes on dividends and capital gains. Kadapakkam (2000) strengthens this argument by documenting that after Hong Kong switched from physical settlement procedures to electronic settlement, which enabled short-term arbitrage trades, ex-day abnormal returns were no longer significantly different from zero.
B. Dividends

Firms listed at the MSM distribute dividends in two forms, namely, cash dividends and stock dividends. Paying dividends in one form or another is not compulsory. If the board of directors proposes to distribute dividends, the details must be published in the daily newspapers. The proposed dividend is subject to the final approval at the shareholders Annual General Meeting (AGM). Generally, most dividend propositions are accepted at the AGM as the board of directors usually represents the majority of the share capital. The date when the AGM is held is the record date. Investors whose names are recorded as stockholders on this date are entitled to receive the declared dividend. The following date is the ex-dividend date. Firms usually pay dividends once a year. Some firms complement their cash dividends with stock dividends.

C. Data

Our sample consists of the universe of Omani stocks paying cash dividends between January 1, 1997 and July 31, 2005. All cash and stock dividends and their cum-dates and ex-dates are obtained from the Muscat Depositary Company Database. We have two sources of stock prices data, namely, MSM prices and the RASP (Research Application Service Provider) database. The MSM provided us with the stock price data, volume data, and the MSM index from 1997 to July 2005. The RASP database covers Oman for the period 1997 to June 2003. Similar to MSM data, the RASP database contains daily stock price data, volume data, and the MSM index. In addition, the RASP database contains intradaily data for the same period. To maintain accuracy, the data supplied by the MSM were randomly selected and compared with the prices provided by RASP; the comparison reveals no difference. As MSM data cover a longer period, we decide to use the MSM data as the main source of data for this paper. However, we also use the intradaily data from RASP to examine the Frank and Jagannathan market microstructure model.

We restricted attention only to cash dividend payments in this sample period. To avoid potential confounding effects of other announcements, a concern first raised by Miller and Scholes (1982), an ex-dividend day is excluded if it coincides with other corporate events such as stock dividends, splits, or subscription rights. Also, if a security did not trade on its ex-dividend day, that observation is eliminated from the sample. The premium is notorious for its extreme values and so it is trimmed by excluding 0.5% of the upper and lower values. This filter ensures that our results are robust and not driven by outliers. The final sample contains 507 cash dividend distributions. The annual number of observations varies from a low of 50 to a high of 105.

5 The RASP database is supplied by Securities Industry Research Center of Asia-Pacific (SIRCA). SIRCA is an industry-sponsored financial markets research center consisting of a consortium of Australian universities. SIRCA receives MSM data from Reuters.
Table 1 describes the sample. The average dividend is RO 0.176 and the average stock price on the cum-day is RO 2.8. The average dividend yield is 7.35%, which is much higher than many countries such as the United States (e.g., Lakonishok and Vermaelen 1986; Graham et al. 2003) and Hong Kong (e.g., Frank and Jagannathan 1998; Kadapakkam 2000). This is, however, not surprising because dividends are not paid annually in these countries.

Table 1  Sample characteristics

<table>
<thead>
<tr>
<th>Statistic</th>
<th>Dividend (D, RO)</th>
<th>Stock price (P_{cum}, RO)</th>
<th>Dividend yield (D/P_{cum})</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>0.1760</td>
<td>2.7963</td>
<td>0.0735</td>
</tr>
<tr>
<td>Median</td>
<td>0.1300</td>
<td>2.2500</td>
<td>0.0615</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>0.1468</td>
<td>1.8681</td>
<td>N/A</td>
</tr>
<tr>
<td>Minimum</td>
<td>0.0200</td>
<td>0.3900</td>
<td>0.0129</td>
</tr>
<tr>
<td>Maximum</td>
<td>1.0000</td>
<td>11.2100</td>
<td>1.1223</td>
</tr>
</tbody>
</table>

The sample contains 507 observations for all cash dividend paying firms listed on the MSM during the period from January 1997 to July 2005. The stock price (P_{cum}) denotes the stock price on the cum-day. D denotes the dividend per share.

