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REITs, Decimalization, and Ex-dividend Stock Prices

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Abstract The ex-dividend pricing of real estate investment trust (REIT) stocks under fractional and decimal pricing regimes is investigated. For REITs, with the move from discrete to decimal pricing, the price drop on the ex-dividend day approaches the dividend amount, the ex-date abnormal return decreases, the spread-to-dividend ratio declines, abnormal trading volume increases, and the potential erroneous appearance of a tax-clientele effect is diminished. Discreteness and other transaction costs are reduced with decimalization implying that part of the persistence in the appearance of the tax-clientele effect when modeling ex-dividend stock pricing might be generated by the interaction between transaction costs, dividend amount, and yield.

Keywords REIT · Decimalization · Ex-dividend · Tax-clientele · Market microstructure

Jel Classifications G10 · G14

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Introduction

Since the publication of early studies by Campbell and Beranek (1955) and Durand and May (1960), the ex-dividend pricing of stocks has been the subject of substantial research. In a much cited work, Elton and Gruber (1970) argue that the ex-dividend pricing anomaly, where the stock price drops by less than the dividend amount on the ex-dividend date, is driven by tax rate considerations as might be inferred from Miller and Modigliani's (1961) marginal tax rate induced clientele hypothesis. Even though Miller and Scholes (1982) question Elton and Gruber's explanation of the ex-dividend pricing anomaly by recognizing that liquidity traders can arbitrage pricing anomalies, Elton and Gruber's tax-clientele postulate remains the leading theory used to explain the ex-dividend pricing anomaly and has been persistently supported by empirical research.

The antecedents to the present investigation, in addition to Miller and Scholes (1982) and Kalay (1982), include works by Bali and Hite (1998), Bhardwaj and Brooks (1999), Boyd and Jagannathan (1994), Dubofsky (1992), Eades, Hess, and Kim (1984), Frank and Jagannathan (1998), Graham, Michaely, and Roberts (2003), Hardin, Liano, and Huang (2002), Jakob and Ma (2004), Karpoff and Walking (1988), Koski (1996), Lakonishok and Vermaelen (1983), Lakonishok and Vermaelen (1986), and Michaely (1991) which investigate other factors that might impact ex-dividend stock prices such as tax policy changes, transaction costs and micro-market limitations, such as discreteness, and a stock's bid-ask spread relative to its dividend amount. The general objective of these studies has been to empirically analyze alternative explanations for the ex-dividend pricing anomaly other than Elton and Gruber's tax-clientele postulate. Building on these studies and using the real estate investment trust (REIT) asset class which evidences no or little correlation in dividend amount and dividend yield and has a general investor group facing similar tax consequences, this study shows that discreteness and transaction costs alone can create what has been interpreted in prior studies, using aggregate data with high correlations between dividend amount and dividend yield, as the tax-clientele effect. By comparing data from the fractional and decimal pricing regimes, the present study results show that discreteness and other transaction costs can impact ex-dividend pricing and that the persistent appearance of a tax-clientele effect might simply reflect ex-dividend pricing limitations and not differences in dividend yield as required by the tax-clientele hypothesis.

Research Framework

On January 29, 2001, the New York Stock Exchange and the American Stock Exchange completed their conversion to a decimal pricing system for all issues. This switch from fractional pricing to decimal pricing provides an opportunity to revisit issues related to market microstructure and ex-dividend stock prices. In one of the first post-decimalization studies Graham et al. (2003), using aggregate data that exclude REITs, compare fractional and decimal pricing regimes and find support for the tax-clientele effect. The current study builds from this work and combines Dubofsky (1992), Frank and Jagannathan (1998), and Bali and Hite's (1998)

discreteness related hypotheses with the use of the REIT asset class by Hardin et al. (2002), which has little correlation between dividend amount and dividend yield and is characterized by investors subject to similar tax rates, to evaluate the competing ex-dividend pricing hypotheses.

Existing research evaluating the tax-clientele and discreteness theories of ex-dividend pricing of stocks continues to provide mixed results partially supportive of the competing postulates. In a preliminary evaluation of ex-dividend pricing comparing the fractional and decimal eras, Graham et al. (2003) find results consistent with the microstructure and discreteness hypotheses, but conclude that the tax-clientele hypothesis better describes the market's reaction to dividends given the inability to discern changes in dividend yield and abnormal returns between pricing eras. The authors indicate that the actual causal relationship creating the persistence of the relationship between ex-dividend pricing and yield remains open for debate. Neither the high correlation between dividend yield and dividend size nor the size of a stock's bid-ask spread relative to its dividend amount (SDR), a measure of transaction costs proposed by Bhardwaj and Brooks (1999), however, are controlled for by Graham, Michaely, and Roberts when modeling the tax-clientele effect. Research by Jakob and Ma (2004) assesses Bali and Hite's (1998) and Dubofsky's (1992) market microstructure and discreteness arguments for ex-dividend pricing under the fractional and decimal pricing eras using aggregate market data and finds that changes in tick size do not effect the change in price relative to the dividend for the typical stock. Again, other transaction costs are not fully modeled and the high correlation between dividend amount and dividend yield is not specifically addressed.

