



Dividend Policy and Cash-Flow Uncertainty

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We explore the role of expected cash-flow volatility as a determinant of dividend policy both theoretically and empirically. Our simple one-period model demonstrates that, given the existence of a stock-price penalty associated with dividend cuts, managers rationally pay out lower levels of dividends when future cash flows are less certain. The empirical results use a sample of REITs from 1985 to 1992 and confirm that payout ratios are lower for firms with higher expected cash-flow volatility as measured by leverage, size and property-level diversification. These results are consistent with information-based explanations of dividend policy but not with agency-cost theories.

Dividend policy is at the very core of corporate finance. The fundamental value relation of corporate finance is couched in terms of dividends: the value of an all-equity firm is equal to the present value of all future dividends. Therefore it is not surprising that in a recent survey on dividend policy, Allen and Michaely (1994) cite close to 100 articles. Despite this voluminous literature, a number of key issues remain unresolved, and clear guidelines for an “optimal payout policy” have not emerged.

In this research, we examine the link between cash-flow volatility and dividend payout both theoretically and empirically. Although many studies¹ find that firms with higher systematic risk coefficients (betas) offer lower dividend yields, we argue that the volatility of cash available for dividends is affected by both market-wide and firm-specific factors. Thus, both sources

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¹ For example, Beaver, Kettler and Scholes (1970), Miller and Scholes (1982) and Rozeff (1982).

of volatility, rather than just market-related volatility, must be examined.² This hypothesis is best tested on data from one industry where cross-observation variations in betas are overwhelmed by variations in the firm-specific component. Our laboratory for testing is the REIT industry from 1985 to 1992. As a result, our study highlights the importance of firm-specific volatility and its determinants.

Examining the link between cash-flow volatility and dividend payout provides a novel method for distinguishing between the agency-cost and signaling theories of dividends. According to the agency-cost hypothesis, dividend payouts serve to reduce agency costs. By distributing free cash flows in the form of a dividend, management can divert fewer funds to projects that are in their best interests, but not in the interests of their shareholders. Firms with high cash-flow volatility are also those with the greatest potential agency costs. When cash flows are variable, it is difficult for investors to accurately attribute deviations in cash flows to the actions of corporate managers or to factors beyond management's control. Thus, the higher the expected variance in cash flows, the greater the potential agency costs, and the greater the reliance on dividend distributions. The value of dividend payout as a guarantee against non-value-maximizing investments should be greatest for those firms with the greatest cash-flow uncertainty. Therefore, the agency-cost theory predicts that firms with volatile cash flows will, on average, pay out a greater proportion of their cash flows in the form of a dividend.

In contrast, the information-content or signaling hypothesis predicts a relation of the opposite sign. In a signaling equilibrium where there is a discrete stock price or shareholder wealth "penalty" associated with cutting dividends, entrepreneurs and managers have incentives to avoid these penalties. One way to do so is to choose a dividend policy where announced dividends are less than expected income, which allows managers to maintain dividends even if subsequent cash flows are lower than anticipated. This

² Eades (1982) and Alli, Khan and Ramirez (1993) examine the relations between total equity return volatility and dividend yields, with mixed results. Eades finds that dividend yield is negatively related to both total contemporaneous volatility and residual risk, while Alli, Khan and Ramirez fail to find a significant relation. These studies use contemporaneous (Eades) or lagged (Alli, Khan and Ramirez) stock return volatility as a proxy for cash-flow volatility. In contrast, we use *ex ante* firm-specific predictors of the volatility of available cash over the coming year. Since our theoretical model centers on avoiding future dividend cuts, we believe that this approach more accurately reflects the information possessed by managers when setting dividend policy.

leads to the prediction in our model that when future cash flows are more volatile, dividend payout ratios will be lower.

To test this hypothesis, we exploit the power of a unique database drawn from the high-dividend REIT industry. Limiting our empirical examination to the REIT industry provides an important advantage. Many prior empirical studies examine inter-industry data to investigate the determinants of dividend policy. With cross-industry data, however, it is difficult to distinguish between industry effects on the one hand, and the factors that determine dividend policy on the other. By concentrating on a single industry, any industry effects are eliminated. In essence, by restricting attention to one industry, the necessity of controlling for cross-industry effects is made moot and the need for independent variables that are designed to “hold other things constant” is eliminated.

Using a sample of 75 equity REITs over the 1985–1992 period, we first confirm the relation between changes in share prices and changes in dividends found in other research. Regardless of whether we measure the price changes associated with changes in dividends over a three-day announcement period or over an entire fiscal year, we confirm that there is a significant fixed “penalty” component associated with dividend cuts.

We then examine the relation between payout rates and the volatility of underlying cash flows. Rather than using a historical measure of volatility as an estimate of expected future volatility, we exploit the homogeneity of our sample and of the assets owned by the firms to estimate a reduced-form equation that includes the determinants of cash flow volatility.³

Our statistical results strongly confirm a negative relation between expected cash-flow volatility and dividend levels. Those REITs with higher expected cash-flow volatility (greater leverage, smaller asset base or an asset base that is undiversified) offer lower dividend payout rates. The sign of this relation

³ Recent empirical evidence indicates that the individual assets possessed by REITs have similar systematic risk (Geltner 1989, Gyourko and Keim 1992). Consequently, differences in the volatility of the individual properties in a REIT’s investment portfolio are due primarily to differences in idiosyncratic or diversifiable risk (*e.g.*, property type, location and local economic conditions). Thus, according to standard portfolio theory, the (total) volatility of a REIT’s cash flow will fall with an increase in the number of properties held, and the extent to which the properties are of a different type (residential, commercial or recreational) and are located in different geographical regions. From standard corporate finance theory, financial leverage is also a determinant of the volatility of cash flows available to equity holders.

suggests that the information-content or signaling effects dominate the agency-cost effects.