IV. EMPIRICAL RESULTS

A. Price behavior on ex-dividend day

Table 2 presents summary statistics for ex-day premium. We calculate the premium using close cum-day prices and open ex-day prices. The price adjustment between the cum- and the ex-day should occur between the cum-day close and the ex-day open. Measuring the premium using the opening ex-day price rather than ex-day close can eliminate noise associated with daily price movements. Elton and Gruber (1970) suggest that opening price is not a market price, but reflects the specialists’ adjusted closing price. While this is not a factor on the MSM, we also provide the premium using closing prices on both cum and ex-dividend days, both adjusted and unadjusted for MSM market movements. We adjust the closing prices using the same approach used by Elton et al. (2005) and Jakob and Ma (2004b)'s paper. The market adjustment is designed to compensate for returns during the ex-dividend day.

In all three cases, we test the null hypothesis that the premium is equal to one (Hypothesis 1). The results show that in all cases the premium is statistically significantly less than one. This implies that the average decline in the stock price on the ex-dividend day is less than the dividend per share. The average decline in stock price on the ex-dividend day ranges from 0.65 to 0.69. This evidence is consistent with previous findings by Frank and Jagannathan (1998) on Hong Kong, which has similar tax treatment for dividends and capital gains.
as in Oman and Milonas and Travlos (2001) on the Athens Stock Exchange where taxes on dividends and capital gain are also absent.

**B. Abnormal returns on ex-dividend day**

Although premium measures are intuitively appealing, they suffer from heteroskedasticity (see Eades et al. 1984; Lakonishok and Vermaelen 1986; Barclay 1987; and Michaely 1991).\(^6\) The heteroskedasticity problem is caused by the fact that price changes are divided by dividend amounts that are not equal across securities.\(^7\) Our second measure of ex-day price change, abnormal return (AR), avoids this problem. The ex-day raw return is \(\left(\frac{P_{\text{ex}}}{C_0} P_{\text{cum}} - 1\right) / P_{\text{cum}}\) such that, if the price drops equal \(D\), then the raw return is zero. Following Graham et al. (2003), Liano et al. (2003), and Cloyd et al. (2004), we calculate the ex-day AR as

\[
AR = \frac{P_{\text{ex},it} - P_{\text{cum},it} + D_{it}}{P_{\text{cum},it}} - E(R_{it}), \tag{8}
\]

where \(E(R_{it})\) is the expected return for firm \(i\) on event day \(t\), as calculated from the market model

\[
E(R_{it}) = \alpha_{it} + \beta_{it}(E(R_{mt}) - R_{ft}), \tag{9}
\]

where \(E(R_{mt})\) is the expected return on the market at time \(t\) and \(R_{ft}\) is the risk-free rate of return at time \(t\). We use the MSM value-weighted return as a proxy for the market return and 1-month rate of Treasury bills as a proxy for the risk-free rate.\(^8\) We estimated the parameters for the market models using daily returns from \(-240\) through \(-41\) relative to the ex-dividend day.

\(^6\) A complete discussion of the problems caused by heteroskedasticity in the price change to dividend ratio is contained in Michaely (1991).

\(^7\) Clustering is not an important issue for our sample as there are very limited cases where firms go ex-dividend on the same calendar date.

\(^8\) Risk-free rate of return is obtained from the Central Bank of Oman.