Transactions costs, as Graham et al. (2003) and others point out continue to be important factors in the modeling of ex-dividend stock pricing. Since most of the existing empirical work on the tax-clientele effect uses data where dividend yield and dividend size are highly correlated and the existence of any transaction cost would generate results consistent with the tax-clientele effect, it is imperative to control for the high correlation between dividend size and yield and transaction costs such as those created by discreteness constraints in stock pricing, the size of a stock's bid-ask spread relative to its dividend amount (SDR), which is also impacted by discreteness, and any operational costs associated with actually booking a stock trade. In the presence of any transaction cost, dividend size can skew the ex-date premium, defined as the ratio of the price change to dividend amount, especially for small dividends. The impact of discreteness on ex-dividend stock prices is related to the dividend amount. For example, Hardin et al. (2002) show that empirical studies need to control for the interaction between dividend amount and dividend yield.[1] In a study using real estate investment trusts (REITs), which have a low or no correlation between dividend amount and dividend yield, Hardin et al. show that

[1] The high correlation between dividend size and dividend yield creates ambiguity in empirically evaluating the tax-clientele effect. Any persistent transaction or execution cost inclusive of costs from discreteness in pricing ex-dividend stocks will create what has been interpreted as evidence of a tax-induced clientele effect when dividend size and dividend yield are highly correlated. Costs can also include operational expenses associated with the actual booking of a transaction, including accounting and firm specific operational costs, and costs associated with market frictions.

discreteness constraints in the re-pricing of ex-dividend stocks can erroneously create the ex-dividend premiums associated with the tax-induced clientele effect.

While not directly evaluating the tax-clientele effect, Chakravarty, Wood, and Van Ness' (2004) investigation of post decimalization stock trading liquidity shows that trading costs for liquidity traders may have actually increased with decimalization as price volatility has increased, the bid-ask spread has declined, and execution costs have increased on a relative spread basis. Hence, a fundamental issue in the debate on ex-dividend stock pricing can be addressed through the use of the REIT asset class characterized by a high dividend yield, little correlation between dividend size and dividend yield and having a large portion of returns coming from dividends. For REITs, the switch from fractional to decimal pricing should reduce at least some of the total microstructure related costs, inclusive of the impact of discreteness on stock re-pricing and the bid-ask spread, given as possible causes for the consistent appearance of the ex-dividend pricing anomaly. Other trading costs associated with a decrease in quoted depth noted by Chakravarty et al., however, will likely offset some of these gains such that the net gain in efficiency is minimized except for those smaller dividend amounts that have been more substantially impacted by discreteness and spread-to-dividend limitations in pricing.

By examining the impact of decimal pricing on ex-dividend date stock prices within the discreteness framework and by showing that the interaction between dividend amount and implied transaction costs in a constant yield environment with investors facing similar tax consequences impacts the relationship between ex-dividend price change and dividend amount, the study supports arguments by Kalay (1982) and Miller and Scholes (1982) that model mis-specification might be the cause for the persistence of the ex-dividend pricing anomaly. The study results generally support Karpoff and Walking (1988), Lakonishok and Vermaelen (1983), and Michaely (1991), which together indicate that dividend size and market microstructure issues may be significant determinants of the behavior of ex-dividend stocks. More recent studies by Bali and Hite (1998), Bhardwaj and Brooks (1999), Dubofsky (1992), Frank and Jagannathan (1998), and Hardin et al. (2002) indicating that market microstructures, including constraints in re-pricing caused by tick or discreteness restrictions, may be the important determinants of the ex-dividend pricing of stocks are also supported.

