The Effect of Tax-Exempt Investors on Stock Ownership and the Dividend Tax Penalty

David A. Guenther* and Richard Sansing**

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Abstract: We investigate how shareholder taxes affect the fraction of a firm's stock held by tax-exempt investors and how this tax-exempt ownership percentage affects the firm's "dividend tax penalty" (the relation between dividend yield and expected pre-tax stock return). Our model demonstrates that in general, the dividend tax penalty reflects tax rates of all investors, and is unaffected by the fraction of a firm's stock held by tax-exempt investors. Our empirical tests are consistent with the model's predictions.
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* Lundquist College of Business, University of Oregon
** Tuck School of Business at Dartmouth and Tilburg University

Corresponding author
Professor Richard Sansing
Tuck School of Business at Dartmouth
100 Tuck Hall
Hanover, NH 03755

Phone: (603) 646-0392
Fax: (603) 646-1308
email: Richard.C.Sansing@dartmouth.edu

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1. Introduction

We investigate the effect of tax-exempt investors on the relation between shareholder-level taxes and expected stock returns using an equilibrium model of stock ownership and stock price. The motivation for our inquiry comes from several recent empirical studies in accounting (see below) that are based on the hypothesis that the higher a firm's level of institutional ownership, the lower that firm's "dividend tax penalty." Our goal in this study is to use equilibrium analysis to identify factors that cause variation in the fraction of a firm's stock held by tax-exempt investors, and to show how tax-exempt investor ownership can affect the dividend tax penalty.

Prior research in finance emphasizes the importance of using an equilibrium approach to investigate how taxes affect stock prices. Brennan's (1970) after-tax capital asset pricing model showed that investors consider both tax considerations and risk sharing considerations, resulting in a dividend tax penalty that is based on a weighted average of the tax rates of all investors in the economy. This dividend tax penalty is identical for all stocks with the same dividend yield. Michaely and Vila (1995 p. 180) point out that "in a world without transaction costs, the *nonequilibrium approaches* to stock price behavior around the ex-day conclude that the premium either should reflect the marginal tax rate of the marginal investor, or it should be equal to one … The *equilibrium solution* to the problem indicates that the expected price reaction relative to the dividend is a function of the average tax rates of the market participants, weighted by their risk tolerance …" (emphasis added).

Equilibrium models in finance also point out that *all* investors can be considered "marginal investors" with respect to risky stocks. Michaely and Vila (1995 p. 180) state that "the premium reflects the relative tax rates of all market participants, not just the marginal trader's," and they conclude in footnote 14 that “in this sense, all the traders are marginal in our model.” Allen, Bernardo and Welch (2000 p. 2507) also view all investors as marginal in equilibrium, stating that “because institutional and retail investors are risk averse, they typically hold all securities. As a result, both are marginal investors in all types of stocks.”

Recent empirical papers in the accounting literature hypothesize that firms with a high percentage of institutional ownership have marginal investors with low tax rates, which in turn serves to mitigate the dividend tax penalty (Dhaliwal, Krull and Li 2007; Li 2007; Dhaliwal, Krull, Li and Moser 2005; Dhaliwal, Erickson and Li 2005; Dhaliwal, Li and Trezevant 2003; and Ayers, Cloyd and Robinson 2002.) For example, Dhaliwal, Krull, and Li (2007 p. 126) state that their second hypothesis “relies on the argument that as the ownership stake by a certain investor group increases, the likelihood that this group is the marginal investor increases.” Dhaliwal, Li, and Trezevant (2003 p. 157) state “if the return on a firm’s common stock incorporates a dividend tax penalty, then the likelihood that low-tax (i.e., institutional or corporate) owners alleviate this penalty rises as the level of institutional and corporate ownership increases.” They go one to predict: “at a given dividend yield the association between the level of institutional and corporate ownership and the return on a firm’s common stock is negative.”

The models in the finance literature have not explicitly characterized the equilibrium stock ownership by tax-exempt investors, making it difficult to assess whether the hypothesis examined in the accounting literature is consistent with an equilibrium model of stock prices and investor ownership. We develop an equilibrium model that allows us to specifically address the relations among shareholder taxes, cross-sectional variation in stock ownership by tax-exempt investors, and expected returns. In a world with both taxable and tax-exempt investors and two risky stocks, we investigate which factors affect the relative holdings of each stock by each type of investor, and which factors affect the expected return on the stocks. We allow the riskiness of the stocks to differ, as well as the risk tolerances of the two types of investors, and we include a risk-free bond as an alternative investment for both types of investors. We use the model to address the specific question of whether differences in the fraction of stock held by tax-exempt investors can result in differences in the dividend tax penalty associated with each stock.

We derive several interesting results from our model. First, we find that, in general, both types of investors (taxable and tax-exempt) will hold strictly positive amounts of each stock.

Second, we demonstrate which factors affect how much of each stock is held by the tax-exempt investors. If dividends, interest, and accrued capital gains are all taxed at the same rate, our results simplify to the familiar risk-sharing result in which each type of investor holds the same percentage of each stock, and the percentage is based on the aggregate risk tolerance of that type of investor relative to the aggregate risk tolerances of all investors in the economy (Wilson 1968). But investors shift their portfolios if different types of income are taxed at different rates.[1] For example, if the two stocks have the same risk and price, tax-exempt investors will hold more of the stock with the larger dividend. This result is consistent with Elton and Gruber (1978), who find that investors with tax rates lower than the average investor tax rate hold more high-dividend stocks. Likewise, Grinstein and Michaely (2005) report in Table II, Panel A that institutions have greater holdings in dividend-paying stocks than in non-dividend paying stocks.

Third, we demonstrate that the expected return on each stock consists of three components: the risk-free interest rate, a risk premium, and a dividend tax penalty. The dividend tax penalty is increasing in the stock's dividend yield, consistent with prior theoretical work in economics (e.g., Poterba and Summers 1985). Each component also reflects a tax term that is a

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[1] For example, under U.S. tax law long term capital gains have historically been subject to a lower tax rate than interest and (until 2003) dividends.

function of the aggregate risk tolerances of the two types of investors as well as the tax rates faced by the taxable investors, consistent with prior theoretical work in finance (e.g., Brennan 1970).

Tax-exempt investors drive down the dividend tax penalty for every stock. However, as long as all investors hold some of each stock, this effect is identical for all stocks, and the fraction of a particular stock held by tax-exempt investors does *not* affect the dividend tax penalty for that stock.

Variation in the dividend tax penalty across firms can arise if some investors do not hold any shares of a firm's stock, because the price (and expected return) of that firm's stock reflects only the tax rates of investors owning shares in that firm. There are non-tax reasons that could make it optimal for some investors in our model to hold no shares in one of the two stocks. For example, some investors could own untraded assets (e.g., human capital), the value of which is so highly correlated with the returns to one of the stocks in our model that they prefer to own none of that stock. Alternatively, some investors may avoid certain stocks (e.g., tobacco stocks) for non-financial reasons.

