

**Tax Clienteles and Implicit Taxes:  
Interaction of Multiple Clienteles in Financial Markets**

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**Abstract:** This paper models equilibrium in a financial market with multiple tax clienteles and multiple assets. When investors face taxation on their returns, arbitrage by a marginal clientele equalizes after-tax returns for different assets, leading to differences in pre-tax returns known as implicit taxes. This paper analyzes a situation in which there is no single marginal clientele arbitraging every asset market, but rather, different clienteles arbitrage different markets (*i.e.*, there are multiple marginal clienteles in the economy). In such an environment, the implicit taxes on many assets reflect a mixture of tax characteristics of multiple clienteles. This study explores the implication of this mixed clientele effect for implicit taxes on corporate equity with varying dividend yields and for municipal bonds. This paper derives different empirical predictions from the extant theoretical literature, predictions that are largely consistent with the extant empirical literature.

## **Tax Clienteles and Implicit Taxes:**

### **Interaction of Multiple Clienteles in Financial Markets**

The questions of whether and how taxes influence financial market equilibrium, asset prices, and rates of return have been analyzed and tested in numerous studies. Models of a tax effect have typically posited a marginal tax clientele which arbitrages available financial assets and equalizes after-tax returns (*e.g.*, Miller, 1977). In such models, tax rates faced by non-marginal clienteles are irrelevant to asset pricing. Empirical tests of the implications of these tax models for relative pre-tax returns of different assets have often failed to provide support for them.

An underutilized extension of the marginal clientele modeling approach involves consideration of the simultaneous clearing of markets for several (at least three) assets with more than one tax clientele (first considered by Dybvig and Ross, 1986). Under these circumstances, more than one clientele could be marginal between different asset pairs, implying that those asset pairs will exhibit relative returns reflecting different tax characteristics. Further, some asset pairs will not be directly arbitrated, but only indirectly arbitrated through intermediary assets and multiple marginal clienteles. The implicit taxes in these asset pairs will reflect a mixture of tax rates faced by multiple clienteles. The after-tax returns on these assets will differ for every clientele, and therefore, would appear inconsistent with clientele-based arbitrage (if empirically tested).

The purpose of this paper is to apply this multiple marginal clientele concept to the choice of three assets with significantly different tax treatments (corporate equity including preferred stock, taxable debt, and tax-free municipal debt). I develop empirical

implications for implicit taxes on stocks (with varying dividend yields) and municipal bonds that differ from the extant literature and might explain the failure of empirical studies to support the predictions of single-marginal clientele models. In particular, implicit taxes on equity possess an inverted trapezoid shape (non-monotonic) as a function of dividend yield. Municipal bond implicit taxes depend on a variety of details of the equity market.

I will proceed as follows. Section I reviews the literature on tax clientele models in finance and empirical studies on the effect of taxes on stock and municipal bond returns and prices. Section II develops a model of relative returns and clientele portfolios in a market with stocks (with a distribution of dividend yields), taxable bonds, and municipal bonds. Section III derives equilibrium implicit taxes on equity and relates these predictions to the empirical literature, while Section IV derives equilibrium implicit taxes on municipal bonds. Section V concludes the paper. The Appendix contains proofs of all the propositions in the paper.

## **I. Literature on tax clienteles, implicit taxes, and tax capitalization**

Numerous studies have considered the effect of taxes on financial market equilibrium, both in terms of rates of return and price levels. The two principal focuses of the literature have been tax-free municipal bonds and corporate equity, especially with respect to variation in dividend payments.

Traditional models of municipal bond yields assume that a clientele arbitrages municipal bonds and taxable bonds (U.S. Treasury or corporate). Since municipal bonds generate no tax liability on the interest they generate, these models predict that municipal

yields should equal taxable bond yields (of equal risk) multiplied by one minus the marginal clientele's tax rate. The literature has largely focused on two issues: who is the marginal clientele (either individuals or corporations) and whether the implicit tax on municipal bonds has the predicted magnitude. Trczinka (1982) claims that corporations are the marginal investors, and the implicit tax corresponds to the corporate tax rate. Fortune (1988) claims that individuals are the marginal investors, and the implicit tax corresponds to the top marginal tax rate on individual investors.<sup>1</sup> While these and other studies of municipal bond implicit taxes identify an association with tax rate changes, they generally estimate implicit taxes for long-term municipal bonds that are too low to be explained by the basic tax clientele model (unless future tax rates have been historically expected to decline, even when at relatively low levels). Mankiw and Poterba (1996) develop a model in which municipal bonds are arbitrated by individuals against corporate equity (and equity is arbitrated by tax-exempts against taxable bonds), resulting in a mix of dividend and capital gains taxes driving implicit tax rates. They find a statistical association consistent with that prediction, although the coefficient on dividend taxes is significantly smaller than predicted by their model.

Models of the effect of taxes on corporate equity include Miller (1977), which predicts that the marginal clientele between debt and equity should have a tax differential between ordinary income and capital gains tax rates equal to the corporate tax rate, and

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<sup>1</sup> Historically, both clienteles have owned substantial portions of the municipal bond market (Board of Governors, 2001), so the appropriate clientele is not obvious. Indeed, the clientele holdings suggest that both corporations and individuals are marginal holders of municipal bonds, yet the traditional clientele models are incompatible with that outcome.

the implicit tax rate on equity should have that magnitude (to induce firms to issue both stocks and bonds).