Data and Methodology

The daily closing prices, returns, trading volume, and ex-dividend information are retrieved from the Center for Research in Security Prices (CRSP) daily files for firms designated as real estate investment trusts (REITs), firms with SIC code 6798 or share code 18 in CRSP (ordinary common shares, REITs) or share code 48 in CRSP (shares of beneficial interest, REITs), and listed on the New York Stock Exchange (NYSE, the exchange code 1 in CRSP) that paid taxable quarterly cash dividends (the distribution code 1232 in CRSP) from January 1994 to December 2003. Data for REITs identified as mortgage REITs are excluded from the analysis. Since more than 90% of the quarterly cash dividends are greater than or equal to $0.125 and less than or equal to $0.75, dividends that are less than $0.125 and greater than $0.75 are

excluded. Similar to Graham et al. (2003), this time period is divided into three eras: (1) the 1/8th era is from January 1, 1994 to May 6, 1997, (2) the 1/16th era is from June 24, 1997 to August 26, 2000, and (3) the decimal era is from January 29, 2001 to December 31, 2003.[2] Like Graham et al., the ex-date premium for REIT i on dividend event day t is calculated as:

$$Premium_{it} = \frac{P_{cum,it} - P_{ex,it}}{Div_{it}} \tag{1}$$

where:

P_{cum} is the last closing price[3] when the stock trades with dividend,
P_{ex} is the first closing price when the stock trades without dividend, and
Div is the quarterly cash dividend amount.

As in Graham et al. (2003), the ex-date abnormal return for REIT i on dividend event day t is calculated as:

$$Abnormal\ Return_{it} = \frac{P_{ex,it} - P_{cum,it} + Div_{it}}{P_{cum,it}} - E(R_{it}) \tag{2}$$

and $E(R_{it})$ is the expected return for REIT i on dividend event day t from the market model and is calculated as:

$$E(R_{it}) = \alpha_{it} + \beta_{it} E(R_{mt}) \tag{3}$$

where

$E(R_{mt})$ is the CRSP value-weighted return index on day t.
The parameters α_{it} and β_{it} are estimated using daily returns from day −251 to day −1 before the dividend event where day 0 is the ex-dividend day.

Following Graham et al. (2003), the abnormal trading volume for REIT i on dividend event day t is calculated as:

$$Abnormal\ Volume_{it} = \left[\frac{Turnover_{it}}{Normal\ Turnover_i}\right] - 1 \tag{4}$$

where

$$Turnover_{it} = \frac{Shares\ Traded_{it}}{Outstanding\ Shares_{it}} \tag{5}$$

and

$$Normal\ Turnover_i = \frac{1}{80}\left[\sum_{t=-45}^{t=-6} Turnover_{it} + \sum_{t=6}^{t=45} Turnover_{it}\right] \tag{6}$$

[2] One of the many features of the Jobs and Growth Tax Relief Reconciliation Act of 2003 is to tax dividends at the same rate as capital gains, 15%. Since REITs are excluded from the 2003 Tax Reform Act, the passage of the Act should not have any major impact on the ex-dividend pricing of REITs.

[3] Graham et al. (2003) show that the premium from close-to-close prices is very similar to the premium from close-to-open prices and conclude that "there is no substantial drawback to using closing prices for ex-day analysis" (p. 2626).

In a market with no offsetting changes in transaction and execution costs, micro-market theory would postulate that the premium will increase, abnormal returns will decrease and abnormal trading volume will increase with the reduction of discreteness limitations in ex-divided stock pricing.

In order to evaluate the impact of the size of a stock's bid-ask spread relative to its dividend amount, which is an additional cost measure, transaction cost is estimated, similar to Bhardwaj and Brooks (1999), using the bid-ask spread-to-dividend ratio (SDR). The SDR for REIT i on dividend event day t is calculated as:

$$SDR_{it} = \frac{Ask_{ex,it} - Bid_{ex,it}}{Div_{it}} \tag{7}$$

where

Ask_{ex} is the average ask prices in the last 15-min of trading on the ex-date, and
Bid_{ex} is the average bid prices in the last 15-min of trading on the ex-date.

The average bid and ask prices in the last 15-min of trading are taken from TAQ transaction data. The final sample requires the availability of all information in both CRSP and TAQ databases. This restriction reduces the number of observations, especially during the 1/8th era.[4] The SDR should decline as the dividend amount increases and with the advent of decimal pricing.

Empirical Results

The relationship between dividend amount and the ex-dividend date change in stock price is evaluated to discern any discreteness or transaction cost induced premiums or abnormal returns. Since smaller dividends are more likely to be affected by transaction costs and discreteness related tick constraints, it is essential to differentiate the impact of transaction costs, including discreteness, with changes that may be caused by increasing dividend yields. Because REITs typically have high dividend yields, little correlation between dividend amount and dividend yield (−0.06 for the overall data used in this study), are required to pay out a large portion of operating cash flow (FFO), which limits capital formation and reduces agency costs, and have a tax structure and return characteristics weighted to the generation of current income to all investors, REITs provide an excellent means to evaluate dividends, yield, and the impact of decimalization on ex-dividend date stock prices.