We emphasize the difference between our results (relating to risky stocks) and the results we would get if we focused on riskless assets, such as taxable and tax-exempt bonds. The tax literature often compares yields on riskless taxable and tax-exempt bonds, where the tax rate implicit in the tax-exempt bond yield (i.e., the "implicit tax" rate) is equal to the tax rate of the marginal investor—the hypothetical investor indifferent between owning either type of bond. Investors with tax rates higher than that of the marginal investor will only hold tax-exempt bonds, whereas those with lower tax rates will only hold taxable bonds, leading to an equilibrium in which all investors (except the marginal investor) sort themselves into distinct tax clienteles holding either riskless taxable or tax-exempt bonds, but not both.

This tax-driven behavior of sorting into separate tax clienteles does not generalize to risky investments. With risky stock, investors make portfolio decisions based on risk as well as expected after-tax returns. In the absence of tax considerations, investors would hold risky assets in proportion to their relative tolerances for risk. Tax considerations, however, induce investors to adjust their portfolios, but not to the corner solution found in the case of riskless bonds. Stock ownership reflects *an interior optimum for each investor* as opposed to *a boundary condition for the marginal investor*. Risk-sharing considerations mitigate the effects of investor-level taxation on portfolio choice. In turn, this causes stock returns to reflect the tax characteristics of all investors, as opposed to the tax rate of a hypothetical marginal investor.

Recent empirical research in accounting has identified both a positive association between dividend yield and returns and a negative interaction term between dividend yield and the fraction of a firm's stock that is held by institutional investors, many of which are tax-exempt. While the first result is consistent with our model, the second is not. We explore this conundrum by replicating Dhaliwal, Li, and Trezevant (2003) (hereafter, DLT), then extending their study to a larger sample that was not available to DLT when they conducted their study.

We reach a different conclusion than DLT for two reasons. First, the coefficients on dividend yield and the interaction between dividend yield and institutional ownership are sensitive to which variables and observations are included in the regression, and how the variables are measured. When dividend yield is measured correctly, the coefficient on yield squared becomes insignificant. When we exclude yield-squared from the model and also exclude all zero dividend observations from the sample, adding two additional risk measures (size and book-to-market) causes the coefficient on the interaction between yield and institutional ownership to become statistically insignificant. This suggests that the interaction term reflects risk instead of taxes.

Second, in all regression specifications the coefficient on the interaction term between yield and institutional ownership is not significantly different from zero when we use a larger sample of data. We believe that the evidence does not support the claim that the fraction of a firm's stock held by institutional investors mitigates the dividend tax penalty.

Our results make an important contribution to tax research in accounting by demonstrating in an equilibrium setting how differences in tax-exempt investor ownership across different stocks affect expected returns. In general, the percentage of tax-exempt investors in the economy affects the dividend tax penalty for all stocks in the same way, and the dividend tax penalty is the same for two stocks with the same dividend yield. We also identify a setting in which dividend tax penalties could vary across different stocks with the same dividend yield. These results should help guide future empirical tax research in accounting.

We present our model and characterize the equilibrium in section 2. In section 3 we derive the relation between a stock's dividend yield and its expected rate of return. We replicate and extend the DLT study in section 4. Section 5 concludes.

2. Model

2.1 Economic environment

Our model features N risk-averse investors who can invest in either a riskless bond or two risky stocks, denoted X and Y. The riskless bond pays interest at the rate R. Each stock $i \in \{X,Y\}$ pays a known dividend d_i one period hence and will trade for an uncertain ex-dividend price π_i on that date. The investors are of two types: taxable and tax-exempt.[2] There are M taxable investors that face a constant statutory tax rate t_b on interest, t_d on dividends, and a constant effective tax rate t_g on accrued long-term capital gains, $t_g \le t_d \le t_b$.[3] The effective tax rate t_g can be lower than the statutory rate on realized capital gains because the tax on unrealized gains is deferred until the stock is sold, and tax may be avoided altogether through a charitable gift of the stock, or through a basis step-up upon the investor's death. The case in which $t_d < t_b$ corresponds to the current U.S. tax law in which qualified dividends are subject to a maximum tax rate of 15 percent. The case in which $t_d = t_b$ represents the U.S. tax law prior to 2003 in which both interest and dividends received by individual shareholders were taxed at the same rate. The remaining $N–M$ investors are tax-exempt.

Each investor j has a utility function over end-of period wealth $\tilde{Z}_{1j}$ of the form $-e^{-\rho_j \tilde{Z}_{1j}}$. This utility function has the property that if $\tilde{Z}$ is normally distributed with mean μ and variance σ^2, the investor's expected utility is equal to $\mu - \frac{\rho_j \sigma^2}{2}$. We define $w_T = \sum_{j=1}^{M} \frac{1}{\rho_j}$, which is the measure of the taxable investors' aggregate tolerance for risk; similarly, we define $w_E = \sum_{j=M+1}^{N} \frac{1}{\rho_j}$, which is the measure of the tax-exempt investors' aggregate tolerance for risk. We solve for the current stock price p_i that equalizes supply and demand for stock i. We assume that the end-of-period price of stock i is normally distributed with mean μ_i and variance σ_i^2, and that the returns of the two stocks are independent.[4,5] We normalize the number of shares

[2] Later in the paper we show how our model can be generalized to include more than two types of investors.
[3] Throughout, we assume that the holding period rules for dividends and realized long-term capital gains to qualify for a lower tax rate are satisfied.
[4] Throughout the paper, we assume that σ_i^2 is sufficiently small relative to μ_i and d_i that current stock prices are always positive.

outstanding for each stock to be one. Each investor has wealth Z_{0j} to invest. Finally, we assume that $d_i < \frac{\mu_i R(1-t_b)}{1-t_d}$. This implies that the dividend cannot be so large that the expected value of the end-of-period price, μ_i, is less than the current stock price, p_i. This ensures that the expected capital gain is positive and so stocks are tax-favored when compared to bonds.

Because the focus of our research is on the effect of tax-exempt investors on the dividend tax penalty, we consider only those stocks that a tax-exempt investor would want to hold. Therefore, we assume that for each stock i, $\frac{\sigma_i^2}{w_T} > \frac{[R\mu_i(t_b - t_g) + Rd_i(t_b - t_d) - d_i(t_d - t_g)]}{(1+R)(1-t_g)^2}$. This ensures that the stock has a large enough risk premium that tax-exempt investors are willing to buy it. Any stock that did not satisfy this condition would have a risk premium so low that no tax-exempt investor would find it attractive. From the perspective of a tax-exempt investor, this stock would be unattractive because it would feature an expected return that is less than the risk-free rate R, and only taxable investors, who face a lower tax rate on dividends and/or capital gains than on interest, would be willing to hold such a stock for its tax advantages.[6]

An equilibrium is defined as a portfolio for each investor that maximizes that investor's expected utility given market prices, and a set of prices at which all markets clear. Each of the M taxable investors buys x_j shares of firm X at a price of p_X per share and y_j shares of firm Y at a price of p_Y per share to solve the following maximization problem.

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[5] Allowing covariance between the two stocks would complicate the analysis without adding new insights. With only two stocks comprising the stock market, each stock covaries with the market portfolio. Brennan (1970) examines the case with many stocks, in which case covariance among stocks is required for a stock to covary with the market portfolio.