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**Table 2** Premium summary statistics

<table>
<thead>
<tr>
<th>Statistic</th>
<th>Unadjusted</th>
<th>Adjusted</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Close–open</td>
<td>Close–close</td>
</tr>
<tr>
<td>Mean</td>
<td>0.6460</td>
<td>0.6919</td>
</tr>
<tr>
<td>(t)-statistic</td>
<td>-4.8474</td>
<td>-4.1668</td>
</tr>
<tr>
<td>Median</td>
<td>0.2500</td>
<td>0.4000</td>
</tr>
<tr>
<td>Minimum</td>
<td>-5.1667</td>
<td>-5.1667</td>
</tr>
<tr>
<td>Maximum</td>
<td>13.7000</td>
<td>13.7000</td>
</tr>
</tbody>
</table>

The sample consists of 507 observations for all cash dividend paying firms listed on the MSM during the period from January 1997 to July 2005. The premium is defined as \(\frac{P_{\text{cum}} - P_{\text{ex}}}{D}\). \(t\)-statistics are for the null hypothesis that the mean premium is equal to one. Adjusted premium uses the MSM index.
Table 3 presents the results for abnormal returns on the ex-dividend day. We are testing the null hypothesis that the abnormal return on the ex-dividend day is 0 (Hypothesis 1). Our results show that the mean abnormal returns are significantly greater than zero. In particular, we find that the average abnormal return on the ex-day is 4.45%, which is highly significant with a $t$-statistic of 7.50. The median abnormal return is 3.43%. These abnormal returns appear to be substantially higher than those reported by Graham et al. (2003) for the United States and by Lasfer and Zenonos (2007) for France, Italy, Germany, and United Kingdom. However, this is not surprising because dividend yields are much lower in these countries. In general, these results are similar to those reported by Eades et al. (1984), and Grinblatt et al. (1984), who documented abnormal return behavior around ex-days of nontaxable distributions such as stock splits and stock dividends.

As a robustness check and to test the sensitivity of our results to beta estimation, we calculate abnormal return, $AR_{it}$, by subtracting the market’s (MSM) daily return, $R_{mt}$, from the observed stock’s return over a given period $t$. That is,

$$ AR_{it} = R_{it} - R_{mt}. $$

In this technique, stocks are assumed to have a $\beta$ of 1.0.\(^9\)

Our results from using this approach are very similar to those reported previously. In particular, we find that the ex-day abnormal return is 0.0482, with a $t$-statistic of 7.2751.

A possible explanation for the positive abnormal returns (and premium less than one) may be market frictions. However, the tick size effect proposed by Bali and Hite (1998) is not applicable, because stock prices are decimalized in Oman. However, we examine whether the bid–ask bounce drives our results in a section below.

\(^9\) Brown and Warner (1980) have shown that this approach is powerful and often more powerful than the market model.
C. Transaction costs and risk

Because abnormal returns are not eliminated, the implication is that arbitrage may be inhibited by transaction costs and risk. To examine this issue, we run the following regression model

\[ AR = \beta_0 + \beta_1 DVYLD_i + \beta_2 1/P_{CUM_i} + \beta_3 \sigma_{i} / \sigma_{Mi} + \epsilon_i, \]  

where \( AR_i \) is the abnormal return as estimated in equation (8), \( DVYLD_i \) is the dividend yield for stock \( i \), \( 1/P_{CUM_i} \) is the inverse of stock \( i \)'s closing price on the last cum dividend day as a proxy for transaction costs, and \( \sigma_{i} / \sigma_{Mi} \) is the standard deviation of the residuals and from estimating equation (9), normalized by market risk (a proxy for idiosyncratic risk).