Table 1 provides descriptive information and statistics for NYSE listed REITs including the ex-date premium, the ex-date spread-to-dividend ratio (SDR), the ex-date abnormal return, and dividend yield. The data are sorted for the 1/8th, 1/16th, and decimal pricing periods. Similar to Graham et al. (2003), the upper and lower 2.5 percentiles of the ex-date premium distribution in each pricing period are excluded from the analyses to minimize the influence of outliers. For REITs, the mean ex-date premium increases from 0.8039 for the 1/8th period, to 0.8202 for the 1/16th period, and then to 0.8881 for the decimal period. The improvement in ex-

[4] The initial CRSP sample size is 1,630 observations for the 1/8th period, 1,813 observations for the 1/16th period, and 1,256 observations for the decimal period.

Table 1 Descriptive statistics of the ex-date premium, ex-date bid-ask spread-to-dividend ratio (SDR), ex-date abnormal return, and dividend yield grouped by era for REITs listed on the NYSE that paid taxable quarterly cash dividends between $0.125 and $0.75

	1/8th era				1/16th era				Decimal era			
	Prem.	SDR	Ab. ret.	Yield	Prem.	SDR	Ab. ret.	Yield	Prem.	SDR	Ab. ret.	Yield
Mean	0.8039	0.5836	0.0032	1.9771	0.8202	0.5271[a]	0.0031	2.0674[a]	0.8881[b]	0.3070[b]	0.0009[b]	1.9307[b]
t-value	8.96	46.79	7.21	96.77	10.20	72.79	8.06	113.04	6.42	110.10	2.98	137.05
Std dev	0.6371	0.2590	0.0130	0.5946	0.6639	0.2446	0.0144	0.6887	0.5868	0.2119	0.0107	0.4742
Median	0.8065	0.5405	0.0029	1.9401	0.8333	0.4943	0.0032	1.9451	0.8819	0.2547	0.0011	1.8868
Minimum	−1.0000	0.1374	−0.0526	0.4354	−1.0870	0.0871	−0.0692	0.3060	−0.4340	0.0169	−0.0437	0.7082
Maximum	2.4590	2.6786	0.0743	13.6842	2.5187	2.0196	0.0689	9.4118	2.4815	1.6568	0.0612	5.5339
Obs	847	847	847	847	1418	1418	1418	1418	1133	1133	1133	1133

[a] Statistically significant (5% level) difference between the 1/8 and 1/16 eras

[b] Statistically significant (5% level) difference between the 1/16 and decimal eras

The ex-date premium is calculated as $(P_{cum} - P_{ex})/\text{Div}$. The ex-date spread-to-dividend ratio is calculated as $(Ask_{ex} - Bid_{ex})/Div$. The ex-date abnormal return is calculated as $((P_{ex} - P_{cum} + \text{Div})/P_{cum}) - E(R)$ where *E(R)* is the expected return from the market model. The dividend yield is calculated as $(\text{Div}/P_{cum}) \times 100$. The 1/8th era is from January 1, 1994 to May 6, 1997. The 1/16th era is from June 24, 1997 to August 26, 2000. The decimal era is from January 29, 2001 to December 31, 2003. The absolute *t*-value for premium and SDR is to test the null hypothesis that premium and SDR are different from one. The absolute *t*-value for abnormal return and yield is to test the null hypothesis that abnormal return and yield are different from zero

Table 2 Descriptive statistics of the ex-date premium, ex-date bid-ask spread-to-dividend ratio (SDR), ex-date abnormal return, and dividend yield grouped by dividend amount (between $0.125 and $0.75) and by era for REITs listed on the NYSE that paid taxable quarterly cash dividends