Other studies have considered the effect of taxes on the relationship between dividend yield and (risk-adjusted) stock return. These include Brennan (1970), who assumes that the marginal clientele includes individuals, and Miller and Scholes (1978), who assume that the marginal clientele includes tax-exempt entities. In consequence, Brennan predicts a positive linear relationship between dividend yield and risk-adjusted return, while Miller and Scholes predict no relationship between dividends and returns. The empirical evidence on this question is mixed and falls into two groups. One group regresses holding period returns (typically one-year returns) on dividend yields. These studies<sup>2</sup> use different empirical structures and risk controls to arrive at conflicting results. Some find no relationship while others find a relationship that does not appear linear. The second group of empirical papers examines the behavior of stock prices on ex-dividend days (when dividend taxes should induce a less than dollar-for-dollar reduction in share price if the marginal clientele does not consist of tax-exempts). While a number of studies find an ex-dividend day effect consistent with individual investors being marginal,<sup>3</sup> other studies have questioned whether the ex-dividend day returns behavior is tax-induced or due to other factors (such as Bali and Hite, 1997, Shaw, 1991, and Kalay, 1982). Overall, the empirical evidence from both these literature streams on the relationship between dividends and returns (and the implied marginal clientele) is mixed.

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<sup>2</sup> These include Naranjo, Nimalendran, and Ryngaert (1998), Chen, Grundy, and Stambaugh (1990), Miller and Scholes (1982), Gordon and Bradford (1980), Blume (1980), Litzenberger and Ramaswamy (1979), and Black and Scholes (1974).

One recent paper, Aboody and Williams (2001), uses stock index futures data to develop a measure of risk-free return for four stock indices (based on a hedged portfolio long in the stock and short in the futures). That paper can, therefore, directly estimate the level of implicit tax in each of the indices. They find a significant, but relatively small implicit tax on equity. Moreover, they find that the implicit tax has declined substantially over time and, cross-sectionally, that the low-dividend NASDAQ 100 index has significantly higher implicit tax than the higher-yielding S&P 500, S&P Midcap 400, and NYSE composite indices.<sup>4</sup>

A related, but distinct, branch of research involves the effect of taxes on asset price levels. By reducing after-tax cash flows received by investors (interest, dividends, and capital gains), taxes should reduce the valuation of those assets. The principal asset considered in this context has been corporate equity. Recent theoretical papers include Kemsley and Williams (2001), Williams (2001a), and Lang and Shackelford (2000). However, Guenther and Sansing (2002) point out that changes in required pre-tax returns and real asset returns could eliminate or even reverse these tax capitalization effects. Several empirical studies have provided evidence supporting the existence of tax capitalization using panel studies (Collins and Kemsley, 2000, Harris, Hubbard, and

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<sup>3</sup> These include Lasfer (1995), Lamdin and Hiemstra (1993), Barclay (1987), Poterba and Summers (1984), and Elton and Gruber (1970).

<sup>4</sup> Interestingly, those three indices have very similar implicit tax estimates despite material differences in average dividend yields. Thus, overall, Aboody and Williams' results suggest the dividend yield-implicit tax relationship to be non-linear.

Kemsley, 1999, and Harris and Kemsley, 1999),<sup>5</sup> event studies (Lang and Shackelford, 2000, and Ayers, Cloyd, and Robinson, 2000), and time series (Williams, 2001a).

Regardless of whether tax capitalization occurs, or how large it is, the question of whether assets bear implicit tax is a fundamentally distinct, albeit related, one. Tax capitalization is an *absolute* effect (stock prices fall in response to taxes), while implicit tax is a *relative* effect (stock returns fall relative to bond returns in response to taxes). As Kemsley and Williams (2001) note, in an economy with multiple clienteles, it is possible for substantial tax capitalization to occur at the same time that implicit taxes are zero.<sup>6</sup> Thus, studies of tax capitalization and studies of implicit taxes, such as this one, are related, but nevertheless distinct.

## II. Model setup

I will consider implicit taxes in the context of a financial market consisting of three tax clienteles of investors and three asset types. The three clienteles include individuals, corporations, and tax-exempt entities. These represent the three basic tax statuses available in most countries. In reality, there could be multiple variations of individuals (high or low bracket, long or short investment horizon, different states of residence) and corporations (net operating losses or not, different states). The model could readily be generalized to accommodate these clientele variations, but for simplicity we assume that

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<sup>5</sup> Other papers have questioned some of these findings (Dhaliwal, Erickson, Myers, and Bany, 2001, and Hanlon, Myers, and Shevlin, 2001).

<sup>6</sup> In Kemsley and Williams' model, the marginal clientele between stocks and bonds includes tax-exempts, leading to no implicit tax, while the marginal clientele between consumption and investment includes individuals, leading to positive tax capitalization.



all members of each basic type are identically taxed. The three clienteles possess the following characteristics:

	Ordinary tax rate	Dividend tax rate	Capital gains tax rate	Endowment
Tax-exempts	0	0	0	$W_e$
Individuals	$t$	$t$	$g (< t)$	$W_i$
Corporations	$t$	$t_d (< t_g)$	$t_g (< t)$	$W_c$

Individuals face preferential tax treatment on capital gains due to lower statutory rate, deferral, selective realization, and possible step-up at death;  $g$  is the accrual-equivalent tax rate on capital gains. Corporations face some preferential tax treatment on capital gains, but also receive a substantial reduction in tax burden from dividends due to the dividend received deduction, currently 70 percent (or higher in some cases) in the U.S. The endowments are the total aggregate investable wealth available to members of each clientele. The clienteles are assumed to consist of many identical independent, atomistic investors who, consequently act as price-takers. As is common in tax clientele models, absent limits on short sale opportunities (borrowing in the case of bonds), no equilibrium exists (due to unbounded tax arbitrage). Similar to Miller (1977), for simplicity we assume that short sales are entirely prohibited, although any finite bound could be imposed with no material effect on the model.

The three asset types comprising the financial market are taxable bonds, tax-free municipal bonds, and corporate equity. Equity is further differentiated by the fact that different securities pay different amounts of dividends. Two stocks with identical dividend

yields are equivalent for tax purposes, so we characterize stocks by their yields ( $d$ ).