A unique characteristic of REITs is their exemption from federal income tax on net income, provided that they satisfy certain IRS requirements. The primary requirement is that they limit their investments to the purchase, sale and maintenance of real estate properties. The second important restriction is that they pay out at least 95% of their net income in the form of a dividend.

It can be argued that the unique requirements for qualification, and especially the mandatory 95% payout restriction, make it difficult to generalize from results for this industry. However the 95% restriction is less binding than it appears. Because depreciation expense allows available cash flow to exceed net income, managers retain a great deal of discretion in setting their dividend policy.⁴ In our sample, dividend payouts are about twice net income on average. Thus, even in this dividend-constrained industry, managers retain wide discretion over dividend payouts. Therefore, this industry may not be as unique as it appears initially, and these relations may be generalizable to a less restrictive environment as well.

In the next section, we present a simple one-period model that establishes the link between, and motivates our tests of, dividend payout policy and the uncertainty of future cash flows. In the third section, we outline our empirical methodology. The fourth section describes our data set and briefly reviews the relevant regulations for REIT dividend payouts. In the next section, we evaluate the response of equity values to changes in dividends. Our main empirical findings linking cash-flow uncertainty and dividend payout ratios appear in the following section. The implications of our findings are reviewed in a concluding section.

Cash-Flow Volatility and Dividend Payout: A Model

In this section we develop a simple one-period, two-date model with risk neutral agents to illustrate the effect of cash-flow uncertainty on dividend policy when there is a valuation penalty for failure to meet a dividend target. The time line in Figure 1 provides the sequence of events.

Our model is in the spirit of Eades (1982). We assume that firms operate in a dividend-signaling world as modeled in Bhattacharya (1979) or Miller and

⁴ See Wang, Erickson and Gau 1993; Lee and Kau 1987; Shilling, Sirmans and Wansley 1986; Corgel, McIntosh and Ott 1995.

Figure 1 ■ Time line.



Rock (1985). At time zero, an entrepreneur wishes to finance a project with capital cost K . Ignoring risk and the time value of money, *i.e.*, assuming a zero interest rate, the present value of the project is $V_0 = V_0(EY)$, where EY is the expected cash flow from the project during the period. To finance the project the entrepreneur sells a fraction of the project, a , to the public, but first signals the value of the project by announcing a dividend, D . The dividend is announced at time 0 and paid (if possible) at time 1. Conditioning on the announced dividend, the public (outside investors) values the project at $P_0 = P_0(D)$ with $dP_0/dD > 0$. Given the public valuation of the project, P_0 , and the needed capital, K , the entrepreneur sells the fraction $a = K/P_0$ to the public and retains the fraction $1 - a = 1 - K/P_0$ of the project. For example, if, conditional on the dividend, the public values the project at \$110 million and K , the required capital, is \$100 million, then the entrepreneur sells \$100 million of equity, which represents a 90.9% share of the project. The entrepreneur retains 9.1%. Notice that when $P_0 = V_0$, the entrepreneur retains the full net present value (NPV) of the project, $V_0 - K$; however, when $P_0 < V_0$, the outside investors capture some of the NPV.

At time 1, the cash flow Y from the project becomes known. If the cash flow is sufficient to pay the announced dividend, the value of the company is $P_1 = V_1(Y)$; but if the announced dividend exceeds the realized cash flow, the market assesses a penalty and $P_1 = V_1(Y)(1 - \pi)$ where π is a proportional penalty. Equivalently

$$P_1 = V_1(Y)(1 - I \pi) \quad (1)$$

where

$$I = \begin{cases} 1 & \text{if } Y < D \\ 0 & \text{if } Y \geq D \end{cases}$$

Signaling aggressively with a high dividend policy increases $1 - a$, the fraction that the entrepreneur retains, but also increases π , the probability of incurring the penalty, if cash flow is insufficient to support the dividend. At time 1 the entrepreneur sells her fractional share to investors at price P_1 ,

which includes the penalty if the dividend target has not been met. The wealth-maximizing entrepreneur will choose dividend policy D^* at time 0 to maximize

$$EW = (1 - a) EP_1. \quad (2)$$

If Y is distributed normally with mean μ and standard deviation σ , then

$$EI = N\left(\frac{D - \mu}{\sigma}\right) \quad (3)$$

where $N(\cdot)$ is the cumulative normal distribution function.

The first-order condition for maximizing (2) with respect to D is

$$(1 - a) \frac{\partial P_1}{\partial I} + \frac{K}{P_0^2} \frac{\partial P_0}{\partial D} EP_1 = 0. \quad (4)$$

The solution to (4) determines the optimal dividend, D^* . The second-order condition is negative, guaranteeing a maximum. Assuming linear valuation functions and implicitly differentiating (4) confirms that $dD^*/d\sigma < 0$, so that the optimal dividend, D^* , is decreasing in the variance of the cash flow.⁵

The optimal dividend balances the increase in the share of the firm retained by the entrepreneur as the announced dividend increases against the probability of incurring the penalty if the dividend is not realized. One consequence of the model is that, even though all agents are risk-neutral, the price at which the project can be sold to the public is decreasing in the total volatility of the firm's cash flow. For risky projects, $P_0 < V_0$, so that some of the NPV of the project is captured by the outside investors. The more risky the project, the lower are dividends D and the greater is the loss of value due to the signaling discount, $V_0 - P_0$. Empirically the model implies that both the expected earnings and the volatility of expected earnings should be included in an equation attempting to explain dividend policy.

⁵ This is also the Riley (1979) non-mimicking condition and holds for positive penalties π .

Empirical Implementation

To implement the analysis empirically, we examine variants of a return equation and a dividend equation. The return equation is

$$R_t - R_t^f = a + b(R_t^m - R_t^f) + c D_t + d \Delta D_t + e I_t \quad (5)$$

and, based on the model above, the dividend equation is

$$D_t = f + g E_t Y_{t+1} + h E_t \sigma_Y \quad (6)$$

where R_t , R_t^f and R_t^m are the total returns to a stock, a riskless asset and some market proxy, respectively, and D_t is the dividend yield (D/P). ΔD_t is the announced change in dividend yield in period t , Y_t is the cash flows available to shareholders during the period, I_t is an indicator variable of dividend reductions and $E_t \sigma_Y$ is the anticipated volatility of cash flows available to shareholders. The tax hypothesis predicts that c will be positive, while the signaling theory predicts that d will be positive.