[6] The price and expected return for this stock would be as characterized in our subsequent results if one sets the tax-exempt investors aggregate tolerance of for risk equal to zero ($w_E = 0$).

$$\max_{x_j \geq 0, y_j \geq 0} \{ x_j [d_X(1-t_d) + \mu_X - t_g(\mu_X - p_X)]$$

$$+ y_j [d_Y(1-t_d) + \mu_Y - t_g(\mu_Y - p_Y)] - \frac{(1-t_g)^2 (x_j^2 \sigma_X^2 + y_j^2 \sigma_Y^2) \rho_j}{2} \tag{1}$$

$$+ (Z_{0j} - p_X x_j - p_Y y_j)[1 + R(1-t_b)] \}$$

Differentiating (1) with respect to x_j and y_j yields the following first-order conditions for each of the M taxable investors.

$$x_j^* = \frac{d_X(1-t_d) - p_X R(1-t_b) + (\mu_X - p_X)(1-t_g)}{\sigma_X^2 (1-t_g)^2 \rho_j} \tag{2}$$

$$y_j^* = \frac{d_Y(1-t_d) - p_Y R(1-t_b) + (\mu_Y - p_Y)(1-t_g)}{\sigma_Y^2 (1-t_g)^2 \rho_j} \tag{3}$$

Each of the N–M tax-exempt investors buys x_j shares of firm X at a price of p_X per share and y_j shares of firm Y at a price of p_Y per share to solve the following maximization problem.

$$\max_{x_j \geq 0, y_j \geq 0} \{ x_j [d_X + \mu_X] + y_j [d_Y + \mu_Y] - \frac{(x_j^2 \sigma_X^2 + y_j^2 \sigma_Y^2) \rho_j}{2} \tag{4}$$
$$+ (Z_{0j} - p_X x_j - p_Y y_j)[1 + R] \}$$

Differentiating (4) with respect to x_j and y_j yields the following first-order conditions for each of the N–M tax-exempt investors.

$$x_j^* = \frac{d_X - p_X R + \mu_X - p_X}{\sigma_X^2 \rho_j} \tag{5}$$

$$y_j^* = \frac{d_Y - p_Y R + \mu_Y - p_Y}{\sigma_Y^2 \rho_j} \tag{6}$$

The two market clearing conditions complete the characterization of the equilibrium.

$$\sum_{j=1}^{M} x_j^* + \sum_{j=M+1}^{N} x_j^* = 1 \tag{7}$$

$$\sum_{j=1}^{M} y_j^* + \sum_{j=M+1}^{N} y_j^* = 1 \tag{8}$$

2.2 Equilibrium

Proposition 1 characterizes the equilibrium stock price in the model.

Proposition 1:

(a) $$p_i = \frac{\mu_i \left[w_E + \frac{w_T}{1-t_g} \right] + d_i \left[w_E + \frac{w_T(1-t_d)}{(1-t_g)^2} \right] - \sigma_i^2}{w_E(1+R) + \frac{w_T[1-t_g+R(1-t_b)]}{(1-t_g)^2}}$$; and

(b) each investor holds a strictly positive fraction of stock *i.*

The proofs of all propositions are in the appendix.

Proposition 1(a) implies that if interest, dividends, and accrued capital gains are taxed at the same rate, the current price of stock *i* is the present value of the cum dividend stock price one period hence, less a risk premium that reflects the variance of the future stock price (σ_i^2) and the investors' aggregate tolerance for risk $\left(w_E + \frac{w_T}{1-t_g} \right)$.

$$p_i = \frac{\mu_i + d_i}{1+R} - \frac{\sigma_i^2}{(1+R)\left(w_E + \frac{w_T}{1-t_g} \right)} \tag{9}$$

In other words, with equal tax rates on all types of income, taxes do not affect the price of the stock, except through the effect that the capital gains tax has in reducing after-tax risk for taxable investors.

Next, we characterize the fraction of each stock owned by tax-exempt investors. Using (5) or (6), the fraction of shares of firm *i* held by tax-exempt investors is

$$\sum_{j=M+1}^{N} i_j^* = \frac{w_E (d_i - p_i R + \mu_i - p_i)}{\sigma_i^2}. \tag{10}$$

As a benchmark case, consider a firm's tax-exempt ownership percentage when tax rates on interest, dividends and accrued capital gains are the same. When $t_b = t_d = t_g$, the price of stock *i* (p_i) is given by (9). Substituting the stock price from (9) into (10) yields the fraction of stock held by tax-exempt investors in terms of the model's exogenous parameters

$$\sum_{j=M+1}^{N} i_j^* = \frac{w_E}{w_E + \frac{w_T}{1 - t_g}}. \tag{11}$$

When all income is taxed at the same rate, tax-exempt investors hold the same fraction of each stock, and this fraction reflects the aggregate risk tolerance of tax-exempt investors relative to the aggregate risk tolerance of all investors. The only tax term that is relevant is the capital gains tax rate, which increases the risk tolerance of the taxable investor because the government absorbs some of the riskiness of future price via the capital gains tax.

When tax rates on different types of income are not equal, substituting the equilibrium stock price from Proposition 1(a) into (10) yields the fraction of stock *i* held by tax-exempt investors in terms of the model's exogenous parameters.

$$\frac{w_E \left[\sigma_i^2 (1+R) - \frac{w_T}{(1-t_g)^2} \left\{ (\mu_i R - d_i)(t_b - t_g) + d_i (1+R)(t_b - t_d) \right\} \right]}{\sigma_i^2 \left[w_E (1+R) + \frac{w_T [1 + R(1 - t_b) - t_g]}{(1-t_g)^2} \right]} \tag{12}$$

We define "incremental tax-exempt ownership" of a stock as the stock's actual tax-exempt ownership percentage from (12) less the tax-exempt ownership percentage from (11) (i.e., when all tax rates are the same). Some properties of incremental tax-exempt ownership are given in Proposition 2.

Proposition 2:

(a) Incremental tax-exempt ownership has the same sign as

$$\frac{R(t_b - t_g)}{w_E + \frac{w_T}{1 - t_g}} - \frac{(\mu_i R - d_i)(t_b - t_g)}{\sigma_i^2} - \frac{d_i(1+R)(t_b - t_d)}{\sigma_i^2};$$

(b) if the two stocks *X* and *Y* have the same price and risk, incremental tax-exempt investor ownership is higher for the firm with the higher dividend;

(c) incremental tax-exempt ownership is increasing in σ_i^2.

Proposition 2(a) shows that differences in tax rates on income earned by taxable investors affect the fraction of shares owned by tax-exempt investors. This occurs because tax rate differences affect the equilibrium stock price derived in Proposition 1(a), which in turn affects the ownership percentage from (10). Depending on the values of the other parameters in the model, differences in investor-level tax rates can either increase or decrease the fraction of shares owned by tax-exempt investors relative to what they would have owned had all income been taxed at the same rate. A decrease in t_d makes stocks more attractive to taxable investors. A decrease in t_g has countervailing effects; the government takes a smaller share of the expected stock price appreciation, but it also bears a smaller share of the risk.