Characteristics of the three assets are:

	Tax treatment	Supply	Return
Municipal bonds	None	$X_m$	$R_m$
Taxable bonds	Ordinary rate	$X_b$	$R_b$
Stock (dividend = $d$ )	Dividend rate on $d$ , capital gains rate on $R(d) - d$	$X(d)$	$R(d)$

The relative returns on assets are endogenously determined by market clearing. Since the model cannot unambiguously determine absolute returns, and the issue of absolute returns is not of concern in this paper, I must fix one of the returns exogenously, in particular,  $R_b$ .<sup>7</sup>

The supply of stocks needs clarification. A continuum of shares exists offering dividend yields ranging from 0 to  $D$ ,  $D \leq R_b$ .<sup>8</sup> The function  $X(d)$  denotes the quantity of stock with dividend yields of no greater than  $d$ . Hence  $X(D)$  is the total quantity of stock available (which we will also denote as  $X_s$ ).  $X(d)$  is assumed to be continuous everywhere

<sup>7</sup> While beyond the interest of this paper, there are at least two ways in which the level of  $R_b$  could be determined. First, firms could have access to unlimited marginal real investments generating that rate of return, which are financed by borrowing (supply-side pegging). Alternatively, there could be a consumption-investment tradeoff, in which case the interest rate is set at just the right level to induce agents to invest sufficient funds (*i.e.*, defer consumption) to purchase the entire supply of financial assets (demand-side pegging).

<sup>8</sup> This assumption is sufficient, but not necessary to ensure that individuals do not find bonds tax preferable to stocks. The results derived in the model hold so long as enough

and increasing in the interval  $(0, D)$ .<sup>9</sup> Aggregate supply equals aggregate demand by assumption, thus

$$W_e + W_i + W_c = X_m + X_b + X_s.^{10}$$

Investors in each clientele select portfolios that maximize after-tax returns. The available assets are modeled as being riskless, so maximizing return is the optimal strategy. As Williams (2001b) points out, this riskless assumption is innocuous as long as a parsimonious set of futures contracts is available to investors. In that case, risk-averse investors will choose portfolios as if risk-neutral, and the asset returns can be regarded as risk-free equivalents.<sup>11</sup>

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stocks exist with dividend yields below the interest rate. In particular, we only require that  $L \neq R_b$ .  $L$  will be derived in Propositions 2a through 2c.

<sup>9</sup> This is to insure that  $X^1(Z)$  is well defined for all  $Z$  such that  $0 < Z < X_s$ . The continuity assumption means that  $X(0) = 0$ , so that no measurable quantity of zero dividend stock exists. While that is not an empirically valid assumption, it makes proofs of the propositions cleaner. Qualitatively, the characterization of equilibrium is the same if  $X(0) > 0$ . The discussion of Proposition 2a in the text includes mention of what happens if  $X(0)$  is positive.

<sup>10</sup> Note that this assumption merely presumes the existence of market forces sufficient to ensure that aggregate demand equals aggregate supply for some  $R_b$ . Importantly, it does not require that either aggregate demand or aggregate supply be inelastic.

<sup>11</sup> Utilizing futures contracts, an investor can acquire any risky portfolio and swap the risk on that portfolio for whatever risk exposure is desired. This risk swap is effectively tax-free regardless of the tax treatment of futures profits (as long as it is symmetric) since the futures position can be rescaled to offset any tax. In this manner, all investors can choose portfolios that are fully tax optimal while simultaneously selecting risk exposures that are optimal from a risk-return tradeoff standpoint. This separation of risk and tax incentives means that investors will act as if risk-neutral, and at the margin all investors will face the same disutility of risk ensuring a common well defined risk premium on every asset. This is critical as it allows me to transform all risky variables, including returns, future prices, future dividends, and future cash flows using the common certainty-equivalent measure; this transformation will be implied throughout the paper. As Williams (2001b)

The equilibrium possesses a preferred habitat flavor. Each clientele acquires certain assets that are relatively tax-favorable to them (relative to other clienteles) and avoids other assets entirely. Any assets held by a particular clientele must generate identical after-tax returns for that clientele (since all investors within the clientele are independent price-takers, nobody would be willing to buy an asset with a lower return), while assets not held by the clientele must generate inferior after-tax returns. Thus, each clientele is the marginal clientele between any two assets held by that clientele and not marginal otherwise. Each pair of assets has at most a single marginal clientele and could have none (*e.g.*, municipal bonds and taxable bonds). If no marginal clientele exists, a path exists between the two assets (and possibly more than one) of different marginal clienteles arbitraging successive asset pairs.

To elaborate, returns on any pair of assets are linked in equilibrium through clientele arbitrage. If the two assets are not directly arbitrated, there must exist a series of arbitrages (a path) linking them (*e.g.*, A and C might be linked by A being arbitrated with B and B arbitrated with C). The implicit tax differential between the two assets will equal the sum of all implicit taxes along the path. Generally, in any tax clientele model, a path must exist between any two assets, but that path need not be unique.

In this manner, all assets have relative returns (implicit taxes) that reflect the tax characteristics of some subset (and potentially all) of the available clienteles. This

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demonstrates, the number of futures contracts required to achieve this outcome equals the number of systematic risk factors in the economy (*e.g.*, one in the CAPM) plus the number of clienteles (two in this paper) minus one.

contrasts with most implicit tax models in which only one clientele is marginal and any other clienteles are inframarginal.

The preferred habitats are low-yield stocks for individuals (due to favorable capital gains treatment), high-yield stocks (particularly preferred stock) for corporations (due to favorable dividend treatment), and taxable bonds for tax-exempt entities (who do not benefit from the tax advantages of other assets). That leaves middle-yielding stocks and municipal bonds as the “frontier” between the three clienteles, which, depending on relative endowments and specific tax parameters, more than one clientele could occupy.

The exact nature of the equilibrium depends upon the relative endowments of the three clienteles and the relative sizes of the different asset markets. For example, if  $W_e < X_b$ , the bond market is too large for the tax-exempt sector by itself and another clientele will “invade” its territory, becoming the marginal bondholder. On the other hand, if  $W_e > X_b$ , the tax-exempt sector will need to spill over into other assets (specifically, equity) and be the marginal (and only) bondholder.