Our empirical contributions to the dividend debate are centered around (6). The tax hypothesis makes no clear prediction for the relation between dividends and either the mean or the variance of anticipated future cash flows. However, signaling theories suggest that g should be positive, since higher dividends would be used as one avenue to signal higher subsequent cash flows.

It is the sign of h , the relation between expected cash-flow volatility and dividends, that is of primary importance to our study. The sign of h will allow us to distinguish between the agency cost and the signaling theories of dividends. As we outlined in the introduction, agency costs are greater for firms with highly variable cash flows, since investors are less capable of evaluating deviations in cash flows arising from managerial (in)discretion. For these firms, higher dividend yields are required to mitigate the retention and sub-optimal consumption of free cash flows. Under this agency-cost theory, h will be positive. In contrast, our model outlined above suggests that to avoid the penalty imposed when dividends are cut, managers will actually pay out smaller dividends when cash flows are more risky. Thus, our analysis predicts a negative relation between dividends and perceived volatility.

Unfortunately, Equation (6) contains unobservables, so that estimation must proceed indirectly. To control for the mean effects in $E_t Y$, we propose a

simple model of cash-flow forecasting. The model follows from the rational-expectations paradigm. Since

$$E_t Y_{t+1} = Y_t + E_t(Y_{t+1} - Y_t), \quad (7)$$

and

$$Y_{t+1} = E_t Y_{t+1} + u_{t+1}, \quad (8)$$

then

$$E_t Y_{t+1} = Y_t + (Y_{t+1} - Y_t) - u_{t+1}. \quad (9)$$

By appealing to rational expectations, we can use the actual change in cash flows ($Y_{t+1} - Y_t$) as a proxy for the expected change in cash flows [$(Y_{t+1} - Y_t) - u_{t+1}$].

To substitute for $E_t \sigma$ we choose a set of economic and financial variables, \mathbf{X} , that are known *a priori* to influence the volatility of cash flows. For example, we know that leverage will amplify the variability of cash flows. We then substitute these variables for $E_t Y$ and $E_t \sigma$ in (6) to obtain

$$D_t = f + g_1 Y_t + g_2 (Y_{t+1} - Y_t) + \sum h_i X_{it} \quad (10)$$

Our empirical models of dividend policy are based on (10). Since the expected change in cash flows is measured with error, we expect the coefficient associated with that component, g_2 , to be biased towards zero (Pagan 1984).

Data

The data for this study are taken from the equity REIT database described in Capozza and Lee (1995). This database is a subset of the REITs listed in the National Association of Real Estate Investment Firms (NAREIT) source books, which list all publicly traded REITs during the years 1985–1992. This database focuses on equity REITs and excludes all mortgage, hotel, restaurant, and hospital REITs; REITs that do not trade on NYSE, AMEX, or Nasdaq; and REITs for which property information is not available. These exclusions lead to a sample of 75 REITs, which are listed in Table 1. Given this list, Capozza and Lee construct one observation per firm for each of the years between 1985 and 1992. Of the 75 equity REITs, 32 appear in all eight years, with the remaining appearing for at least one year. This leads to a total of 416 observations.

Table 1 ■ The REIT sample.

*B R E Properties Inc	P S Business Parks Inc
Berkshire Realty Co Inc	Partners Preferred Yield Inc
*Bradley Real Estate Trust	Partners Preferred Yield II
Burnham Pacific Properties Inc	Partners Preferred Yield III
*California Real Estate Invt Tr	*Pennsylvania Real Est Invt Tr
Cedar Income Fund Ltd	*Property Trust Amer
Cedar Income Fund 2 Ltd	*Prudential Realty Trust
Chicago Dock and Canal Trust	Public Storage Properties VI
*Clevetrust Realty Investors	Public Storage Properties VII
*Continental Mortgage & Equity Tr	Public Storage Properties VIII
Copley Property Inc	Public Storage Properties IX Inc
Cousins Properties Inc	Public Storage Properties X Inc
Dial REIT Inc	Public Storage Properties XI Inc
Duke Realty Investments Inc	Public Storage Properties XII
*E Q K Realty Investors 1	Public Storage Properties XIV
*Eastgroup Properties	Public Storage Properties XV Inc
*Federal Realty Investment Trust	Public Storage Properties XVI
*First Union Real Est Eq&Mg Invts	Public Storage Properties XVII
Grubb & Ellis Realty Inc Trust	Public Storage Properties XVIII
*H R E Properties	Public Storage Properties XIX
*I C M Property Investors Inc	Public Storage Properties XX
*I R T Property Co	*Real Estate Investment Trust Ca
Income Opportunity Realty Trust	Realty South Investors Inc.
Koger Equity Inc	*Santa Anita Realty Enterprises
Landsing Pacific Fund	Sizeler Property Investors Inc
Linpro Specified Pptys	*Trammell Crow Real Estate Invs
*M G I Properties Inc	*Transcontinental Realty Investors
*M S A Realty Corp.	*U S P Real Estate Investment Trust
*Meridian Point Realty Tr 83	*United Dominion Realty Tr Inc
*Meridian Point Realty Tr 84	Vanguard Real Estate Fund I
Meridian Point Realty Trust IV	Vanguard Real Estate Fund II
Meridian Point Realty Trust VI	Vinland Property Trust
Meridian Point Realty Trust VII	*Washington Real Est Invt Tr
Meridian Point Realty Trust VIII	*Weingarten Realty Investors
*Merry Land & Investment Inc	*Western Investment Real Est Tr
Monmouth Real Estate Invt Corp.	Wetterau Properties Inc
*New Plan Realty Trust	
*Nooney Realty Trust Inc	
*One Liberty Properties Inc	

The sample of REITs is drawn from the equity REIT database described in Capozza and Lee (1995). The database excludes all mortgage, hotel, restaurant, and hospital REITs, REITs that do not trade on NYSE, AMEX or Nasdaq, and REITs for which property information is not available. These exclusions lead to a sample of 75 REITs, which are listed here. Of them, 32 appear in all eight years and are marked *; the rest appear in at least one year.