Proposition 2(b) says that, other things being equal, tax-exempt investors will own more of a stock that pays a high dividend. Taxes induce taxable investors to adjust their portfolios to reflect tax rates on dividends, interest, and capital gains. The taxable investors, facing higher tax rates on dividends than on capital gains, will buy more low-dividend stocks, thus driving up the price of these stocks to reflect the tax-favored nature of capital gains; the tax-exempt investors, who do not have a tax-induced preference for capital gains, will buy more high-dividend stocks. However, neither type of investor will limit their investment to only one type of stock. Although taxes influence portfolio choices, investor preferences for a diversified portfolio result in taxable investors buying some high dividend stocks, albeit less than they would have in the absence of tax rate differentials. Similarly, tax-exempt investors will buy low-dividend stocks for the same reason.

Finally, Proposition 2(c) says that tax rate differences induce tax-exempt investors to hold more risky stocks. Because of risk considerations, both taxable and tax-exempt investors hold stock in equilibrium even though the tax-favored features of stock (e.g., lower tax rates on capital gains and dividends) only benefit taxable investors. Holding these tax benefits constant, the more risky the stock, the greater is the risk-sharing benefit relative to the tax benefit, and thus the tax-exempt investors hold more of the riskier stock in equilibrium.

We contrast this equilibrium with the equilibrium that would arise with two riskless assets with different tax treatments (e.g., riskless taxable and tax-exempt bonds), as discussed in chapter 5 of Scholes et al. (2005). In a setting in which investors care only about after-tax returns instead of both risk and after-tax returns, each investor will only buy one of the two assets: high-tax rate investors will buy the tax-exempt bond and low tax-rate investors will buy the taxable bond.[7] The two assets will have different interest rates, and this difference will reflect the tax rate of the *marginal investor*, who by definition would receive the same after-tax rate of return from the two bonds. In this setting, every investor except the marginal investor strictly prefers one asset to the other, and only the tax rate of the marginal investor is relevant in characterizing the difference in equilibrium interest rates between the two riskless assets.

[7] Tax law restrictions (IRC §265(a)(2) and §163(d)) that prevent a high-tax rate investor from taking a short position (i.e., borrowing) in the taxable asset and investing in the tax-exempt bond sustain this equilibrium. See Scholes et al. (2005).

The setting we examine, with risky tax-favored stocks instead of riskless tax-exempt bonds, features a fundamentally different equilibrium outcome. Investor preferences for diversification induce investors to adopt a less extreme response to taxes. The intuition provided by the riskless asset setting does not carry over to the setting with risky assets. As we will show in the next section, expected stock returns for two risky assets will differ if one asset is relatively more tax favored than the other, but this tax-related difference in returns will reflect the tax attributes of all investors.[8] In this sense, all investors are marginal.

3. Investor taxes and expected stock returns

In this section, we examine the relation between investor tax characteristics and the expected pretax rate of return on stock *i*, $\frac{d_i + \mu_i - p_i}{p_i}$. We define two tax-related terms:

$\tau_b = \frac{w_T(t_b - t_g)}{w_E(1-t_g)^2 + w_T(1-t_g)}$ and $\tau_d = \frac{w_T(t_d - t_g)}{w_E(1-t_g)^2 + w_T(1-t_g)}$. These terms reflect the differences between the statutory tax rates on interest and dividends, respectively, and the effective tax rate on capital gains, weighted to reflect the risk tolerances of the taxable and tax-exempt investors. The intuition behind the terms τ_b and τ_d is clearest in the special case of $t_g = 0$. Then, $\tau_b = \frac{w_T t_b}{w_E + w_T}$ and $\tau_d = \frac{w_T t_d}{w_E + w_T}$, the tax rates on interest and dividends, weighted by the relative risk tolerances of taxable investors.

Proposition 3: The expected pretax rate of return on stock *i* is

$$R(1-\tau_b) + \frac{\sigma_i^2}{p_i\left[w_E + \frac{w_T}{1-t_g}\right]} + \frac{d_i \tau_d}{p_i}.$$

[8] Expected returns for two risky assets will also differ to the extent one asset is more risky than the other.

The expected return on any stock in our model can be expressed in terms of three components: (1) the risk-free rate of interest, (2) the variance of the future stock price expressed as a percentage of the current stock price, and (3) the stock's dividend yield. Each component is multiplied by a constant that reflects the aggregate risk tolerances of the two types of investors and the tax rates faced by the taxable investors.

An important feature of Proposition 3 is that the tax coefficients on the terms containing the risk-free rate and dividend yield are identical for both stocks in our model. *The fraction of a stock owned by the tax-exempt investors has no effect on the relation between dividend yield and that stock's expected return (i.e., the "dividend tax penalty").* To be sure, the tax-exempt investors play an important role in determining the dividend tax penalty. The greater the aggregate risk tolerance of the tax-exempt investors, the lower the tax rates (τ_b and τ_d) reflected in the terms containing the risk-free rate and the dividend yield in Proposition 3. But these tax rate effects are identical for both stocks in our model; they do *not* vary with the fraction of a firm's stock that is owned by the tax-exempt investors.

Proposition 3 shows how tax-exempt investors do and do not affect the relation between expected returns, risk, and dividend yield. They do have an effect in the sense that the tax rates reflected in the coefficients on the risk-free rate and dividend yield are lower than they would have been if no tax-exempt investors held stock, i.e., if $w_E = 0$. On the other hand, the *level* of tax-exempt investor ownership in any particular stock does not affect this relation. Proposition 3 shows that tax factors affect the fraction of each stock held by the tax-exempt investors, but the coefficients on the risk-free rate, risk and dividend yields are the same for each firm. The level of tax-exempt investor ownership of any particular firm should have no effect on the dividend tax penalty. Therefore, tax-exempt investors do mitigate the dividend tax penalty, but not in the manner suggested by prior empirical tax papers in accounting. The dividend tax penalty is the same for all firms with the same dividend yield, regardless of the level of tax-exempt ownership in any particular firm.

The intuition behind our result—that the fraction of stock held by tax-exempt investors is not associated with expected returns—rests on a simple equilibrium argument. For a given level of risk, all investors prefer higher returns. If two stocks with the same risk have different expected returns because one of the stocks has a larger fraction of tax-exempt investors, then all investors would prefer to hold more of the stock with the higher expected return and less of the stock with the lower expected return. The prices of the stocks would change, thereby eliminating the difference in expected returns.

3.1 Some extensions of the model

We can relate our results in Proposition 3 to Brennan's (1970) after-tax capital asset pricing model. The equilibrium outcome in Brennan implies the following expression for the expected pretax return to stock *i*, $E(\tilde{R}_i)$, when the tax rates on dividends and interest are the same.

$$E(\tilde{R}_i) = r_f(1-\tau) + \beta_i[E(R_m) - r_f - \tau(\delta_m - r_f)] + \tau\delta_i, \qquad (13)$$

where r_f is the pretax rate of interest on the riskless taxable bond, $E(R_m)$ is the expected pretax rate of return to the market portfolio, β_i is the systematic risk of security *i*, δ_i is the dividend yield to security *i*, δ_m is the dividend yield of the market portfolio, and τ has the same meaning as in our model; note that $\tau_b = \tau_d = \tau$ in Brennan's model. We emphasize that β_i and δ_i are firm-specific parameters; all the other terms in the right-hand side of (13) are common to all stocks. Because the parameter τ is the same for all firms, our result—that the proportion of stock held by a tax-exempt investor in any particular firm has no effect on the relation between that stock's dividend yield and its expected rate of return—is also implied by Brennan's after-tax capital asset pricing model.