Numerous equilibria exist based on different relative endowments. The equilibria of greatest interest are those in which each clientele has a stake in the equity market. These are also the most realistic considering that each clientele actually has a substantial presence in the equity market. Section IV will outline the three possible regimes in which all clienteles participate in the stock market (the three regimes differ in terms of who buys municipal bonds). The various other cases, in which at least one clientele is pushed out of the equity market, are of insufficient interest to warrant derivation in this paper.<sup>12</sup>

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<sup>12</sup> The specific restrictions on endowments required to ensure that all clienteles participate in the equity market depend on the tax parameters. This is because, for different tax

Equilibrium involves tax-exempts purchasing all taxable bonds. Stocks split into three groups based on dividend yields. There exist cutoffs  $L$  and  $U$  (derived below) such that individual investors purchase all stocks with yields less than or equal to  $L$ , corporate investors purchase all stocks with yields greater than  $U$ , and tax-exempts purchase all stocks with yields between  $L$  and  $U$ . The municipal bond market could be dominated by either individuals or corporations or shared between them (more on this later).

This split of the stock market between clienteles holding shares with distinct dividend yields is consistent with Dhaliwal, Erickson, and Trezevant (1999) who find that firms initiating dividends experience a shift in ownership from individuals to institutions. Likewise, the portfolios predicted by the model for each clientele are consistent with the asset holdings in the Flow of Funds Accounts (Board of Governors, 2001).

### **III. Equilibrium stock returns**

Within the set of stocks owned by each clientele, that clientele equalizes after-tax returns. Stocks at the boundary between two clienteles must be consistent with equalization of after-tax returns for both clienteles. That links the returns on stocks with different clienteles. Finally, the tax-exempt sector ensures that all stocks it owns have the same return as the taxable bond ( $R_b$ ). In the premise of Proposition 1 below, I conjecture that the stock market will partition between the three clienteles in a particular way. In

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parameters, either individuals or corporations or both clienteles could participate in the municipal bond market. The exact parameter restrictions will be stated in Propositions 2a, 2b, and 2c.

Propositions 2a through 2c, I demonstrate that the conjectured partition of the stock market occurs in equilibrium.

*Proposition 1:* If individuals own all stocks with dividend yields less than  $L$ , corporations own all stocks with yields greater than  $U$ , and tax-exempts own all stocks with yields between  $L$  and  $U$  as well as all taxable bonds, then stock returns will be

$$R(d) = \left\{ \begin{array}{ll} R_b - \frac{t-g}{1-g}(L-d), & 0 \leq d \leq L, \\ R_b, & L < d < U, \\ R_b - \frac{t_d - t_g}{1-t_g}(U-d), & U \leq d \leq D. \end{array} \right\} \quad (1)$$

*Proof:* Appendix.

$R(d)$  exhibits a trapezoidal shape, increasing until  $L$ , flat until  $U$ , and decreasing after that (see Figure 1). Conversely, implicit taxes on equity have an inverse trapezoidal shape, 0 in the center and positive for dividend yields in the tails. This contrasts with the linear relationship derived in Brennan (1970) which assumes the existence of only one marginal clientele.

**Insert Figure 1 Here**

The non-linear relationship between implicit tax and dividend yield embodied in (1) is entirely consistent with the implicit tax estimates in Aboody and Williams (2001). They find that the implicit tax rate is, on average, positive (6 to 10 percent) but much smaller than it would be if the marginal clientele for all common stocks included individuals (more than 20 percent during the post-1993 period of their study). (1) suggests that some stocks bear no implicit tax, while others bear less than they would if individuals were the only clientele (ignoring the high-yield stocks that are likely to include primarily preferred stocks in practice), so on average, common stocks bear modest implicit taxes, as Aboody and Williams find.

In addition, Aboody and Williams find that the NASDAQ 100 bears a substantially greater implicit tax rate (7 to 8 percent more) than the other three indices they study (S&P 500, Midcap 400, and NYSE Composite) as one would expect given the extremely low dividend yield of most NASDAQ stocks (average is 0.2 percent according to Aboody and Williams compared to 1.3 percent for the Midcap, 1.5 percent for the S&P 500, and 1.9 percent for the NYSE). That is not surprising, but what is interesting is the relative implicit tax of the other three indices. These indices do not follow the expected ordering based on traditional tax theory (*e.g.*, the NYSE has the highest average dividend yield of the three, but it also has the highest implicit tax). This latter result is entirely inconsistent with a Brennan-type single marginal clientele model, but it is consistent with (1) when one notes that the NYSE has not only the highest average dividend yield, but the highest standard deviation dividend yield of all the indices studied by Aboody and Williams. (1) suggests that, holding the average yield constant, an index with a larger spread of yields should have a larger average implicit tax (due to the convex shape of the yield-implicit tax



relationship). Thus, this model can explain the cross-sectional evidence in Aboody and Williams that is inconsistent with the prior theoretical literature.

Finally, Aboody and Williams find that the average implicit tax has declined significantly over time (their study covers the 1993-1999 period), concurrent with a steady decline in average dividend yields. This is precisely the opposite of what traditional tax theory would predict. Lower dividends should imply higher implicit taxes. This anomalous empirical finding is readily explained by my model. Note that as dividend yields decline for all stocks,  $L$  also declines.<sup>13</sup> As  $L$  falls, implicit taxes on low-yield stocks decline, so the average implicit tax declines as well. This is precisely what Aboody and Williams document. Of course, these predictions of my model are comparative statics of different dividend policy regimes, rather than true time series implications.

Note that the non-linear relationship in (1) is also consistent with Lang and Shackelford (2000). They find that the impact of the capital gains tax on risk-adjusted returns differs significantly between the lowest dividend portfolio and all of the other portfolios, but does not differ between any of the higher dividend portfolios.