		1/8th era				1/16th era				Decimal era			
		Prem.	SDR	Ab. ret.	Yield	Prem.	SDR	Ab. ret.	Yield	Prem.	SDR	Ab. ret.	Yield
$0.125<Div≤$0.25	Mean	0.7433	0.8930	0.0036	1.8343	0.8780	0.8960	0.0019	1.9831	0.8946	0.6036[b]	0.0005	2.0435
	t-value	4.01	3.36	2.96	35.08	1.78	2.70	1.16	28.02	1.88	15.19	0.52	47.37
	Std Dev	0.7101	0.3529	0.0135	0.5800	0.7201	0.4042	0.0168	0.7424	0.6464	0.3010	0.0121	0.4974
	Median	0.6250	0.8523	0.0044	1.8519	0.8726	0.9160	0.0015	2.0408	0.8800	0.5869	0.0015	2.0210
	Obs	123	123	123	123	110	110	110	110	133	133	133	133
$0.25<Div≤$0.375	Mean	0.8232	0.6446	0.0030	2.0309	0.7960	0.6120	0.0040	2.1737[a]	0.8988	0.3588[b]	0.0011[b]	2.0598[b]
	t-value	3.83	20.81	2.83	58.11	5.86	31.12	4.77	48.05	2.55	45.58	1.36	59.45
	Std Dev	0.6100	0.2259	0.0141	0.4623	0.6608	0.2365	0.0158	0.8583	0.6003	0.2129	0.0118	0.5243
	Median	0.8065	0.6466	0.0014	1.9868	0.8333	0.6204	0.0035	1.9521	0.9189	0.3356	0.0011	2.0781
	Obs	175	175	175	175	360	360	360	360	229	229	229	229
$0.375<Div≤$0.50	Mean	0.8191	0.5308	0.0029	1.9984	0.7936	0.4956[a]	0.0034	2.0075	0.8863[b]	0.2637[b]	0.0008[b]	1.8508[b]
	t-value	5.68	53.34	4.89	96.38	7.38	71.73	5.95	83.47	3.54	92.37	1.40	91.45
	Std Dev	0.6283	0.1735	0.0118	0.4089	0.6581	0.1655	0.0133	0.5661	0.6133	0.1521	0.0106	0.3861
	Median	0.8333	0.5357	0.0032	1.9422	0.8013	0.5094	0.0040	1.9255	0.8739	0.2349	0.0012	1.8229
	Obs	389	389	389	389	554	554	554	554	364	364	364	364
$0.50<Div≤$0.625	Mean	0.8189	0.4273	0.0038	1.8919	0.8015	0.4021	0.0038	2.0651[a]	0.8726	0.2306[b]	0.0012[b]	1.8909[b]
	t-value	3.16	50.32	3.03	61.91	4.98	75.90	4.78	56.06	4.15	130.11	2.23	63.83
	Std Dev	0.6333	0.1257	0.0140	0.3375	0.6747	0.1332	0.0136	0.6229	0.5292	0.1019	0.0096	0.5106
	Median	0.8197	0.4397	0.0027	1.8716	0.7955	0.4154	0.0037	1.9596	0.8780	0.2224	0.0009	1.8689
	Obs	122	122	122	122	286	286	286	286	297	297	297	297
$0.625<Div≤$0.75	Mean	0.7068	0.3432	0.0040	2.2469	1.0282[a]	0.3613	−0.0022[a]	2.1123	0.9062	0.1903[b]	0.0009[b]	1.8978[b]
	t-value	2.90	37.91	1.64	7.24	0.50	64.26	1.70	31.30	1.79	98.14	1.03	47.07
	Std Dev	0.6240	0.1068	0.0150	1.9128	0.5823	0.1033	0.0132	0.7013	0.5495	0.0865	0.0096	0.4229
	Median	0.7937	0.3746	0.0022	1.9469	1.0198	0.3797	−0.0006	1.8688	0.8692	0.1707	0.0014	1.8433
	Obs	38	38	38	38	108	108	108	108	110	110	110	110

[a] Statistically significant (5% level) difference between the 1/8 and 1/16 eras

[b] Statistically significant (5% level) difference between the 1/16 and decimal eras

date premium is statistically significant at the 5% level when the discrete trading regime is compared with the decimal regime. Although the *t*-value rejects the hypothesis that the average ex-date premium is equal to 1, the dollar profit is small. During the 1/8th period, the average price drop measured as $P_{cum}-P_{ex}$ is \$0.3337 while the average dividend is \$0.4136 for a difference of \$0.08. During the 1/16th period, the average price drop is \$0.3575 while the average dividend is \$0.4328 for a difference of \$0.08. During the decimal period, the average price drop is \$0.3955 while the average dividend is \$0.4458 for a difference of \$0.05. The median ex-date premium has an increasing pattern similar to the mean's, suggesting that the results are not driven by outliers. In comparison, the median and mean ex-date premium exhibit a declining trend in Graham et al. which use non-REIT data. The higher ex-date premium with a reduction in pricing constraints implies a net reduction in transaction costs inclusive of the cost of discreteness for REITs with decimalization.

The mean ex-date abnormal return for REITs moves from 0.32% for the 1/8th period, to 0.31% for the 1/16th period, to 0.09% for the decimal period. These results also differ from the results in Graham et al. (2003) which use non-REIT data and show no reduction in abnormal returns. Although the mean returns for REITs are statistically different from zero at the 1% level for each period, the dollar profit is minimal. With an average stock price the day before the ex-dividend date of \$21.99 for the 1/8th period, \$22.84 for the 1/16th period, and \$24.63 for the decimal period, these abnormal returns are equivalent to profits of \$0.07, \$0.07, and \$0.02, respectively. Similar to the results for the ex-date premium, the reduction in abnormal return is statistically significant at the 5% level when the discrete trading regime is compared to the decimal trading regime. The dividend yield across all eras is relatively high, around 2% per quarter indicating that ex-dividend pricing improves in an overall high yield environment. The results support a net reduction in micro-market costs, inclusive of discreteness induced costs, as pricing moves to decimalization.