Proposition 3 easily generalizes to a setting with taxable investors having different tax rates. Suppose there are two types of taxable investors, *H* and *L,* with tax rates on ordinary income of t_H and t_L and aggregate risk tolerances of w_H and w_L, $w_H + w_L = w_T$. Then Proposition 3 continues to hold, except $\tau_b = \frac{w_H(t_H - t_g) + w_L(t_L - t_g)}{w_E(1-t_g)^2 + w_H(1-t_g) + w_L(1-t_g)}$ and, if dividends are taxed as ordinary income, $\tau_b = \tau_d$.

Finally, proposition 3 implies that the 2003 reduction in the tax rate on dividends (t_d) in turn reduces τ_d, so the dividend tax penalty should go down following the 2003 tax law change. The decrease in the dividend tax penalty should be a constant proportion of each stock's dividend yield, $\frac{d_i}{p_i}$. Because the dividend tax penalty itself does not change with the fraction of stock owned by tax-exempt investors, the decrease in the dividend tax penalty should also not depend on the fraction of stock owned by tax-exempt investors.

3.2 The effect of additional risk factors: size and book-to-market

Dhaliwal, Krull, and Li (2007) suggest that other factors not considered in our model might change the result in Proposition 3. They state (p. 126):

> "Guenther and Sansing (2006) develop an equilibrium model with heterogeneously taxed investors who form their investment portfolios based on optimal risk sharing and taxes. They show a dividend tax premium in the aggregate that is identical for all firms held by taxable and tax-exempt investors. This finding is true in the presence of perfect dividend tax clienteles that only consider risk sharing and taxes in forming portfolios. Such clienteles are unlikely if investors consider other factors, such as size and book-to-market ratio, in forming portfolios."

With respect to the factors that Dhaliwal et al. suggest have been left out of our model (book-to-market ratio and size), Fama and French (1992) show a statistical association between size, book-to-market, and average returns that is not explained by the CAPM. While the economic interpretation of this association remains contentious, Dhaliwal et al. do not offer an interpretation that would cause the dividend tax penalty to vary across stocks.

Fama and French (1995) offer a possible interpretation of the effect of the book-to-market ratio and size that is based on investors' desires to hedge risks that are not affected by their portfolio holdings. For example, suppose an investor holds an untraded asset (e.g., human capital), the return to which is positively correlated with the return to stock X. That investor will want to hold less than the fraction of X implied by equation (2). This lower level of demand will drive down the equilibrium price and drive up the expected return of stock X. In particular, the risk premium shown in Proposition 3 will increase. However, the dividend tax penalty will not change as long as every investor holds a strictly positive fraction of both stocks. In other words, incorporating additional risk factors into the model (such as book-to-market or size) results in changes to the risk premium component of expected return, but does not affect the dividend tax penalty shown in Proposition 3.

However, suppose that some investors are so sensitive to stock X that their demand for stock X at the equilibrium price is zero. For example, the human capital of taxable investors or the donations received by tax-exempt entities could be highly correlated with the performance of firm X. If an investor is already exposed to the risk of firm X in a way that cannot be easily diversified, that investor could be *inframarginal* with respect to stock X because the investor's demand for stock X is no longer described by the first-order condition expressed in equations (2) and (5). Inframarginal investors have no effect on price and no effect on a firm's dividend tax penalty.[9]

Let the aggregate risk tolerances of taxable and tax-exempt investors who do hold stock X be v_T and v_E, respectively. For expositional convenience only, consider the special case in which $t_g = 0$. Then $\tau_d = \frac{v_T t_d}{v_E + v_T}$ for stock X, and so the dividend tax penalties for stocks X and Y differ if $\frac{v_T}{v_E + v_T}$ differs from $\frac{w_T}{w_E + w_T}$.

Continuing this example, suppose all investors own stock Y, all tax-exempt investors own stock X, but some taxable investors own none of stock X. Then

$\frac{v_T}{w_E + v_T} < \frac{w_T}{w_E + w_T}$ because $v_T < w_T$, and if both stocks have the same dividend yield, then both τ_d and the dividend tax penalty for stock X will be lower than for stock Y. However, we emphasize that this result relates to the *number* of investors of a particular type owning shares in a firm, and not to the percentage of a firm's stock owned by particular types of investors. If the same investors own shares in both X and Y (regardless of the amount owned), then the dividend tax penalties for the two firms will be the same despite the fact that the percentage of stock owned by tax-exempt investors may be higher for one firm.

4. Empirical tests

Although our theoretical model suggests that the dividend tax penalty should not depend on the fraction of shares held by tax-exempt investors, recent empirical papers in accounting report a statistically significant negative relation between returns and an interaction variable

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[9] Investors could also be inframarginal because they have prefer not to hold certain stocks (e.g., tobacco stocks) for non-financial reasons.

between dividend yield and institutional ownership. In an effort to reconcile these reported results with our theoretical model, we have replicated and extended DLT. Our replication uses the same firms examined in DLT; our extension uses a larger sample using data that was not available when the DLT paper was written. We find that the empirical evidence does not support the DLT hypothesis that institutional ownership mitigates the dividend tax penalty.

4.1 Sample and measurement of variables

Our sample selection procedure follows as closely as possible that of DLT. For each year from 1989 through 1998 (the original DLT sample period) we use all observations for which data are available on CRSP and Compustat (NYSE, AMEX, and NASDAQ) and for which data on institutional ownership are available from the Thomson Financial CDA/Spectrum institutional (13f) holdings database. This results in a sample size that is substantially larger than the DLT sample. Because of this we report two sets of empirical results, one using just the original DLT sample observations[10] and one using our larger sample.

For each firm-year observation we obtain the calendar year annual return, and compute risk-adjusted returns using the portfolio approach outlined in DLT.[11] We also compute a market model beta for each firm year using the prior 48 months returns.[12] We include industry dummy variables based on the same Fama-French industry groups used by DLT.

In measuring the dividend yield, we disagree with the measure that is used in DLT, and we therefore report two sets of results, one based on the DLT measure of yield, and the second based on our corrected yield measure. In explaining their measure of dividend yield, DLT state

[10] We thank Oliver Li for his assistance in identifying the firms examined in the original DLT study.

[11] DLT form 9 portfolios each year, based on market cap (lowest 27%, middle 46%, highest 27%) and book-to-market (lowest 27%, middle 46%, highest 27%) and subtract the mean portfolio return from the raw return to compute risk-adjusted returns.

[12] Following DLT, we use the annualized return on 3-month treasury bills as a proxy for the risk-free rate, and the value weighted CRSP index as a proxy for the market return.