Furthermore, the non-linear (in fact, non-monotonic) nature of (1) could explain the failure of the dividend yield-returns literature, discussed in Section 1, to consistently find a relationship between dividend yield and risk-adjusted returns. Another drawback of many of those studies is the use of time series data. As discussed in the context of

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<sup>13</sup>  $L$  represents the boundary between the stocks that individuals can purchase with their residual wealth (after buying municipal bonds) and the stocks that tax-exempts can purchase with their residual wealth (after buying taxable bonds). As the number of low-yield stocks increases, individuals do not need to settle for as high-yielding stocks to fill up their portfolios, while the reduction in higher-yield stocks compels the tax-exempts to buy lower-yielding shares to use up all of their available funds.

Aboody and Williams, my model offers very different predictions for the time series and cross-sectional relationships between dividend yield and return. Specifically, the time series relationship should be driven by endowment shifts and shifts in the distribution of dividend yields,  $X$ , which determine  $L$  and  $U$ .<sup>14</sup>

The model can also explain the findings in Engle, Erickson, and Maydew (1999) who compare yields on regular preferred stock to trust preferred stock exchanged for it. Trust preferred stock is debt for tax purposes, but otherwise essentially identical to the regular preferred stock it replaces. That paper estimates an implicit tax rate on preferred stock of 5.2 percent. With a corporate tax rate of 35 percent and a 70 percent dividend received deduction, (1) would predict that level of implicit tax if the preferred had an average dividend yield 1.5 percent above  $U$ . Given an average yield of 7.9 percent on the preferred in that study, that would imply that  $U$  is roughly 6.4 percent, a level that very few common stocks provide (but most preferred stocks do).

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<sup>14</sup> As an example, assume that the dividend distribution  $X$  shifts to the left over time (as it has in the last 20 years).  $L$  will steadily decline, causing the return on low-yielding stocks to increase according to my model, holding all else constant. The average dividend yield will decrease over time for a portfolio of the lowest-yielding stocks. Hence, the model predicts a negative time series relationship between dividend yield and returns for low-yielding stocks, while the cross-sectional relationship is positive. Indeed, Chen, Grundy, and Stambaugh (1990) find a significant negative relationship between dividend yield and returns for the lowest yielding portfolio, a result seemingly at odds with tax theory, but in fact, consistent with my model given the panel structure of their study.

#### IV. Municipal bond market and equilibrium

As noted in Section II, there are three possible regimes for the municipal bond market. Both individuals and corporations are willing to accept rates of return equal to the after-tax returns they receive on their stock holdings. Whichever clientele is willing to accept the lower return will acquire the entire supply of municipal bonds. If the two clienteles have identical after-tax returns, they will share the municipal market. I now consider each case, deriving the complete market equilibrium for the locus of parameter values that leads to that case (and characterizing the locus).

##### Case 1: Individuals buy all municipal bonds.

*Proposition 2a:* Assume that the following conditions hold,

$$W_i > X_m,$$

$$W_e > X_b, \text{ and}$$

$$(\mathbf{t}_g - g)R_b \leq (t - g)X^{-1}(W_i - X_m) + (\mathbf{t}_g - \mathbf{t}_d)X^{-1}(X_s - W_c). \quad (2)$$

In equilibrium, tax-exempts will choose to hold all taxable bonds and individuals will choose to hold all municipal bonds. Individuals will choose to hold all stocks with dividend yields less than  $L$ , corporations will own all stocks with yields greater than  $U$ , and tax-exempts will own all stocks with yields between  $L$  and  $U$ , where

$$L = X^{-1}(W_i - X_m) \text{ and}$$

$$U = X^{-1}(X_s - W_c).$$

Stock returns will obey (1) and municipal bond returns will be

$$R_m = (1 - g)R_b - (t - g)L. \tag{3a}$$

*Proof:* Appendix.

This case is very similar to the model in Mankiw and Poterba (1996). Municipal bond implicit taxes are a weighted average of the capital gains and dividend tax rates, with the weight being the fraction of total return on the marginal stock received in the form of a dividend. Mankiw and Poterba assume that all shares provide the same dividend and thus is a special case of this model. Since dividend yields do in reality vary across firms, the appropriate dividend yield,  $L$ , in the implicit tax formula is different from the average dividend. Hence, Mankiw and Poterba's use of the average dividend yield in their regression results in mis-specification, which could explain why their coefficient estimate on  $(t - g)d$  is significantly less than the predicted value of one.

If non-dividend paying stock exists, so that  $X(0) > 0$ , then the equilibrium is the same as in Proposition 2a, as long as  $X(0) \leq W_i - X_m$ . Since  $X$  is not invertible if  $X(0) > W_i - X_m$ , the characterization of equilibrium in the proposition is not well defined then. In that case, individuals will only buy non-dividend paying stocks (but not all of them),

$L = 0$ , and consequently  $R_m = (1 - g) R_b$ . In this special case, only the capital gains tax is relevant for municipal bond yields.

The first two restrictions on the parameter space in proposition 2a ensure that all clienteles participate in the stock market. Condition (2) is the crucial restriction on the parameter space that ensures that only individuals choose to hold municipal bonds, since if (2) holds, the municipal bond return is less than or equal to the after-tax return for corporate investors in high-yield stock so that corporations do not find municipals attractive. If (2) fails to hold, individuals will not monopolize the municipal market, and one of the following cases applies.

Case 2: Corporations buy all municipal bonds.