Kalay (1982) argues that stock prices should drop by the full amount of the dividend. Otherwise, short-term traders, who face no differential taxes on dividends versus capital gains, could make excess returns. On the other hand, transaction costs could inhibit the ability of short-term traders to make arbitrage profit. Higher transaction costs should act like a barrier against short-term trading in the period around the ex-dividend day and thereby reduce the volume of trading and ex-dividend day premium. To capture this effect, we follow previous research (e.g., Karpoff and Walking 1988; Naranjo et al. 2000; and Cloyd et al. 2004) and include the inverse of the closing stock price on the last cum-dividend day (\( 1/P_{cum} \)) as a proxy for transaction costs. Previous studies report evidence of a positive association between ex-day abnormal returns and transaction costs that is usually interpreted as evidence of dividend capture. This is because transaction costs prevent ex-day abnormal return being arbitraged away (Kalay 1982). Karpoff and Walking (1988, 1990) argue that ex-day abnormal returns are eliminated up to the marginal cost of trading around the ex-day, which implies a positive association between ex-day returns and transaction costs. Therefore, if dividend capture trading occurs, the resulting ex-day returns will be positively correlated with the cost of trading. Consequently, we expect a positive association between abnormal returns and transaction costs proxy (Lakonishok and Vermaelen 1986; Karpoff and Walking 1988, 1990; Michaely et al. 1996; Naranjo et al. 2000).

Another factor potentially limiting dividend capture is risk. Heath and Jarrow (1988) demonstrate that the ex-dividend day stock price may differ arbitrarily from the dividend for each individual stock: consequently, short-term traders cannot generate riskless arbitrage profits. As a result, ex-dividend returns must include a risk premium because ex-day share prices are unknown (see also Michaely and Vila 1996). Grammatikos (1989) and Boyd and Jagannathan (1994) argue that risk exposure is a major cost faced by short-term traders. Empirical evidence supporting the existence of such risk premia is provided by Grammatikos (1989) in his study of the effects of the Tax Reform Act of 1984. Fedenia and Grammatikos (1993) also report evidence consistent with the risk premium. To capture this effect, we use a risk measure similar to that used by Michaely and Vila (1996) and Cloyd et al. (2004). We measure \( \sigma_{i} / \sigma_{Mi} \) as the...
standard deviation of the residuals from a market model regression of daily returns for the dividend paying stocks on daily market returns, divided by the standard deviation of daily market returns. Because a short-term trader has to be compensated for taking extra risk, we expect a positive relationship between the ex-day abnormal returns and our risk proxy.

Table 4 reports the results on the relationship between ex-day abnormal returns and transaction costs and risk. Following previous research (Kadapakkam 2000), we include dividend yield as a control variable.

Contrary to our expectations, there is no significant relationship between transaction costs and abnormal returns, indicating that transaction costs do not prevent arbitrage activity. Our risk proxy is also insignificant, suggesting that risk considerations do not deter arbitrage activity. The fact that the transaction cost and risk proxies are insignificant suggests that a high level of ex-day abnormal returns and a full adjustment of stock price to the amount of dividends, which is inconsistent with Kalay (1982) and Michaely and Vila (1995). The significant negative coefficient on dividend yield suggests that short-term traders are eliminating or reducing abnormal returns in high-dividend-yield stocks.

D. Behavior of trading volume around ex-days

To investigate the presence of short-term trading around the ex-dividend day, we analyze volume data. Lakonishok and Vermaelen (1986) argue that the influence of short-term traders around the ex-day can best be investigated by examining abnormal volume around the ex-day. The presence of short-term traders would be shown through a positive abnormal volume around the ex-day. Green’s (1980) analysis suggests that this abnormal trading volume will be highest on the cum- and ex-day. There are many studies that report abnormal...

We examine abnormal trading volume over the 11-day period centered on the ex-day. In doing so, we follow the methodology of Graham et al. (2003) where turnover is computed as the aggregate number of shares traded on a given day divided by the number of outstanding shares. We estimate normal turnover as the average daily turnover for the 80 days from day 45 to day 6 and days 6 to day 45 relative to the ex-dividend day.

The sample contains 495 observations for all cash dividend paying firms listed on the MSM during the period from January 1997 to June 2005. Abnormal trading volume is presented for a 11-day window centered on the ex-day. Abnormal trading volume (ATV) for each day in the event window is defined as the ratio of a stock's trading turnover on a particular day to that stock normal trading turnover, minus one. Turnover is computed as the aggregate number of shares traded on a given day divided by the number of outstanding shares. Normal turnover is estimated as the average daily turnover for the 80 days from day 45 to day 6 and day 6 to day 45 relative to the ex-dividend day.