(p. 160): “The annual dividend yield for a dividend-paying firm is computed as the amount of dividends per share declared in the last quarterly dividend announcement of the year times four, deflated by the prior-year-end split-adjusted stock price.” Our disagreement relates to the use of the “prior-year-end split-adjusted stock price.” The adjustment factor in CRSP to adjust stock prices for splits is a cumulative factor, and should be applied not only to the stock price, but to the dividend amount as well, since the dividend is a per-share amount. By adjusting the stock price but not the dividend, DLT's yields in the earlier years of their study are overstated. For example, in 1989 their maximum dividend yield is 6.13, which means the firm paid a regular annual dividend that was 6 times the price of its stock. When both the dividend and share price are adjusted for stock splits, the maximum dividend yield in 1989 (for the same sample) becomes 0.308.

Our measure of dividend yield is the amount of dividends per share declared in the last quarterly dividend announcement of the year times four, deflated by the prior-year-end stock price, where both the dividend per share and the stock price are deflated by the cumulative adjustment factor for stock splits. This procedure assures that any splits that occur after the prior year-end stock price but before the last quarterly dividend are controlled for. However, splits subsequent to the last quarterly dividend should affect both the stock price and the dividend amount in the same proportion. Correcting this error roughly halves the mean dividend yield, which in turn generally increased both the point estimates and the standard errors in the empirical tests. A detailed example of this yield measurement issue is presented in Appendix B.

We report in Table 1 the descriptive statistics for our sample firms using both the original DLT sample (called "Replication: DLT sample") and the larger sample (called "Extension: large sample") for the 1989 sample year. Table 1 also reproduces the original descriptive statistics from DLT as a comparison. The table shows that, with the exception of the dividend yield variable, our descriptive statistics for the DLT sample are quite similar to those reported in DLT. We report just the 1989 statistics to save space; the comparisons between our results and the DLT results using other years are generally similar to those in the table. As noted above, we were unable to replicate the DLT dividend yield results, except that for the early years of the sample period (1989-1992), the maximum dividend yields we get with the DLT sample are the same as those reported in DLT when we adjust the stock price but not the dividend amount for stock splits (see Appendix B).

4.2 Empirical tests

We estimate the following cross-sectional model separately each year for our sample firms:

$$\begin{aligned} R - PORTR = {} & \beta_0 + \beta_1 DUM + \beta_2 BETA + \beta_3 YIELD + \beta_4 YIELD^2 \\ & + \beta_5 INST + \beta_6 DUM * INST + \beta_7 YIELD * INST \\ & + \sum_{k=8}^{16} \beta_k IND_k + e \end{aligned} \tag{14}$$

where R is the calendar year return, $PORTR$ is the return of the risk portfolio to which the firm is assigned, DUM is a dummy variable equal to 1 if the firm pays a dividend and 0 otherwise, $BETA$ is the market model estimate of beta, $YIELD$ is the dividend yield (measured two ways, as explained above and in Appendix B), $INST$ is the percentage of the firm's stock held by institutions according to the Thomson Financial CDA/Spectrum institutional (13f) holdings database,[13] and IND_k is a dummy variable equal to 1 if the firm is in the Fama-French industry grouping k and 0 otherwise. This equation is identiacal to equation (2) in DLT, and we refer to this equation as the "original DLT model specification" in tables 2 and 3.

[13] We use the institutional ownership reported in the first quarter following the data year to measure institutional ownership. However, similar results are obtained when the last quarter of the data year is used.

In Table 2 we estimate equation (14) using the DLT sample for two different measures of dividend yield—the way yield was measured in DLT (Column 2), and the way we believe yield should be measured (Column 3). Following DLT, we estimate the regression coefficients separately in annual regressions, and the amounts reported in Table 2 are the means and t-statistics for the ten annual coefficients. We do not report coefficients on the industry dummy variables. Table 2 also reproduces the original results reported in DLT for comparison with our results (Column 1). As the table demonstrates, our replication results are very similar to the original DLT results. Two main differences are apparent. First, the size of the coefficients on YIELD and INST*YIELD are larger when we measure the dividend yield in the correct way, which is likely due to the much smaller yield measures that we get when both stock price and dividend amount are adjusted for stock splits. Second, when we use our corrected yield measure, the sign on the $YIELD^2$ variable is positive (rather than negative as in DLT) and is not significantly different from zero.

For nearly half of our sample firm-year observations, the dividend yield variable is zero (i.e., the firm did not pay a dividend). Since we are interested in how the dividend yield affects the dividend tax penalty, the large number of zero dividend observations in the sample is problematic. DLT attempt to control for these zero dividend firms by including the dummy variable DUM in equation (14) and interacting it with INST, where DUM is equal to 1 if the firm does not pay a dividend and zero other wise. In our opinion, a more straightforward approach is to simply estimate equation (14) without the zero dividend observations, and we do so in Columns 4 and 5 of Table 2. While interacting DUM with all of the independent variables will give the same result as excluding the zero dividend observations from the sample, avoiding all of the DUM interactions makes the results easier to interpret when we add additional risk variables to the model.

Because the coefficient on $YIELD^2$ is no longer significant when the corrected dividend yield measure is used (see Column 3 where the t-statistic on the mean of $YIELD^2$ is 0.50) we drop $YIELD^2$ from the regressions reported in Columns 4 and 5. Finally, because the institutional ownership variable may be correlated with risk measures that have not been adequately controlled for in the DLT risk adjustment procedure, we include two additional risk measures (in addition to BETA) in Column 5—the log of market value of equity (SIZE) and book-to-market (BTM).

To summarize the results reported in Table 2, the coefficient on $YIELD^2$ is no longer significant when yield is measured correctly, so we exclude it from the regression. We also exclude all zero dividend observations, and we add two additional risk measures. The results of these modifications to the original DLT model specification (Column 5) show that the coefficients on INST and INST*YIELD are no longer significantly different from zero, which is not consistent with the original DLT results. Also, the coefficients on the three risk measures are all significant.

We report our estimation of equation (14) under various specifications using the larger sample in Table 3. When yield is measured correctly, the critical INST*YIELD variable is positive in every specification, including the original DLT specification, and is not significantly different from zero. This result is robust to removing the $YIELD^2$ variable and the zero dividend observations, as well as adding additional risk measures. Using the largest sample available, and measuring dividend yield correctly, there is no evidence that the coefficient on dividend yield differs as the level of institutional ownership increases.

5. Conclusions

We investigate whether the fraction of a firm's stock owned by tax-exempt investors mitigates the effect of shareholder-level taxes on expected stock returns. We develop a model that specifically addresses the relations among shareholder taxes, stock ownership, and expected returns. Like the earlier finance models, we use an equilibrium approach, but in our model we explicitly characterize the equilibrium stock ownership by tax-exempt investors in order to evaluate whether stock ownership by tax-exempt investors mitigates the dividend tax penalty, as hypothesized in several recent articles in the accounting literature.

Our model has two types of investors, taxable and tax-exempt, and three investments: a taxable bond and two risky stocks.[14] First, we demonstrate which factors affect how much of each stock is held by tax-exempt investors. Except for stocks with extremely low risk, we find that both taxable and tax-exempt investors will hold strictly positive amounts of each stock. If interest, dividends and accrued capital gains were all taxed at the same rate, tax-exempt investors would hold the same fraction of every stock. This fraction equals the aggregate risk tolerance of tax-exempt investors relative to all investors. Differences in the tax rates on interest, dividends, and accrued capital gains induce tax-exempt investors to hold more high-dividend stocks and more high-risk stocks.