In order to evaluate whether traders and investors could possibly benefit from changes generated from the move to decimal pricing, the bid-ask spread-to-dividend ratio (SDR) is generated. Bhardwaj and Brooks (1999) argue that lower SDR ratios below one are associated with trading opportunities for short-term traders while higher SDR ratios indicate the lack of short-term trading opportunities. The SDR for REITs for the 1/8th period is 0.5836, for the 1/16th period is 0.5271, and for the decimal period is 0.3070. In all periods, the SDR for REITs is below 1.0 indicating that liquidity traders will likely have an impact on ex-dividend REIT pricing. Concurrently, the reduction in REIT SDRs is statistically significant at the 5% level when the discrete trading regime is compared to the decimal trading regime. This would be expected given REIT investors' knowledge that the majority of REIT returns have historically come from dividends and a reduction in discreteness imposed constraints on stock re-pricing and the bid-ask spread. This reduction in the bid-ask spread with decimalization is consistent with Bessembinder (2003).

In Table 2, the ex-date premium, SDR, ex-date abnormal return, and dividend yield are grouped by dividend size in 1/8th increments. The ex-date premium increases in four of the five dividend subgroups when the discrete trading era is compared to the decimal trading era. In the decimal period, the ex-date premium is

stable across the dividend amount subgroups while the dividend yield across the dividend amount subgroups is high and constant. The implication is that the relationship between dividend yield and ex-date premium is essentially eliminated when discreteness and execution costs are reduced.

Analysis of the ex-date abnormal returns is also supportive of a transaction cost, discreteness hypothesis. The appearance of any ex-date abnormal returns disappears as the market moves toward decimalization (the 11th column). The change in ex-date abnormal returns across regimes supports more efficient pricing with the elimination of the appearance of systematic abnormal returns. In the 1/8th era, four of the five dividend amount groups generate statistically significant abnormal ex-date returns, while in the decimal era, four of the five groups do not generate statistically significant abnormal ex-date returns. Additionally, four of the five dividend amount groups evidence statistically significant reductions in abnormal ex-date returns at the 5% level between eras. When holding dividend yield high and relatively constant (see the fourth, eighth and twelfth columns), in the case of REITs, it appears that discreteness and implied execution costs have been primary constraints in ex-dividend price movements.

These initial results indicate that REIT ex-dividend price efficiency might also be impacted by the relationship between share price and bid-ask spread. As the bid-ask spread is reduced with decimalization, the SDR measure should improve. As shown in Table 2, with the move to decimal pricing the SDR measure does improve across all dividend subgroups. The dividend subgroup SDRs in the decimal period are lower and statistically significant at the 5% level when compared to the discrete period SDRs. Concurrently, a downward SDR pattern as the dividend amount increases is shown for all pricing eras (the second, sixth, and tenth columns) even though dividend yield remains high and relatively constant across each dividend subgroup. This pattern contrasts with the work of Bhardwaj and Brooks (1999) which shows an inverse relationship between dividend yield and SDRs of less than one and proposes a tax related effect. In the case of REITs, lower SDRs are related to dividend amount and not dividend yield. Since dividend size and yield are not correlated in REITs, it is likely that the pattern shown is more reflective of transaction and execution costs which will have a greater impact on smaller dividends, than a tax-related trading strategy.

Finally, the transaction cost and discreteness cost theory of ex-dividend pricing implies increased trading volume around the ex-dividend date event as the market moves to decimalization. In Table 3, abnormal trading volume around the ex-dividend date is evaluated. During all three pricing regimes, trading volume is statistically higher than normal around the ex-dividend date as would be expected from an asset class that gets substantial returns from the payment of dividends and can be valued using a dividend pricing model (Kallberg, Liu, & Srinivasan, 2003). On the ex-dividend day 0, the average abnormal trading volume in REITs increases from 10.49% for the 1/8th period to 30.60% for the 1/16th period and to 83.26% for the decimal period with the abnormal trading volume during the 1/16th period being statistically higher than the abnormal trading volume during the 1/8th period at the 5% level and with the abnormal trading volume during the decimal period being statistically significant and higher than the abnormal trading volume during the 1/16th period at the 5% level. The increase in abnormal trading volume indicates

Table 3 Abnormal trading volume grouped by era for REITs listed on the NYSE that paid taxable quarterly cash dividends between $0.125 and $0.75 from January 1994 to December 2003