*Denotes significance at the 5% level using a two-tailed test.

Table 5

<table>
<thead>
<tr>
<th>Event day</th>
<th>ATV</th>
<th>Standard error</th>
</tr>
</thead>
<tbody>
<tr>
<td>– 5</td>
<td>– 0.0291*</td>
<td>0.0145</td>
</tr>
<tr>
<td>– 4</td>
<td>– 0.0336*</td>
<td>0.0090</td>
</tr>
<tr>
<td>– 3</td>
<td>– 0.0272</td>
<td>0.0147</td>
</tr>
<tr>
<td>– 2</td>
<td>– 0.0347*</td>
<td>0.0099</td>
</tr>
<tr>
<td>– 1</td>
<td>– 0.0383*</td>
<td>0.0142</td>
</tr>
<tr>
<td>0</td>
<td>– 0.0821*</td>
<td>0.0049</td>
</tr>
<tr>
<td>1</td>
<td>– 0.0618*</td>
<td>0.0076</td>
</tr>
<tr>
<td>2</td>
<td>– 0.0612*</td>
<td>0.0060</td>
</tr>
<tr>
<td>3</td>
<td>– 0.0614*</td>
<td>0.0056</td>
</tr>
<tr>
<td>4</td>
<td>– 0.0528*</td>
<td>0.0092</td>
</tr>
<tr>
<td>5</td>
<td>– 0.0550*</td>
<td>0.0064</td>
</tr>
</tbody>
</table>

The sample contains 495 observations for all cash dividend paying firms listed on the MSM during the period from January 1997 to June 2005. Abnormal trading volume is presented for a 11-day window centered on the ex-day. Abnormal trading volume (ATV) for each day in the event window is defined as the ratio of a stock's trading turnover on a particular day to that stock normal trading turnover, minus one. Turnover is computed as the aggregate number of shares traded on a given day divided by the number of outstanding shares. Normal turnover is estimated as the average daily turnover for the 80 days from day 45 to day 6 and day 6 to day 45 relative to the ex-dividend day.

*Denotes significance at the 5% level using a two-tailed test.


We examine abnormal trading volume over the 11-day period centered on the ex-day. In doing so, we follow the methodology of Graham et al. (2003) where turnover is computed as the aggregate number of shares traded on a given day divided by the number of outstanding shares. We estimate normal turnover as the average daily turnover for the 80 days from day 45 to day 6 and days 6 to 45 relative to the ex-dividend day. Abnormal trading volume (ATV) for each day in the event window is defined as the ratio of a stock's trading turnover on a particular day to that stock normal trading turnover, minus one.

Table 5 presents evidence on trading volume around ex-dates. Significant positive abnormal volume around the ex-day will be a clear evidence of the presence of short-term trading activities. The results indicate that the abnormal volume before the ex-day is uniformly negative. That is, on each of the 5 days before the ex-day, trading volume decreases substantially. In most cases, the
drop in volume is statistically significantly different from zero. There is also a significant drop in trading volume on the ex-day and on each of the following 5 days. These results are inconsistent with the hypothesis that short-term traders have a significant impact on ex-day behavior. Rather, it is consistent with the market microstructure model by Frank and Jagannathan (1998), which predicts negative abnormal volume around the ex-days due to a shortage of buyers in the cum-period and a shortage of sellers in the ex-period (Cloyd et al. 2002). These results are very similar to those reported by Lakonishok and Vermaelen (1986) for stock splits and stock dividends. It is also consistent with the findings of Copeland (1979), who studied trading volume behavior of 25 NYSE firms around stock splits during the period 1963–1973. He reports evidence that trading volume decreased in anticipation of the stock split and continued to be lower following the split. In general, unlike the United States markets, where short-term traders affect ex-day prices (e.g., Lakonishok and Vermaelen 1986; Karpoff and Walking 1990; Michaely 1991), our results do not provide support for the short-term trading hypothesis.10