Second, we demonstrate that the expected return on each stock consists of three components: the risk-free interest rate, a risk premium, and a dividend tax penalty. The dividend tax penalty is the product of the stock's dividend yield and a tax term that is a function of the aggregate risk tolerances of the two types of investors as well as the tax rates faced by the

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[14] We also demonstrate how our model can easily be generalized to include taxable investors facing different tax rates.

taxable investors. However, the percentage of a stock held by tax-exempt investors does not affect the amount of the dividend tax penalty. Assuming all investors hold some of each stock, the penalty is identical for both stocks as long as the dividend yields are the same, regardless of the percentage of each stock held by tax-exempt investors.[15]

We reconcile the predictions of our model with recent empirical work in accounting that suggests institutional ownership mitigates the dividend tax penalty. We find that these empirical results are sensitive to which variables and sample firms are included in the model, and how the dividend yield variable is measured. When we measure the dividend yield correctly, the variable yield squared is no longer significant. Excluding yield squared and those observations with zero dividends, while including two additional measures of risk (size and book-to-market), results in a coefficient on the interaction of institutional ownership and dividend yield that is not significantly different from zero. Furthermore, this critical interaction term is not significant for any specifications for a larger sample using more recently available data.

Our results make an important contribution to tax research in accounting by demonstrating in an equilibrium setting how differences in tax-exempt investor ownership across different stocks affect expected returns. In general, the percentage of tax-exempt investors in the economy affects the dividend tax penalty for all stocks in the same way, and the dividend tax penalty does not differ for two stocks with the same dividend yield. These results should help guide future empirical tax research in accounting.

[15] However, if due to exposure to undiversifiable risks or due to non-financial preferences, some investors are inframarginal with respect to a particular stock (i.e., they own no shares of the stock), then those investors will have no effect on the price of that stock and thus no effect on that stock's dividend tax penalty.

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Appendix A

Proof of proposition 1: Equations (2), (5), and (7) imply:

$$\sum_{j=1}^{M}\frac{d_X(1-t_d)-p_X R(1-t_b)+(\mu_X-p_X)(1-t_g)}{\sigma_X^2(1-t_g)^2\rho_j}+\sum_{j=M+1}^{N}\frac{d_X-p_X R+\mu_X-p_X}{\sigma_X^2\rho_j}=1$$

$$\frac{w_T[d_X(1-t_d)-p_X R(1-t_b)+(\mu_X-p_X)(1-t_g)]}{\sigma_X^2(1-t_g)^2}+\frac{w_E[d_X-p_X R+\mu_X-p_X]}{\sigma_X^2}=1$$

$$p_X=\frac{\mu_X\left[w_E+\frac{w_T}{1-t_g}\right]+d_X\left[w_E+\frac{w_T(1-t_d)}{(1-t_g)^2}\right]-\sigma_X^2}{w_E(1+R)+\frac{w_T[1-t_g+R(1-t_b)]}{(1-t_g)^2}} \qquad \text{(A1)}$$

Similarly, equations (3), (6), and (8) imply:

$$p_Y=\frac{\mu_Y\left[w_E+\frac{w_T}{1-t_g}\right]+d_Y\left[w_E+\frac{w_T(1-t_d)}{(1-t_g)^2}\right]-\sigma_Y^2}{w_E(1+R)+\frac{w_T[1-t_g+R(1-t_b)]}{(1-t_g)^2}} \qquad \text{(A2)}$$

Substituting these market clearing prices into equations (2)-(3) and (5)-(6) shows that each ownership fraction is strictly greater than zero for stock *i* when

$$\frac{R\mu_i(t_b-t_g)+Rd_i(t_b-t_d)-d_i(t_d-t_g)}{(1+R)(1-t_g)^2}<\frac{\sigma_i^2}{w_T}. \text{ QED}$$

Proof of Proposition 2:

(a) Subtracting (11) from (12) and simplifying yields the result.

(b) Set $\sigma_X^2 = \sigma_Y^2$ and solve for the value of μ_Y that makes $p_X = p_Y$, using (A1) and (A2). Then substitute this value of μ_Y into (12) to determine the fraction of shares of *Y* held by tax-exempt investors. Subtracting this value from the fraction of shares of *X* held by tax-exempt investors (found using (12)) yields

$$\frac{\dfrac{w_E w_T (d_X - d_Y)(t_d - t_g)}{(1-t_g)^2}}{\sigma_X^2\left[w_E + \dfrac{w_T}{1-t_g}\right]}.$$

(c) Differentiating (12) with respect to σ_i^2 yields the result. QED

Proof of Proposition 3: The expected rate of return on stock *i* is $\dfrac{d_i + \mu_i - p_i}{p_i}$. Substituting the price from equation (A1) into the numerator and denominator of this expression and simplifying yields the result. QED

Appendix B

The effect of stock splits on the measure of dividend yield

DLT state that their measure of dividend yield is (p. 160) “the amount of dividends per share declared in the last quarterly dividend announcement of the year times four, deflated by the prior-year-end split-adjusted stock price.” However, deflating the stock price to reflect stock splits without also deflating the dividend per share causes the dividend yields measured in the earlier sample periods to be overstated by a large amount. We illustrate this effect using the sample firm Kansas City Southern for 1989.

Table B1 panel A reports the CRSP data relating to the share price of Kansas City Southern for 1988, the year prior to the sample year. The last column labeled "CFACPR" is the cumulative factor to adjust share prices for stock splits. The factor for December, 1988 is 192.24. Dividing the year-end share price of 33.875 by this factor results in an adjusted stock price of 0.1762.

Panel B of Table B1 reports the CRSP data relating to dividend distributions by Kansas City Southern for 1989, the first sample year. The column "DISTCD" of 1232 is the CRSP code indicating this is a regular quarterly cash dividend that is fully taxable. The last dividend of the year, in the amount of 0.27, was declared on November 20, 1989 ("DCLRDT") and paid on December 29, 1989 ("PAYDT"). Although not shown on this table, the CFACPR value at November and December of 1989 was still 192.24.

Multiplying the 0.27 quarterly dividend by 4 results in an annual dividend of 1.08. Dividing this by the split-adjusted stock price of 0.1762 results in a yield of 6.129, which is equal to the maximum dividend yield for 1989 reported in Table 1 of DLT.

However, because there were no stock splits between December, 1988 (when the prior year stock price was measured) and November, 1989 (when the last quarterly dividend of 1989 was declared), the correct dividend yield is 1.08/33.875 = .032. This would be the result if both the stock price and the dividend amount were adjusted by the cumulative adjustment factor. Adjusting only the price and not the dividend amount results in a dividend yield that is nearly 200 times too large.

This is obviously an extreme example, and was chosen to illustrate our point. The method of computing dividend yields in DLT appears to be in error. Not only are the yields much too large, but they are related to the number of stock splits experienced by the sample firm.