Firm-specific information was gathered from 10-K reports, annual reports to shareholders and proxy statements augmented with stock price data from the CRSP daily return file. The database includes balance sheet, income statement and property variables from the 10-K reports.

The proxy we use to measure asset concentration (focus) is a Herfindahl index based on product-line data, which are also provided in the database. For each observation, we construct two Herfindahl indices. The first, *PropHerf*, is computed as $\sum_{k=1}^4 S_k^2$ where S_k is the proportion of a firm's assets invested in each of four property types: office, warehouse, retail or apartment. Higher levels of concentration by property type lead to higher levels of the index: if the firm is highly focused along one dimension, the index is close to one, while the index approaches 0.25 if the firm's portfolio of properties is equally diversified across the four property types. We also compute *RegHerf* as $\sum_{r=1}^8 S_r^2$, where S_r is the proportion of a firm's assets invested in each of eight real estate regions: New England, Middle Atlantic, Southeast, Midwest, Plains, Southwest, South Pacific, and North Pacific. This concentration variable can vary from 1 for a geographically concentrated REIT to 0.125 for a REIT with holdings equally diversified across the eight regions. The database also provides estimates of the market value of properties held and the net asset value (NAV) on a per-share basis.

Table 2 contains mean, standard deviation and extreme values on variables culled from the database that are used in this study. There is a large dispersion in the size of the firms considered here; book values of the property portfolios vary from \$2.1 million to about \$486 million, while book values of all assets vary up to \$604 million. Portfolio book values generally lie below market values, with a mean book-to-market ratio for properties of about 85%. There is considerable variation in the use of debt in the capital structure, with debt representing anywhere from 0 to 94% of the capital structure. Portfolio diversification also varies in the cross section. The Herfindahl indices vary across most of their feasible ranges.

Dividends and REITs

REITs are, by law, exempt from income taxation. As discussed above, to maintain their tax-exempt status, a REIT must pay out at least 95% of net income to shareholders in dividends. Although the 95% rule may appear stringent, REIT managers retain much discretion over the use of funds.

We can illustrate the magnitude of managerial discretion using data reported in Table 2. We report gross or property-level cash flows and expenses as a proportion of the market value of total assets. For our sample, property

Table 2 ■ Summary statistics.

Variable	Mean	Max	Min	Std. Dev.
Total assets (\$ million)	126.8	603.8	2.1	110.2
Property assets (\$ million)	94.7	485.7	2.1	85.3
Book-to-market ratio of property (%)	85.2	201.0	14.0	33.0
Book-to-market ratio of total assets (%)	87.0	166.0	20.0	26.0
Leverage ratio (%)	36.8	94.4	0.0	25.0
Property-type Herfindahl index (%)	65.3	100	25	23.5
Cash-flow yield (%)	8.9	58.0	0.0	5.1
G&A expenses/total assets (%)	1.1	7.5	0	1.1
Interest expense/total assets (%)	3.0	10.8	0	2.3
Depreciation expense/total assets (%)	2.5	6.3	0	1.1
Dividend yield (% of share price)	8.4	34	0	4.1
Dividends/funds from operations	1.1	5.4	0	0.59

This table reports means, standard deviations and extreme values for a number of summary statistics calculated across the sample of 416 observations for 75 firms. Total assets and property assets are book values. Total market assets are measured by estimated market value of properties plus the book value of other assets. The leverage ratio is defined as (book value of total liabilities)/(book value of total liabilities + market value of the equity). The property-type Herfindahl index is computed by summing the squared proportions of each of four asset classes (office, warehouse, retail and residential). The cash-flow yield is the property-level cash flows (rental income less property-level expenses including insurance, property taxes, maintenance and advertising) divided by total market assets. Funds from operations, or corporate-level cash flows, are property-level cash flows less interest and G&A expenses.

assets, on average, provide net operating income (property-level cash flows) of about 9% of assets. Of this 9%, 1% is consumed by overhead (general and administration, or G&A) expenses, and 3% by interest costs. The remaining 5% is equally split between depreciation expense and reported net income. As a result, managers are required to pay a dividend that is at least 95% of the 2.5% net income yield. However, their corporate cash flows available for distribution are roughly 5% of assets or about twice the required payout.

Highly levered REITs, of course, may have little or no accounting income, leaving managers with complete discretion over the use of funds. At the other extreme, even in a REIT without debt, managers still have significant discretion due to the 2.5% depreciation expense. Therefore, while the distribution requirement may reduce the discretion of managers, the limits are not constraining.

In the last rows of Table 2, we provide evidence of significant cross-sectional variation in dividend policy. Dividends expressed as a percentage of share price (dividend yield) vary widely.⁶ The interquartile range spans from 6.2% to 10.6%. Dividends expressed as a proportion of funds from operations (or cash available to shareholders calculated as property-level cash flows less interest and G&A expenses⁷) vary from their mean and median of 107% and 100%, respectively, with an interquartile range from 83% to 122%. Of the observations, 3% involve zero dividends.⁸ As discussed above, since cash flow is about twice net income on average in the sample, payouts are also about twice the level required by the 95%-of-net-income rule.

Stock Values and Changes in Dividends

In this section, we provide estimates of Equation (5) and confirm that the previously documented link between changes in dividends and changes in share price⁹ exists for our sample. Our novel contribution is to show that

⁶ Return of capital distributions from property sales and depressed equity REIT prices during part of the sample cause dividend yields to range as high as 34%.

⁷ Revenue from property sales is not included in our cash-flow measure, “funds from operations.”