E. Midpoint pricing using RASP data

Until now, we have been using MSM daily closing prices to conduct our analysis, which is the standard methodology in prior research. In this section, we repeat our analysis and calculate the ex-day premium and ex-day abnormal return utilizing the RASP intra-daily data. The reason for this is to test for the market microstructure argument proposed by Frank and Jagannathan (1998). Frank and Jagannathan (1998) argue that the premium, to a large extent, is an artifact of bid–ask spread. Their model implies that if prices are measured at the midpoint of the bid–ask spread, the premium should be one, or at least closer to one compared with when measured by closing daily prices. Similarly, the ex-day abnormal return should be zero or closer to zero when measured using the midpoint of the bid–ask quotes relative to when measured by transaction prices (Hypothesis 2). As discussed in Graham et al. (2003), these hypotheses cannot be tested using daily closing prices because bid–ask bounce may cause a bias in the ex-day premium and abnormal returns.

In order to see whether our previous results hold when using the RASP data, we first use the RASP closing transaction prices and recompute the ex-day premium and abnormal returns. We find almost no difference with the MSM analysis reported in Tables 2 and 3. Next, we follow the methodology of Graham et al. (2003) and measure $P_{ex}$ and $P_{cum}$ at the close of the trading day using the midpoint of the bid and ask quotes (rather than transaction prices).11 As explained in Graham et al. (2003), the use of the midpoint prices should attenuate bid–ask bounce that might impact traditional ex-day analysis and

10 In untabulated analysis, we repeat the volume analysis using the RASP data and we find results similar to those reported in Table 5.
11 For more information on the methodology, see Graham et al. (2003).
allow us to test the Frank and Jagannathan bid–ask bounce hypothesis. If bid–ask bounce is the primary cause of the ex-day behavior, we should find that the ex-day premium is closer to one and the ex-day abnormal return is closer to zero when we use the midpoint prices (Hypothesis 2). This is exactly what we find. In particular, Table 6 indicates that the premium is slightly less than one and the abnormal return is slightly greater than zero, but as expected the differences are not statistically different from one and zero at any reasonable level of significance. These results are very different from the one reported in Tables 2 and 3 based on closing daily stock prices. Consequently, using midpoint prices to eliminate bid–ask bounce makes a huge difference compared with using transaction pricing. This clearly indicates that the bid–ask bounce in transaction prices is an important driver of the ex-day pricing in our sample. This finding supports the predictions of the premium differing from one because of bid–ask bounce and the ex-day abnormal return differing from zero for the same reason.

Eades et al. (1994) and Boyd and Jagannathan (1994) point out that price noisiness is a major obstacle in the examination of the ex-dividend day behavior. Graham et al. (2003) suggest that the use of closing prices in the examination of ex-dividend day behavior is adding noise to the ex-day analysis, which makes it hard to make accurate inferences. To avoid this problem, we repeat our analysis using the opening quotes on the ex-day. The use of opening quotes should eliminate noise associated with daily price movements (Graham et al. 2003).

We find in Table 7 that the premium is very close to and not statistically significantly different from one. The abnormal return is very close to zero and the difference from zero is not statistically significant. These results are almost identical to the one reported using the closing prices on the ex-day. This indicates that the noisiness of using the closing prices is not an important driver for our results.