Table 1
Descriptive statistics for 1989

	n	mean	median	SD	min	max
DLT reported results						
annual return	1,517	0.198	0.174	0.416	-0.800	3.917
inst ownership	1,517	0.351	0.350	0.204	0.000	0.956
dividend yield	1,517	0.057	0.028	0.176	0.000	6.129
Replication: DLT sample						
annual return	1,517	0.198	0.174	0.416	-0.800	3.917
inst ownership	1,511	0.342	0.336	0.204	0.000	0.936
dividend yield	1,517	0.068	0.029	0.184	0.000	6.129
corrected div yield	1,517	0.023	0.018	0.025	0.000	0.308
Extension: large sample						
annual return	2,830	0.167	0.118	0.597	-0.961	15.444
inst ownership	2,830	0.270	0.227	0.210	0.000	0.936
dividend yield	2,830	0.050	0.000	0.145	0.000	6.129
corrected div yield	2,830	0.018	0.000	0.026	0.000	0.317

"DLT reported results" reprints the results reported in Table 1 of DLT.
"Replication: DLT sample" is our replication using the same sample firms as DLT.
"Extension: large sample" is our extension of DLT using a larger sample.
Annual return = calendar year return from CRSP.
Inst ownership = the percentage of shares held by institutions reported by Thomson Financial CDA/Spectrum institutional 13(f) holdings database.
Dividend yield = the yield computed as in DLT.
Corrected div yield = the yield computed by adjusting both stock price and dividend amount for stock splits.

Table 2
Replication and sensitivity of DLT table 2 results using the DLT sample

	original DLT reported results		replication results							
			using DLT yield measure		using corrected yield measure					
			original DLT model specification		original DLT model specification		drop zero dividend observations and yield^2 term		drop zero dividend observations and yield^2 term; add size and book-to-market	
	mean coef	t	mean coef	t	mean coef	t	mean coef	t	mean coef	t
intercept	0.105	2.27	0.056	2.11	0.054	2.04	-0.189	-2.43	-0.092	-0.99
DUM	-0.180	-3.79	-0.146	-3.30	-0.215	-3.44	-	-	-	-
BETA	0.008	0.49	-0.002	-0.10	0.001	0.03	0.071	2.18	0.073	2.35
YIELD	2.672	6.47	1.634	4.75	4.419	4.85	4.705	4.76	4.743	4.44
YIELD^2	-4.306	-2.74	-2.864	-2.12	4.364	0.50	-	-	-	-
INST	-0.235	-2.58	-0.226	-3.95	-0.228	-3.96	-0.019	-0.42	-0.013	-0.31
INST*DUM	0.156	2.11	0.153	2.17	0.264	3.25	-	-	-	-
INST*YIELD	-0.966	-3.98	-0.402	-3.53	-3.491	-3.95	-2.833	-2.29	-1.821	-1.18
SIZE	-	-	-	-	-	-	-	-	-0.009	-2.48
BTM	-	-	-	-	-	-	-	-	-0.056	-3.01
n =			20,877		20,877		11,054		11,054	

Dependent variable is return minus mean return of risk portfolio based on size and book-to-market.
Coefficients reported are means of coefficients from ten annual cross-sectional regressions (1989-1998).
DUM = 1 if firm paid dividend and 0 otherwise.
BETA = market model beta using prior 48 monthly returns.
YIELD = the yield computed as in DLT (first two columns) or the yield computed by adjusting both stock price and dividend amount for stock splits (last three columns).
INST = percentage of shares held by institutions reported by Thomson Financial CDA/Spectrum institutional 13(f) holdings database.
SIZE = log of market value of equity.
BTM = book-to-market.
Industry dummy variables not reported.

Table 3
Replication and sensitivity of DLT table 2 results using a larger sample size (same sample time period)

	using DLT yield measure		using corrected yield measure					
	original DLT model specification		original DLT model specification		drop zero dividend observations and yield^2 term		drop zero dividend observations and yield^2 term; add size and book-to-market	
	mean coef	t	mean coef	t	mean coef	t	mean coef	t
intercept	0.052	2.95	0.050	2.90	-0.101	-2.29	-0.135	-2.19
DUM	-0.140	-4.07	-0.145	-3.19	-	-	-	-
BETA	-0.013	-0.67	-0.011	-0.52	0.050	1.87	0.049	1.82
YIELD	1.254	4.32	2.005	2.86	1.368	4.23	1.433	4.29
YIELD^2	-1.692	-1.77	-4.786	-1.37	-	-	-	-
INST	-0.246	-5.09	-0.248	-5.02	-0.098	-2.99	-0.109	-3.60
INST*DUM	0.194	3.17	0.180	3.09	-	-	-	-
INST*YIELD	-0.297	-1.25	0.997	0.84	1.138	1.38	0.907	1.13
SIZE	-	-	-	-	-	-	0.005	1.33
BTM	-	-	-	-	-	-	0.017	1.72
n =	34,538		34,538		15,152		15,152	

Dependent variable is return minus mean return of risk portfolio based on size and book-to-market.
Coefficients reported are means of coefficients from ten annual cross-sectional regressions (1989-1998).
DUM = 1 if firm paid dividend and 0 otherwise.
BETA = market model beta using prior 48 monthly returns.
YIELD = the yield computed as in DLT (first column) or the yield computed by adjusting both stock price and dividend amount for stock splits (last three columns).
INST = percentage of shares held by institutions reported by Thomson Financial CDA/Spectrum institutional 13(f) holdings database.
SIZE = log of market value of equity.
BTM = book-to-market.
Industry dummy variables not reported.

Table B1

CRSP data for price and dividend for Kansas City Southern

Panel A: Price data for 1988

Obs	CUSIP	DATE	month	year	PRC	RET	CFACPR
1	48517030	19880129	1	1988	49.000	0.19878	192.24
2	48517030	19880229	2	1988	47.500	-0.02510	192.24
3	48517030	19880331	3	1988	51.125	0.07632	192.24
4	48517030	19880429	4	1988	37.000	-0.27628	192.24
5	48517030	19880531	5	1988	37.625	0.02419	192.24
6	48517030	19880630	6	1988	42.875	0.13953	192.24
7	48517030	19880729	7	1988	38.750	-0.09621	192.24
8	48517030	19880831	8	1988	37.250	-0.03174	192.24
9	48517030	19880930	9	1988	34.625	-0.07047	192.24
10	48517030	19881031	10	1988	38.000	0.09747	192.24
11	48517030	19881130	11	1988	38.250	0.01368	192.24
12	48517030	19881230	12	1988	33.875	-0.11438	192.24

Panel B: Dividend data for 1989

DATE	month	year	DISTCD	DIVAMT	DCLRDT	PAYDT	SHROUT
19890223	2	1989	1232	0.27	19890217	19890321	.
19890331	3	1989	.	.	.	.	10,384
19890524	5	1989	1232	0.27	19890522	19890620	.
19890630	6	1989	.	.	.	.	10,384
19890823	8	1989	1232	0.27	19890818	19890919	.
19890929	9	1989	.	.	.	.	10,384
19891127	11	1989	1232	0.27	19891120	19891229	.
19891229	12	1989	.	.	.	.	10,408