⁸ Dividends can be omitted by a REIT if earnings are nonpositive. In the sample a few highly leveraged REITs were able to do so (EQK, Trammell Crow, Meridian 84).

⁹ See Pettit (1972); Charest (1978); Aharony and Swary (1980); Wang, Erickson and Gau (1993); Shilling, Sirmans and Wansley (1986).

there exists a fixed penalty associated with dividend reductions that is independent of the magnitude of the decrease.

We investigate the relation between dividends and share value over two distinct measurement horizons. First, we examine the relation between total equity returns over a year and concurrent changes in both dividends and cash available to shareholders. We supplement these findings by using traditional event study methodology to examine abnormal returns accumulated over three days surrounding announcements of dividend changes.

Evidence from Annual Data

We first examine the relation between share value and dividends using annual measurements. By employing annual data, we include annual funds from operations (FFO, or corporate level cash flows available to shareholders) in the specification. Including changes in both dividends and FFO in the specification allows us to test for the irrelevance of dividends. If shareholders are indifferent between receiving dividend income and capital gains, then shareholders should care about cash flows generated over the year but be indifferent to the amount of this cash that is distributed to them. Conditional on the inclusion of changes in FFO in the specification, the coefficient associated with changes in dividends should be zero.

In contrast, if shareholders face a greater rate of taxation on dividend than on capital gain income, or if capital gains provide the shareholder with a valuable option to recognize income at some future time, then the coefficient associated with changes in dividends should be negative, conditional on the inclusion of FFO. However, for reasons reviewed above, both the signaling hypothesis and the free-cash-flow hypothesis predict a positive coefficient associated with changes in dividends.

Table 3 provides the empirical specifications of the model. The dependent variable is the total rate of return to shareholders over a fiscal year. The two key independent variables are the differences in dividends per share and FFO per share. Both differences are scaled by dividing by the share price as of the beginning of the fiscal year over which the total return is measured. For example, we measure the change in dividends as the difference between the dividends paid in the four quarters of one fiscal year and the dividends paid in the four quarters of the previous fiscal year. This dollar change in dividends is scaled by the closing stock price at the end of the first fiscal year (the beginning of the second fiscal year) to obtain the change in the dividend yield.

Table 3 ■ The effects of changes in dividends on stock returns.

Independent Variable	Coefficient		Dependent Variable:	
	Annual Stock Return		Three-Day Abnormal Return	
	Model 1	2	1	2
Change in cash available for shareholders	2.4 (4.4)	2.4 (4.2)		
Change in Dividends	0.88 (1.9)	1.2 (1.8)	0.09 (7.3)	0.55 (19.4)
Reduction indicator	-0.11 (-2.8)	-0.14 (-3.1)	-0.01 (-13.5)	-0.01 (-15.3)
No-change indicator		-0.04 (-1.0)		-0.001 (-4.1)
(Reduction indicator) × (change in dividends paid)		-0.83 (-0.9)		-0.56 (-18.0)
Adjusted R ² (%)	42.3	42.4	2.0	4.0
F-test versus model 1	—	1.14	—	168.2**

Estimates of regressions of total returns on changes in dividends. The dependent variable is the total return (capital gains plus dividends) to a REIT over a fiscal year. To control for market-wide or industry-wide fluctuations, a series of annual intercepts are estimated but not reported. "Changes in cash available for shareholders" is the FFO (funds from operation or corporate level cash flows) per share in the observation year less the same number in prior year, with the difference divided by the share price as of the beginning of the observation year. "Changes in dividends" are also computed by taking annual differences of per share dividends paid and deflating by the share price at the beginning of the observations year. The reduction indicator equals 1 if dividends were lower in the observation year than in the previous year, and zero otherwise. The no-change indicator equals 1 if dividends were no different in the observation year than in the previous year, and zero otherwise. ** indicates significance at the 1% level. *t*-statistics are in parentheses.

The statistical power of this test is enhanced if we control for market-wide effects. Thus, we include annual intercepts (indicator variables) which represent average rates of returns for REITs with no changes in dividends or funds from operations.¹⁰

The estimates indicate that the coefficient associated with changes in FFO are reliably greater than zero. The magnitude of the coefficient indicates that each 1% increase in FFO over share price is associated with a 2.4% increase in share price. Of greater relevance, however, is the coefficient associated with changes in dividends, which is positive and significant. A positive and significant coefficient associated with changes in dividends, even after controlling for changes in FFO, is consistent with both the signaling and agency theories, suggesting that these effects outweigh any tax disadvantages to dividends. Further, the magnitude of the dividend coefficient is economically meaningful. If FFO per share increases by 1%, but dividends are unaltered, then agents revise their valuation of the present value of future dividends upwards by 2.4%. If, instead, this increase in FFO is accompanied by an increase in dividends that is also 1% of share price, then the share value increases by an additional 0.9% for a total effect of 3.3%.

We also impose the restriction that the slope linking changes in dividends to changes in share value is the same for dividend increases and decreases, but allow for a discontinuity in the function by including an indicator variable that equals one if there is a dividend decline and zero otherwise. Graphically, including this indicator variable allows the segment of the line to the left of zero to shift up or down by the amount of the coefficient associated with the indicator variable.¹¹

The coefficient associated with the dividend-decline indicator is significantly negative. This estimate suggests that there exists an 11% loss in share value

¹⁰ If expected or required rates of returns vary in the cross section, but this variation is uncorrelated with the two independent variables, then both estimation and inference are valid using this simple correction, although the statistical power may be adversely affected. Econometric concerns arise if the variation in required rates of return is correlated with either of the independent variables. However, we believe the effect of any such correlations would be small. First, recall that these variables are changes in dividends and FFOs and not levels. Therefore, arguments that riskier firms pay out higher *levels* of dividends or command higher FFO yields are irrelevant (see Maris and Elayan 1991). Second, by limiting our sample to one industry, we believe that cross-sectional variations in required rates of return are small.