*Proposition 2b:* Assume that the following conditions hold,

$$W_c > X_m,$$

$$W_e > X_b, \text{ and}$$

$$(\mathbf{t}_g - g)R_b \geq (t - g)X^{-1}(W_i) + (\mathbf{t}_g - \mathbf{t}_d)X^{-1}(X_s + X_m - W_c). \quad (4)$$

In equilibrium, tax-exempts will choose to hold all taxable bonds and corporations will choose to hold all municipal bonds. Individuals will choose to hold all stocks with dividend yields less than  $L$ , corporations will own all stocks with yields greater than  $U$ , and tax-exempts will own all stocks with yields between  $L$  and  $U$ , where

$$L = X^{-1}(W_i) \text{ and}$$

$$U = X^{-1}(X_s + X_m - W_c).$$

Stock returns will obey (1), and municipal bond returns will be

$$R_m = (1 - t_g)R_b + (t_g - t_d)U. \tag{3b}$$

*Proof:* Appendix.

The return formula for municipal bonds parallels that in Proposition 2a, with corporate tax rates substituted for individual tax rates and a much higher dividend yield. While some studies have explored the possibility of corporations as marginal municipal bondholders, none considered the prospect that they would arbitrage municipals and high-yield stocks. Thus, while Fortune (1988) rejects the hypothesis of corporations being the marginal clientele for municipal bonds, that rejection could be due to the presumption that corporations would arbitrage using taxable bonds.

The necessary restrictions on the parameter space to ensure that all clienteles hold stock are slightly different from Proposition 2a. The key difference in the assumptions of Propositions 2a and 2b is the substitution of condition (4) for condition (2). (4) ensures that the municipal bond return is less than or equal to the after-tax return for individual investors in low-yield stock so individuals do not find municipals attractive.

Case 3: The municipal bond market is shared. This case occurs if the other cases do not.

*Proposition 2c:* Assume that the following conditions hold,

(2) and (4) are both violated,

$$W_i > X_m,$$

$$W_c > X_m, \text{ and}$$

$$W_e > X_b.$$

Given these assumptions, there is a unique  $f$  (with  $0 < f < 1$ ) such that

$$(\mathbf{t}_g - g)R_b = (t - g)X^{-1}(W_i - fX_m) + (\mathbf{t}_g - \mathbf{t}_d)X^{-1}(X_s + (1 - f)X_m - W_c).$$

Tax-exempts will choose to hold all taxable bonds. Individuals will choose to hold fraction  $f$  of the municipal bond supply. Corporations will choose to hold the remainder of the municipal bond supply. Individuals will choose to hold all stocks with dividend yields less than  $L$ , corporations will own all stocks with yields greater than  $U$ , and tax-exempts will own all stocks with yields between  $L$  and  $U$ , where

$$L = X^{-1}(W_i - fX_m) \text{ and}$$

$$U = X^{-1}(X_s + (1 - f)X_m - W_c).$$

Stock returns will obey (1), and municipal bond returns will be

$$R_m = (1 - g)R_b - (t - g)L \quad (3a)$$

$$= (1 - t_g)R_b + (t_g - t_d)U. \quad (3b)$$

*Proof:* Appendix.

In this case, there are two paths by which municipal bonds are arbitrated with taxable bonds; each path goes through equity using a different marginal clientele.  $f$  adjusts to ensure that each arbitrage path produces the same implicit tax on municipals. Likewise, in this case, low-yield and high-yield stocks are arbitrated through two different paths; one path is the standard path through middle-yield stocks and the other path flows through the municipal bond market. Figure 2 displays this equilibrium.<sup>15</sup>

### Insert Figure 2 Here

In Proposition 2c, the formulas for  $R_m$  from Propositions 2a and 2b hold simultaneously ((3a) and (3b)). Therefore any empirical finding consistent with one clientele being the marginal municipal bondholder does not imply rejection of the hypothesis that the other clientele is also marginal (*e.g.*, Mankiw and Poterba, 1996, which suggests that individuals are marginal investors).

Which of the three cases represents the real world is an empirical issue. Case 3 appears most consistent with the Flow of Funds data (Board of Governors, 2001) in which

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<sup>15</sup> The first two parameter restrictions in Proposition 2c are, in fact, unnecessarily strong. Given  $f$ , the equilibrium holds if  $W_i > fX_m$  and  $W_c > (1 - f)X_m$ .



both individuals and corporations have held substantial quantities of municipal bonds throughout the data record.

## **V. Concluding Remarks**

This study has considered how the interaction of multiple marginal tax clienteles in financial markets can influence relative returns of different assets (implicit taxes). It has developed implications that differ from prior studies that assume a single marginal clientele. Moreover, the paper's predictions appear to fit the empirical evidence very well. The general nature of the results is that the implicit tax on an asset is often driven by a mixture of tax characteristics of different clienteles, including clienteles that do not own the asset in question, as well as tax characteristics that are unrelated to the asset (such as capital gains taxes for an interest-generating bond).

Some of the key findings in the paper are as follows:

- 1) Implicit taxes on equity exhibit an inverted trapezoid shape (see Figure 1) as a function of dividend yield, cross-sectionally. Only the lowest and highest yielding stocks bear any implicit tax. [Proposition 1]
  
- 2) A market-wide reduction in dividend yields results in lower implicit taxes on low-yield stocks.

- 3) Implicit taxes on municipal bonds involve a mixture of dividend and capital gains tax rates faced by the marginal clientele. The marginal clientele could be either individuals or corporations or both simultaneously (see Figure 2). [Propositions 2a, 2b, and 2c]

These findings allow me to re-examine various empirical studies of implicit taxes in the literature. This paper's model can explain some seemingly anomalous results in prior papers, such as the negative time series association between stock returns and dividend yields. This association has been documented by Aboody and Williams (2001) and others. In addition, such a time series relationship would explain the negative relationship between returns and dividend yield for the lowest-yielding stocks found in the panel data studies of Chen, Grundy, and Stambaugh (1990) and others. The negative time series relationship between returns and dividend yields contradicts traditional single-clientele tax theory (such as in Brennan, 1970). This paper's prediction of a trapezoid shaped cross-sectional returns-yield relationship can also explain the highly non-linear capitalization of a capital gains tax cut (as a function of dividend yield) observed by Lang and Shackelford (2000). The trapezoid shape is also consistent with Aboody and Williams's finding of a non-linear relationship between implicit tax estimates and average dividend yields for their four stock indices.