Abnormal volume by event day and by dividend amount			
Panel A: abnormal volume by event day			
Event day	1/8th era	1/16th era	Decimal era
−5	0.0645 (1.26)	0.0232 (0.85)	0.0667 (2.74)
−4	0.0238 (0.72)	0.0791 (2.41)	0.1022 (3.75)
−3	0.0665 (1.24)	0.1136 (2.60)	0.1273 (3.14)
−2	0.1658 (1.64)	0.0493 (1.84)	0.0858 (3.49)
−1	0.6206 (6.68)	0.4299 (8.51)	0.8943[b] (4.59)
0	0.1049 (2.54)	0.3060[a] (3.69)	0.8326[b] (4.18)
1	0.5807 (3.34)	0.1738[a] (3.62)	0.2570 (3.20)
2	2.6032 (7.13)	2.0992 (9.24)	1.9831 (7.74)
3	0.0969 (1.37)	0.1115 (2.30)	0.0524 (1.75)
4	0.3106 (1.84)	0.1208 (2.57)	0.0838 (2.02)
5	0.1304 (1.52)	0.0178 (0.39)	0.1264 (2.39)
Panel B: ex-date abnormal volume by dividend amount			
Dividend amount	1/8th era	1/16th era	Decimal era
$0.125<Div≤$0.25	0.1037 (0.83)	0.0382 (0.53)	0.4319[b] (2.70)
$0.25<Div≤$0.375	0.1068 (1.38)	0.1134 (1.56)	0.5447[b] (3.95)
$0.375<Div≤$0.50	0.1229 (1.83)	0.4613[a] (2.92)	0.4607 (3.72)
$0.50<Div≤$0.625	0.1173 (1.38)	0.1919 (2.57)	0.1968 (3.10)
$0.625<Div≤$0.75	−0.1236 (−1.20)	0.7258 (1.11)	4.8637[b] (2.51)

t-statistics are in parentheses
[a] Statistically significant (5% level) difference between the 1/8 and 1/16 eras
[b] Statistically significant (5% level) difference between the 1/16 and decimal eras

that as transaction cost declines, short-term investors, arbitrageurs, and dividend capture traders trade heavily around the ex-dividend date. The inverse relationship between abnormal trading volume and transaction cost is consistent with Lakonishok and Vermaelen (1986). In comparison, the abnormal trading volume for non-REITs as measured by Graham et al. (2003) remains relatively stable around the ex-date.

In Panel B of Table 3, the abnormal trading volume on the ex-dividend date is grouped by dividend size in 1/8th increments. This allows a cleaner evaluation of the relationship between the actual dividend amount (size) and increased abnormal trading volume. Only one of the groups shows statistically significant increases in abnormal trading volume for the 1/8th regime. In the decimal regime, all of the groups evidence statistically significant increases in abnormal trading volume on the ex-date. The increased abnormal trading volume in the decimal period is especially driven by the increased abnormal trading volume for stocks with dividends in the lower two dividend subgroups ($0.125<Div≤$0.25 and $0.25<Div≤$0.375) and the upper dividend subgroup ($0.625<Div≤$0.75). For the decimal period, these three groups evidence substantial and statistically significant increases in abnormal trading volume on the ex-dividend date when compared to the 1/16th period. As pricing becomes more efficient, trading volume in REITs with smaller dividends increases.

In the case of REITs, the movement to decimalization substantially reduces the appearance of a tax-clientele return pattern when modeled by ex-date premium, ex-

date SDR or ex-date abnormal return. When dividends are segmented by amount, there is little appearance of any ex-date abnormal returns, especially in the decimal period. In all pricing regimes, the REIT SDR measures indicate pricing efficiency and the importance of liquidity traders with a reduction in SDRs for stocks with larger dividend amounts and with decimalization. During the decimal regime, ex-date abnormal trading volume increases substantially, especially for stocks with small and large dividends. This implies that pricing has improved with decimalization as the market can more effectively price ex-dividend REIT stocks. The results are also supportive of Skinner and Gilster's (1990) argument that investor clienteles, which are based on investor return preferences, are not dependent on the existence of a tax-clientele effect.