¹¹ We have estimated variants of this model where the indicator variable was defined using changes in dividends other than zero. However, the specification using zero provided the best fit, and inferences remained unchanged for the alternative specifications.

or “penalty” associated with any dividend cut, regardless of the magnitude of the dividend cut. This penalty is assessed in addition to the proportional valuation effects in the change in dividend. For example, if a trust cuts its dividend by 1% of the beginning of year share price, the total return to the stock over the year will be, on average, 11.8% [= $-0.11 + 0.88(-0.01)$] lower than a stock with no change in dividends.

In the next column of Table 3, we consider an alternative functional form. We create an indicator variable that equals one if there is no change in dividends. This has the effect of allowing the fitted value associated with no change in dividends to differ from the limit as the change in dividend approaches zero from the right. We interact the dividend decline indicator with the change in dividend. By including this variable and the dividend decline indicator, we allow the intercept and the slope associated with dividend declines to vary from those associated with dividend increases.

In this alternative specification, coefficients associated with changes in FFO and the reduction indicator remain positive and significant. Further, the bottom row contains the *F*-statistic associated with the test of whether these models provide significantly greater explanatory power than the model presented in the first column. We cannot reject the first model in favor of the second. Of primary importance is the finding that the estimate of the dividend decrease penalty remains negative and significant. Further, the magnitude of this penalty is economically meaningful and exceeds 10% in each specification.

Announcement-Period Returns

In the right panel of Table 3, we re-examine the relation between changes in dividends and changes in share price using a measurement horizon that is more familiar to finance researchers. Specifically, we measure the abnormal share price behavior in the three days surrounding the CRSP-reported dividend announcement date. We report results using abnormal returns calculated by subtracting the product of market returns and firm-specific estimated betas from raw returns. Results are unchanged if mean-adjusted abnormal returns are used.

The estimates reported in the rightmost panel yield at least four interesting conclusions. First, estimates of coefficients from the three-day event horizon are roughly one-tenth their counterparts generated using an annual horizon. This contrast suggests that much of the share-price reaction to changes in dividends occurs at times outside the three-day announcement-period horizon. In well-functioning capital markets, changes in dividends are

anticipated (Ball and Brown 1968; Pettit 1972). Therefore it is not surprising to find that roughly 90% of the valuation effects occur outside the three-day announcement window.

Despite smaller point estimates, associated t -statistics are dramatically larger, with many exceeding 10 in absolute value. There are three potential sources for the increase in the magnitude of the t -statistics. First, by associating one observation with each quarterly dividend, rather than each year, our sample increases fourfold, thus reducing standard errors by a factor of two. Second, since we use quarterly data, we cannot construct a suitable corresponding quarterly change-in-FFO variable. Since changes in dividends and changes in FFOs are correlated, the standard errors in the annual specifications reflect this multicollinearity, while the standard errors in the quarterly specifications do not. Finally, since three-day returns are less variable than annual returns, the standard error of the dependent variable is smaller in the quarterly specification.¹²

Our third, and most important, conclusion is that, as with the annual specifications, there is a negative and significant “penalty” associated with dividend cuts. In each of the specifications, the coefficient associated with the reduction indicator equals about -1% with associated t -statistics that exceed 13 in absolute value, and, as we argued above, these coefficients capture only the unanticipated component of value revisions due to dividend cuts.

Finally, unlike its annual counterpart, the final specification suggests that the magnitude of the dividend reduction is not pertinent. In response to dividend increases, the share value increases by about half the increase in dividends (0.55). However, in response to dividend cuts, the relevant coefficient linking valuation with the magnitude of the dividend change is essentially zero (0.55–0.56). This suggests that for unanticipated dividend cuts, the fact that there is a cut is highly significant, but the magnitude of the cut is not.

Cash-Flow Volatility and Dividend Payout

The results in the previous section provide strong empirical support for the existence of a “penalty” associated with dividend cuts which was assumed

¹² It may appear paradoxical that standard errors are smaller and t -statistics are larger, yet R^2 s are smaller. Although this result is consistent with omitting an important variable in the quarterly specifications (FFO), we believe that it is instead due to our use of annual intercepts. In the annual panel these intercepts are highly significant, but they are insignificant in the quarterly three-day-horizon specifications.

in the model of Section 2. Trusts that reduce their dividends experience changes in value that are 10–15% lower than their contemporaries, even after controlling for changes in cash flows. This reduction is not fully anticipated before the announcement; dividend cuts are associated with a 1% value decline in the three days surrounding the announcement. Our model demonstrated that, conditional on the existence of such a discrete penalty, dividend payouts would be negatively related to the volatility of cash flows available to shareholders. In this section, we tie these strands together and empirically test for such a link.

To test our fundamental hypotheses, we construct a regression model of Equation (10) to explain dividend payout and include the variables X that affect future volatility of cash flows.¹³ Our empirical tests focus on size, leverage, and Herfindahl indices of the diversification of assets both by region and by asset type as determinants of cash-flow volatility. Our choice of these variables requires explanation. Size affects volatility because, in the cross-section, as the market value of a portfolio of assets increases, the contribution of assets' own volatility is diminished. Larger REIT portfolios contain a larger number of discrete assets. If returns to these assets are not perfectly correlated, portfolios with a larger number of discrete assets will experience lower volatility.¹⁴

¹³ In our analysis we do not attempt to evaluate differences in the systematic component of risk. Although returns to equity REITs are correlated with systematic factors, evidence that cash flows at the property level are correlated with systematic factors is meager. Gyourko and Keim (1992) estimate single-factor betas for the returns to equity REITs in the range of 0.43 to 0.93, but are unsuccessful in finding any systematic relation between equity factors and contemporaneous returns to the Russell–NCREIF appraisal-based index of property values. Similarly, Geltner (1989) finds CAPM-type betas associated with equity REITs in excess of 0.6, but can find no evidence of systematic risk associated with either the FRC or PRISA indices of property values. Even when delays in updating property-value indices are explicitly accommodated, measures of systematic risk are either insignificant (Geltner 1989) or below 0.1 (Gyourko and Keim 1992). Therefore, we assume that even if underlying property assets are subject to systematic factors, the cross-sectional variation of the systematic risk is small and statistically overwhelmed by the cross-sectional variation of the unsystematic components of risk in these portfolios. We concentrate on the residual or unsystematic component of volatility. For single-factor studies, see Chan, Hendershott and Sanders (1990), Chen and Tsang (1988) and Patel and Olsen (1984). For multiple factor approaches, see Titman and Warga (1986) and Gyourko and Keim (1992).