A research area of considerable interest in finance is the association between dividend yield and stock returns. As discussed in Section I, a variety of studies has estimated this relationship. These studies offer conflicting evidence. However, they generally test for a linear association whereas my model implies a non-monotonic one.

Clearly, if a non-monotonic relationship exists, a linear test could fail to detect it. Further, my model implies that the time series relationship between yield and return is far different (and typically opposite) from the cross-sectional one. Since the tests in the literature generally utilize time series or pooled panel data, they should not be expected to detect the cross-sectional association. The model in this paper offers a foundation for more discriminating empirical tests of the returns-dividend yield relationship that could overcome these mis-specification problems in prior research.

Other promising avenues for future empirical research based on this paper's findings include tests of municipal bond yields based on both individual and corporate arbitrage, as well as a test of the division of the municipal market between the two clienteles across time, since my model predicts what factors determine that split.

The model developed in this paper could be extended in a variety of interesting ways. One possibility would be to develop a general equilibrium involving endogenous supply of assets, similar to Miller (1977). Additionally, the model can be augmented with other assets and clienteles (*e.g.*, a continuum of individuals with different tax rates, or similarly a progressive tax system). Indeed, the basic principle that underlies the analysis in this paper, that multiple clienteles can be simultaneously marginal leading to mixture effects in implicit taxes that cannot be replicated in single clientele models, offers broad applicability to a wide variety of issues in taxation and finance.

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## Appendix: Proof of the Propositions

### Proposition 1

Since members of a clientele are independent, atomistic price-takers, they will only be willing to hold an asset if it generates at least as great an after-tax return as all other assets. Thus, all assets held by a clientele must have equal after-tax returns. The tax-exempt sector is assumed to hold taxable bonds (with return  $R_b$ ). Hence, all stocks held by the tax-exempts (those with  $L \leq d \leq U$ ), must also have a return of  $R_b$ .

Since  $R(L) = R_b$ , its after-tax return to individuals is

$$(1 - g)(R_b - L) + (1 - t)L.$$

All stocks held by individuals (those with  $0 \leq d \leq L$ ), must generate an identical after-tax return, hence,

$$(1 - g)[R(d) - d] + (1 - t)d = (1 - g)(R_b - L) + (1 - t)L.$$

Rearranging this, yields the formula for  $R(d)$  given by (1).

The proof that (1) is valid for  $U \leq d \leq D$  is analogous using the equalization of after-tax returns by corporations.

### Proposition 2a

Given the first two assumptions, the specifications of  $L$  and  $U$  in the proposition are well specified with  $L < U$ . I begin the proof by conjecturing that the clienteles do, in fact, choose portfolios in the manner specified by the proposition. I will then demonstrate the returns on assets implied by arbitrage given this conjecture. Finally, I will show that given those returns, the conjectured portfolios are optimal for the clienteles and that all markets clear.

The conjecture on portfolios is that tax-exempts will choose to hold all taxable bonds and individuals will choose to hold all municipal bonds. Individuals will choose to hold all stocks with dividend yields less than  $L$ , corporations will own all stocks with yields greater than  $U$ , and tax-exempts will own all stocks with yields between  $L$  and  $U$ , where

$$L = X^{-1}(W_i - X_m) \text{ and}$$

$$U = X^{-1}(X_s - W_c).$$

By Proposition 1, this implies that (1) holds. Also, arbitrage by individuals (who hold municipal bonds) ensures that the after-tax return on municipals equals the after-tax return on stocks held by individuals (those for which  $d < L$ ). Given  $R(d)$  from (1), for  $d < L$ ,

$$R_m = (1 - g) \left( R_b - \frac{t - g}{1 - g} (L - d) - d \right) - (1 - t)d.$$

Any  $d$  leads to the same simplification, (3a). The transformation to (3a) is easiest to see if  $d = L$  and the second term in brackets drops out.

By construction of the asset returns, each clientele is indifferent between all assets that it is conjectured to hold. The proof of portfolio optimality requires the demonstration that for each clientele, no asset exists with a higher after-tax return than the assets in its portfolio.

Tax-exempts: This clientele only cares about pre-tax return. It can be readily seen that stock and municipal bond returns in (1) and (3a) never exceed  $R_b$  (since  $t > g > 0$  and  $t_g > t_d$ ).

Individuals: Given (3a), this clientele does not desire to hold taxable bonds unless

$$(1 - t)R_b > (1 - g)R_b - (t - g)L.$$

This condition reduces to  $L > R_b$ , which cannot occur since  $L < D$ , and  $D \leq R_b$  by assumption (on page 8).

The other assets not included in individuals' portfolios are stocks with  $d > L$ . From (1), increasing  $d$  beyond  $L$  does not increase the pre-tax return (and eventually decreases it), while the tax on stock increases with  $d$  (due to shifting from lightly-taxed capital gains to dividends). Thus, increases in  $d$  beyond  $L$  monotonically reduce after-tax return, making these stocks sub-optimal for individuals.

Corporations: Given (1), this clientele does not desire to hold taxable bonds unless

$$(1 - t)R_b > (1 - t_g)R_b - (t_d - t_g)U.$$

This could only occur if  $U < 0$ , which is impossible.

Another set of assets not included in corporations' portfolios are stocks with  $d < U$ . From (1), decreasing  $d$  below  $U$  does not increase the pre-tax return (and eventually decreases it), while the tax on stock for corporations decreases with  $d$  (due to shifting from capital gains to lightly-taxed dividends). Thus, decreases in  $d$  below  $U$  monotonically reduce after-tax return, making these stocks sub-optimal for corporations.