Another implication of the Frank and Jagannathan model is that bid-to-bid and ask-to-ask prices should drop by the amount of dividend in the absence of

<table>
<thead>
<tr>
<th>Statistic</th>
<th>Premium</th>
<th>AR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>0.9816</td>
<td>0.0001</td>
</tr>
<tr>
<td>t-statistic</td>
<td>-0.1211</td>
<td>1.3909</td>
</tr>
</tbody>
</table>

The sample includes 382 observations for all dividend cash paying firms listed on the MSM during the period from January 1997 to June 2003 that have information available in both the MSM data and RASP database. The premium is defined as \( \frac{P_{\text{cum}} - P_{\text{ex}}}{D} \). The ex-day Abnormal Return is defined as \( \frac{P_{\text{ex}} - P_{\text{cum}} + \text{Div}}{P_{\text{cum}}} \) – ER, where ER is the expected return defined by the Market Model. t-statistic is for the null hypothesis that (1) the mean premium is equal to one and (2) the mean ex-day abnormal return is equal to zero. The \( P_{\text{cum}} \) is calculated using the midpoint of bid–ask spread of the closing quote on the cum-day. \( P_{\text{ex}} \) is calculated using the midpoint of the bid–ask spread of the closing quote on the ex-day.
taxes and discrete tick size effects. We repeat our analysis using bid-to-bid and ask-to-ask quotes.

Table 8 shows that stock prices fall by almost the exact amount of the dividend using these prices. These results are evidence that systematic bid–ask bounce around ex-dividend days bias closing transaction prices for this sample. The results from cum-day close ask to ex-day close ask are slightly smaller than the average drop from cum-day bid to ex-day close bid. Most importantly, in both cases, we cannot reject the null hypothesis that ex-day premium is equal to one and ex-day abnormal returns are equal to zero. In both cases, the ex-day premiums are not statistically different from one and the abnormal returns are not statistically different from zero. In general, the results using the midpoint quotes show that the inferences based on premium are very

Table 7  Premium and ex-day abnormal return (AR) using RASP opening quote midpoints

<table>
<thead>
<tr>
<th>Statistic</th>
<th>Premium</th>
<th>AR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>1.0238</td>
<td>0.0001</td>
</tr>
<tr>
<td>t-statistic</td>
<td>0.1504</td>
<td>1.1528</td>
</tr>
</tbody>
</table>

The sample consists of 382 observations for all dividend cash paying firms listed on the MSM during the period from January 1997 to June 2003 that have information available in both the MSM data and RASP database. The premium is defined as \( \frac{P_{\text{cum}} - P_{\text{ex}}}{D} \). The ex-day Abnormal Return is defined as \( \left( \frac{P_{\text{ex}} - P_{\text{cum}} + \text{Div}}{P_{\text{cum}}} \right) - \text{ER} \), where ER is the expected return defined by the Market Model. t-statistic is for the null hypothesis that (1) the mean premium is equal to one and (2) the mean ex-day abnormal return is equal to zero. The \( P_{\text{cum}} \) is calculated using the midpoint of bid–ask spread of the closing quote on the cum-day. \( P_{\text{ex}} \) is calculated using the midpoint of the bid–ask spread of the opening quote on the ex-day.

Table 8  Premium and ex-day abnormal return (AR) using RASP closing bid and ask quotes

<table>
<thead>
<tr>
<th>Statistic</th>
<th>Premium bid</th>
<th>Premium ask</th>
<th>AR bid</th>
<th>AR ask</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>0.9916</td>
<td>0.9716</td>
<td>0.0001</td>
<td>0.0001</td>
</tr>
<tr>
<td>t-statistic</td>
<td>-0.0381</td>
<td>-0.1015</td>
<td>1.1654</td>
<td>1.0994</td>
</tr>
</tbody>
</table>