¹⁴ We recognize that it is at least possible that larger REIT portfolios contain fewer distinct assets. However, our review of REIT filings suggests that, with few exceptions, this is not the case.

We include Herfindahl measures of diversification because correlations among assets depend on the similarity of the property types and geographic locations of the properties in the portfolio. Specifically, the correlation of returns to two assets is higher if the assets are of the same property type and/or the assets are in the same geographic region. As a result, portfolio variation is smaller when there is greater property-type diversification and smaller when there is greater geographic dispersion.

Leverage is included because the volatility of cash flows from operations are “grossed up” or multiplied by the firm’s financial leverage to determine the volatility of cash flows available to shareholders. Thus, holding the cash flows from operation constant, as the debt-to-total-assets ratio increases, the volatility of cash flows to shareholders also increases.

To summarize, we propose four determinants of the expected volatility of a firm’s cash flows, with each variable measured as of the beginning of the fiscal year. Three of the variables are related to the expected volatility of the cash flows of the portfolio of properties, to the natural log of the market value of the property portfolio and to Herfindahl measures of the geographic and property-type concentrations of properties in the portfolio. The fourth measure, the debt-to-asset ratio, captures the multiplicative effect financial leverage has on the portfolio-level cash flows. Our fundamental hypothesis is that dividends are lower when the volatility of net cash flows increases in the cross section. Consequently, we anticipate that dividends will be lower when the market value of the asset portfolio is lower, when the portfolio is more focused along either geographic or property-type dimensions, and/or when the trust is more highly levered.¹⁵

Table 4 presents the tests of the model based on Equation (10). In the first specification appearing in the first column of Table 4, the coefficient

¹⁵ To test whether our four proposed proxies are, in fact, related to the volatility of subsequent cash flows available to shareholders, we construct the unsigned percentage change in FFO yield as a noisy measure of cash-flow volatility. We next regress this measure against our set of four proxies. Each of the four coefficient estimates associated with the proxies is of the correct sign. Realized volatility is higher when either of the Herfindahl concentration metrics is closer to one, when the value of the asset pool decreases and when there is more leverage in the capital structure. However, only leverage and size are significant at traditional levels of confidence.

Table 4 ■ Dividends and cash-flow uncertainty.

Independent Variable	Coefficient Dependent Variable: ln(Dividends Paid per Share)		
	Model 1	2	3
Lagged ln(FFO per share)	0.75 (17.6)	0.67 (15.8)	0.64 (14.4)
Change ln(FFO per share)	0.33 (5.7)	0.32 (5.7)	0.32 (5.7)
ln(market value of assets)		0.13 (4.7)	
Leverage ratio		-0.39 (-3.6)	
Regional Herfindahl		-0.20 (-2.2)	
Property-type Herfindahl		-0.02 (-0.2)	
Fitted FFO volatility			-1.3 (-5.6)
Adjusted R^2 (%)	61.4	65.8	66.1
F -test versus model 1	—	7.0*	30.6**

Estimates of regressions of dividends on cash flows available to shareholders and proxies for the riskiness of cash flows. For each of the 225 usable observations, constructed using REIT data from 1985 to 1992, the dependent variable is the natural log of dividends per share paid out over a given calendar year. To control for market-wide or industry-wide fluctuations, a series of annual intercepts are estimated but not reported. The natural log of FFO (funds from operation or corporate level cash flows) per share over the previous year and the natural log in the observation year less the same number in prior year are included to account for projected cash flows. The leverage ratio is the book value of total liabilities divided by the market value of assets. "Property-type Herfindahl" is computed as the sum of squared proportions of a firm's real estate assets invested in each of four real estate types: office, warehouse, retail or apartment. "Regional Herfindahl" is computed as the sum of squared proportions of a firm's real estate assets invested in each of nine real estate regions. The final row provides F -statistics for the null hypothesis that the riskiness proxy coefficients are jointly insignificant and are constructed by contrasting squared errors to those associated with the first model. F -statistics that are significant at 5% and 1% are designated with * and ** respectively. t -statistics are in parentheses.

associated with the previous period's FFO is positive and significant.¹⁶ The proxy for the anticipated change in FFO is also positive and significant, but the magnitude of the coefficient (0.33) is less than half the coefficient associated with lagged FFO. This smaller coefficient estimate is consistent with the standard errors-in-variables bias towards zero.

In the following column, we add the four determinants of volatility. The coefficient estimate for the log of the value of the real estate portfolios is significantly positive, as predicted. This result is consistent with the joint hypothesis that (1) larger portfolios are subjected to smaller unsystematic risk and (2) firms with less volatile cash flows pay out larger dividends. The coefficient 0.13 suggests that as the value of the real estate assets in the portfolio doubles in the cross section, dividends per share are increased by 13%, holding cash flows per share constant.

The coefficient associated with the ratio of debt to total assets is significantly negative. As above, this estimate is consistent with the joint hypothesis that (1) the volatility of cash flows available to shareholders increases with financial leverage, and (2) dividend payout rates vary with the perceived riskiness of these cash flows. The coefficient -0.39 indicates that, holding the mean of expected cash flows after interest payments constant, increasing the debt-to-total-asset ratio by 10% in the cross section reduces dividends by about 4%.