The final asset not owned by corporations is municipal debt. It will be desirable to acquire it if it generates a higher return than the stocks held by corporations. Comparing (3a) to (1) implies that corporations will prefer municipals if

$$(1 - g)R_b - (t - g)L > (1 - t_g)R_b - (t_d - t_g)U.$$

Condition (2) holds if and only if the above inequality fails.

Market clearing: The final step in the proof involves the demonstration that all markets clear if clienteles choose their conjectured portfolios. The municipal and taxable bond markets clear since the portfolios involve exhaustive investment in each of these markets by a single clientele (individuals and tax-exempts, respectively). Market clearing for stocks is evident by the fact that the amount of stock with dividends less than  $L$  exactly equals the residual wealth of individuals (after investing in municipals), the amount of stock with dividends between  $L$  and  $U$  exactly equals the residual wealth of tax-exempts (after investing in taxable bonds), and the amount of stock with dividends greater than  $U$  exactly equals the wealth of corporations (who invest in nothing else).

### Proposition 2b

The proof is directly analogous to the proof of 2a. The differences are that the municipal bond return is determined by equating it to the corporate after-tax return on high-yield stock, resulting in (3b). Also, I need to demonstrate that individuals do not want to hold municipal bonds. It can be readily seen that (4) ensures that the after-tax return for individuals of low-yield stock exceeds the return on municipals, similar to the role that (2) plays in the proof of 2a.

### Proposition 2c

The key to this proof is the demonstration that there is a unique  $f$  that solves

$$(t_g - g)R_b - (t - g)X^{-1}(W_i - fX_m) - (t_g - t_d)X^{-1}(X_s + (1 - f)X_m - W_c) = 0$$

with  $0 < f < 1$ .

Note that the above expression is negative if  $f = 1$  by (2) and positive if  $f = 0$  by (4). Further, the expression is monotonically decreasing in  $f$ , since  $X^{-1}$  is monotonically increasing. Thus, there exists a unique  $f$  between 0 and 1 that solves the above equation.

Given this  $\mathbf{f}$ , the conjectured portfolios are well specified and clear the market. Proposition 1 ensures that (1) holds. Given that both individuals and corporations hold municipals, the return on municipals must equal the after-tax return on stocks held by each of the two clienteles. Given (1), that implies that both (3a) and (3b) must hold. Equating the returns given by (3a) and (3b) results in the above expression, which holds for  $\mathbf{f}$ . The remainder of the proof is analogous to the proof of Proposition 2a.

Figure 1  
Relationship between Implicit Taxes and Dividend Yield

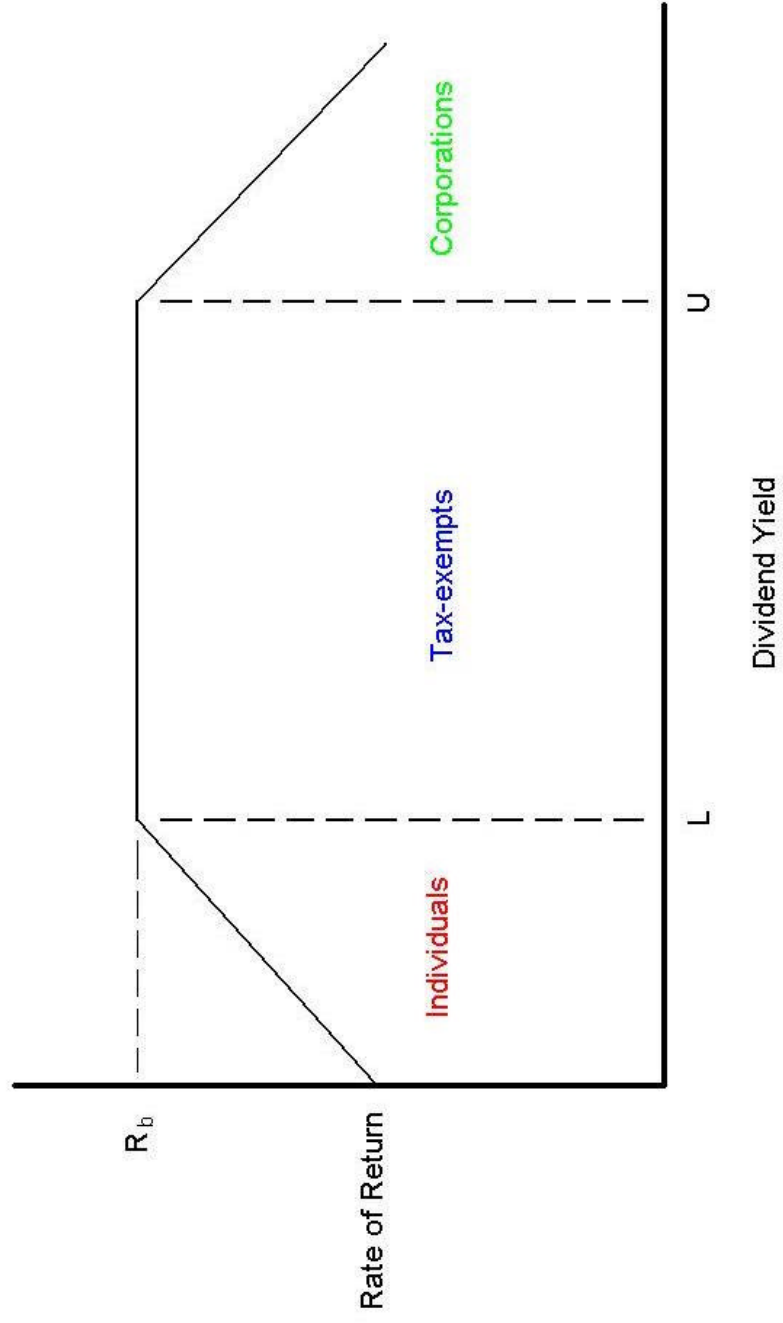


Figure 2  
Equilibrium in Financial Markets  
with a Continuum of Dividend Yields