The sample includes 382 observations for all dividend cash paying firms listed on the MSM during the period from January 1997 to June 2003 that have information available in both the MSM data and RASP database. The premium is defined as \( \frac{P_{\text{cum}} - P_{\text{ex}}}{D} \). The ex-day Abnormal Return is defined as \( \left( \frac{P_{\text{ex}} - P_{\text{cum}} + \text{Div}}{P_{\text{cum}}} \right) - \text{ER} \), where ER is the expected return defined by the Market Model. t-statistic is for the null hypothesis that (1) the mean premium is equal to one and (2) the mean ex-day abnormal return is equal to zero. The \( P_{\text{cum}} \) is calculated using (1) bid quote of the closing quote on the cum-day and (2) the ask quote of the closing quote on the cum-day. \( P_{\text{ex}} \) is calculated using the (1) bid quote of the closing quote on the ex-day and the (2) ask quote of the closing quote on the ex-day.
similar to those based on returns and the results for bid quotes are virtually identical to those for ask quotes. Overall, inferences based on quotations are different from those based on transaction prices.

In summary, the above results indicate that market microstructure explanations are the dominant cause of the ex-day premium deviating from one and the ex-day abnormal returns deviating from zero. Once these market microstructure effects are taken into account, at the margin, a Rial of dividends and a Rial of capital gains are valued equally in Oman.

### V. CONCLUSION

In this paper, we examine ex-dividend day behavior in a unique setting that is characterized by less frictional trading: no taxes on dividend and capital gains, dividends paid annually, and prices are decimalized. While one would expect that in this market stock prices should drop by an amount equal to the dividend, our evidence shows that stock prices drop by less than the amount of dividends. Similarly, we find significant positive abnormal returns on the ex-day. These results cannot be explained by taxes and price discreteness.

We examined whether transaction costs and risk inhibit arbitrage trading around ex-days. We find that neither of these variables is significant, which suggests that these variables do not hinder investors’ ability to trade and arbitrage the excess returns. These results are inconsistent with the hypothesis that dividend-capture traders affect the ex-dividend day returns. We also examine abnormal trading volume around the ex-days. Our results reveal that there is a significant reduction in trading volume around ex-days. The reported results show that, unlike the US market, ex-day behavior in Oman is not affected by short-term trading. Finally, we tested the Frank and Jagannathan (1998) model, which predicts that the bid–ask bounce is the primary factor

### Table 9  Premium and ex-day abnormal return (AR) using RASP opening bid and ask quotes

<table>
<thead>
<tr>
<th>Statistic</th>
<th>Premium bid</th>
<th>Premium ask</th>
<th>AR bid</th>
<th>AR ask</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>1.0343</td>
<td>1.0133</td>
<td>0.0001</td>
<td>0.0001</td>
</tr>
<tr>
<td>t-statistic</td>
<td>0.1491</td>
<td>0.0456</td>
<td>0.9666</td>
<td>0.9076</td>
</tr>
</tbody>
</table>

The sample consists of 382 observations for all dividend cash paying firms listed on the MSM during the period from January 1997 to June 2003 that have information available in both the MSM data and RASP database. The premium is defined as \( (P_{cum} - P_{ex})/D \). The ex-day Abnormal Return is defined as \( ((P_{ex} - P_{cum} + Div)/P_{cum}) - ER \), where ER is the expected return defined by the Market Model. T-statistic is for the null hypothesis that (1) the mean premium is equal to one and (2) the mean ex-day abnormal return is equal to zero. The \( P_{cum} \) is calculated using (1) bid quote of the closing quote on the cum-day and (2) the ask quote of the closing quote on the cum-day. \( P_{ex} \) is calculated using the (1) bid quote of the opening quote on the ex-day and the (2) ask quote of the opening quote on the ex-day.
behind the ex-dividend day behavior. Our results indicate that when midpoint prices are used instead of transaction prices, stock prices drop by the full amount of dividends on the ex-day and the ex-day abnormal return is insignificantly different from zero. Our analysis of bid-to-bid and ask-to-ask prices reveals similar results.

In sum, the results indicate that market microstructure influences the ex-dividend day premium and ex-day return. Once market microstructure effects are taken into account, dividends and capital gains are valued equally at the margin.

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REFERENCES