Of the two diversification metrics, only the geographic dispersion measure is significant at traditional levels of significance. Perhaps surprisingly, there is no evidence that property-type focus affects the dividend payout decision. Since each of our proxies is predicated on a joint hypothesis, it is impossible to determine which of the joint hypotheses fails. It is possible that either dividend rates are not related to expected future cash-flow volatility, or property-type concentration is not so related. However, given that three alternative proxies are each significantly related to the dividend payout ratio, we believe that these findings suggest that it is the latter link that is violated

¹⁶ The coefficient is economically and statistically below unity. This suggests that dividend policy is not homogeneous in FFO levels. In other words, the log of dividends should be negatively related to the log of FFO/share. One interpretation of this finding is that dividend payout ratios depend negatively on the number of shares outstanding. A second and more plausible interpretation is that the prior-period FFO is an imperfect proxy for the expected FFO. Since the prior period FFO may contain transitory components, the resulting measurement error leads to the standard downward bias of the slope coefficient.

and that diversification across property types within a geographic region has little impact on portfolio volatility.

In sum, holding anticipated cash flows constant, dividend payout rates are lower when financial leverage is higher, when the portfolio of underlying real estate assets is larger, and when the portfolio of real estate assets is more geographically dispersed.

In the final specification, we replace our set of four determinants of volatility with a single variable that is a linear combination of the four proxies. We first regress an *ex post* measure of realized volatility on our four independent variables (see footnote 15). The single variable, which we call *fitted FFO volatility*, is the fitted value from this regression. These fitted values are linear combinations of the four proxies, measured as of the beginning of a year, weighted by the coefficients from the regression. Since these coefficients were estimated using our entire data set, these fitted values are not pure forecasts.

In the right column, we report estimates of this specification. The coefficient associated with fitted volatility is negative and significant, which is consistent with our joint hypotheses. Also note that the adjusted R^2 is similar in magnitude to those reported in earlier specifications. When compared to existing studies of cross-sectional variation in dividend payouts, our specifications, which concentrate on the role of expected cash-flow volatility, provide an unusually high degree of explanatory power.¹⁷

Finally, although not reported, we estimated a specification that includes fitted volatility and the four volatility measures. If one or more variables were to enter this specification significantly, it would suggest that the variable affected dividend policy directly as well as through its indirect link through volatility. However, no individual proxy is significant. This specification check suggests that our four measures of volatility are related

¹⁷ For example, Jensen, Solberg and Zorn (1992) find that dividend yield is inversely related to inside ownership, but report R^2 values of around 0.20. Schooley and Barney (1994) consider non-linear relationships between inside ownership and dividends but report R^2 values of around 0.50. Chang and Lee (1986) report GLS models of dividend yields with R^2 values of around 0.36. Our models also provide more explanatory power than those presented in prior studies linking dividends to cash-flow uncertainty. Rozeff presents models with R^2 values between 0.12 and 0.48, while Eades's models have R^2 's between 0.15 and 0.40. It may be argued that our approach of examining only a single industry may explain our uniformly higher degree of explanatory power. However, Hansen, Kumar and Shome (1994) also examine one industry (electric utilities) but concentrate on the role of inside ownership. Their models of dividend yields have adjusted R^2 values of only 0.25, however.

to dividend policy, but only through their association with predicted subsequent volatility.

Conclusions

In this study, we model optimal dividend policy when cash flow is uncertain and when share values decline if firms do not meet dividend targets. In a signaling equilibrium, the existence of a discrete reduction penalty implies that managers will use dividend policy to signal not only the expected level of earnings but also their volatility. For a given level of cash flow, firms with more volatile earnings promise lower dividends. An important insight of the analysis is that dividend levels vary with the total volatility of future cash flows and not just the systematic or market-related component of risk.

We provide strong empirical evidence of a discrete penalty to equity price when dividends are reduced. Specifically, although equity price reacts to the sign and magnitude of the change in dividends, we show that there exists an economically significant discrete component in equity price declines associated with a dividend cut, regardless of the magnitude of the cut. This discrete penalty is observable both over annual horizons and over 3-day event windows.

In our empirical analysis we use four measures of expected cash-flow volatility: firm size, financial leverage and two Herfindahl indices of product type and regional diversification. All have the expected sign, and all but one are statistically significant. Therefore, anticipated cash-flow volatility not only is an economically important determinant of dividend policy, but also has great statistical importance relative to previously considered factors.

Our evidence on dividend policy helps distinguish between two competing theories. We include measures of expected cash-flow uncertainty in an empirical analysis of dividend policy and find that for all measures, higher levels of expected uncertainty are associated with lower payout ratios. The results are not consistent with agency-cost explanations, which predict a positive relationship between payout and uncertainty. However, the results are consistent with information-based theories of dividend policy. We suggest that managers are aware of the large effect that dividend reductions have in reducing stock prices. As a result, when managers anticipate uncertain future cash flows, they reduce the payout ratio to avoid the possibility of having to reduce dividends in the future.

Our results also have important implications for some general themes in corporate finance. First, standard corporate financial theory suggests that,

under general conditions, investment and financing decisions are independent. However, we identify another avenue through which investment decisions and financing decisions are linked. Specifically, the combination of assets chosen by the firm affects the firm's optimal dividend policy.

Second, standard corporate financial theory suggests that managers, when evaluating potential projects, should consider only the project's systematic risk. Our results indicate that both systematic and non-systematic components of risk affect dividend policy. As a result, managers may wish to consider the effect of adding a potential project on the total volatility of a firm's asset portfolio and the resultant effect on its optimal dividend policy.

While our results provide strong evidence of a link between dividend policy and cash flow volatility, it must be recognized that our data arise from a single industry with unique characteristics. The characteristics of the REIT industry make it possible to construct unique tests of the hypotheses. Although this industry is subject to restrictions on dividend policy, we have shown that these restriction are not very constraining. Therefore, we see no reason why the fundamental economic relationships estimated in this research would not apply equally well to other industries. Nevertheless, because of the limitation to one industry, general conclusions must await studies of other industries and other time periods. The results do provide a roadmap of promising avenues for future research on other industries.

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