Summary

Using the REIT asset class which evidences little correlation between dividend amount and dividend yield, it is shown that discreteness and other transaction and order execution costs have likely been primary constraints in re-pricing ex-dividend stocks. With the introduction of decimal pricing, the market more efficiently prices ex-dividend REIT stocks. For REITs, the ex-date premium improves and the ex-date abnormal return decreases as pricing shifts from a fractional basis to a decimal basis. The REIT SDR measure improves over the trading regimes indicating the importance of liquidity traders in pricing REITs and discreteness related limitations in the generation of the bid-ask spread. Trading volume also increases with the move to decimalization as would be expected in a more efficiently priced market. The results support the discreteness and transaction cost hypotheses of ex-dividend date re-pricing. By using an asset class where dividend size and dividend yield are uncorrelated, it is shown that the well-known results from empirical studies of ex-dividend stock pricing can be caused by the interaction between transaction costs and dividend amount and not dividend yield as required by the tax-clientele hypothesis. Further studies incorporating the potential impact of firm leverage, industry capital structures, and investor clienteles can shed additional light on the ex-dividend pricing of REITs and stocks in general. The movement toward substantial institutional ownership of stocks, program trading, and differences in execution prices are also areas that need to be addressed within the literature as they impact transaction costs and market efficiency.

References

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

Bessembinder, H. (2003). Trade execution costs and market quality after decimalization. *Journal of Finance and Quantitative Analysis, 38*, 747–777.

Bhardwaj, R. K., & Brooks, L. D. (1999). Further evidence on dividend yields and the ex-dividend day stock price effect. *Journal of Financial Research, 22*, 503–514.

Boyd, J. H., & Jagannathan, R. (1994). Ex-dividend price behavior of common stocks: fitting some pieces of the puzzle. *Review of Financial Studies, 7*, 711–741.

Campbell, J. A., & Beranek, W. (1955). Stock price behavior on ex-dividend dates. *Journal of Finance, 10*, 425–429.
Chakravaty, S., Wood, R. A., & Van Ness, R. A. (2004). Decimals and liquidity: A study of the NYSE. *Journal of Financial Research, 27*, 75–94.
Dubofsky, D. A. (1992). A market microstructure explanation of ex-day abnormal returns. *Financial Management, 21*, 32–43.
Durand, D., & May, A. M. (1960). The ex-dividend behavior of American telephone and telegraph stock. *Journal of Finance, 15*, 19–31.
Eades, K. M., Hess, P. J., & Kim, E. H. (1984). On interpreting security returns during the ex-dividend period. *Journal of Financial Economics, 13*, 3–34.
Elton, E. J., & Gruber, M. J. (1970). Marginal stockholder tax rates and the clientele effect. *Review of Economics and Statistics, 52*, 68–74.
Frank, M., & Jagannathan, R. (1998). Why do stock prices drop by less than the value of the dividend? Evidence from a country without taxes. *Journal of Financial Economics, 47*, 161–188.
Graham, J. R., Michaely, R., & Roberts, M. R. (2003). Do price discreteness and transaction costs affect stock returns? Comparing ex-dividend pricing before and after decimalization. *Journal of Finance, 58*, 2611–2635.
Hardin, W. G. III, Liano, K., & Huang, G. (2002). The ex-dividend pricing of REITs. *Real Estate Economics, 30*, 533–549.
Jakob, K., & Ma, T. (2004). Tick size, NYSE rule 118, and ex-dividend day stock price behavior. *Journal of Financial Economics, 72*, 605–625.
Kalay, A. (1982). The ex-dividend day behavior of stock prices: A re-examination of the clientele effect. *Journal of Finance, 37*, 1059–1070.
Kallberg, J. G., Liu, C. H., & Srinivasan, A. (2003). Dividend pricing models and REITs. *Real Estate Economics, 31*, 435–450.
Karpoff, J. M., & Walking, R. A. (1988). Short-term trading around ex-dividend days: Additional evidence. *Journal of Financial Economics, 21*, 291–298.
Koski, J. L. (1996). A microstructure analysis of ex-dividend stock price behavior before and after the 1984 and 1986 tax reform acts. *Journal of Business, 69*, 313–338.
Lakonishok, J., & Vermaelen, T. (1983). Tax reform and ex-dividend day behavior. *Journal of Finance, 38*, 1157–1179.
Lakonishok, J., & Vermaelen, T. (1986). Tax-induced trading around ex-dividend days. *Journal of Financial Economics, 16*, 287–319.
Michaely, R. (1991). Ex-dividend day stock price behavior: The case of the 1986 tax reform act. *Journal of Finance, 46*, 845–860.
Miller, M. H., & Scholes, M. S. (1982). Dividends and taxes: Some empirical evidence. *Journal of Political Economy, 90*, 1118–1141.
Miller, M. H., & Modigliani, F. (1961). Dividend policy, growth, and the valuation of shares. *Journal of Business, 34*, 411–433.
Skinner, D. L., & Gilster, J. E. Jr. (1990). Dividend clienteles, the tax-clientele hypothesis and utilities. *The Financial Review, 25*, 287–296.