

Grandfather Clauses and Optimal Portfolio Revision

Bruce Tuckman
Jean-Luc Vila*

ABSTRACT

Grandfather clauses protect a security from adverse changes in the tax law. One such clause in the 1986 Tax Reform Act raised the effective tax rate that property-liability insurers pay on newly acquired tax-exempt bonds. This article derives an optimal switching strategy between taxable and exempt bonds that reflects the enhanced value of previously purchased exempts relative to those newly acquired.

Introduction

Adverse changes in the tax treatment of particular securities are often accompanied by grandfather clauses that shield existing holders from the changes. If these holders consider selling their positions, they should realize that any repurchases of these securities will be subject to the new, more severe tax law. By focusing on a particular provision in the Tax Reform Act of 1986, this article illustrates how to derive an optimal investment policy in the presence of grandfather clauses.

The Tax Reform Act of 1986 required property-liability insurers to reduce their tax deductions for losses by 15 percent of their tax-free income,¹ effectively raising their marginal tax rate on tax-exempt income. A grandfather clause stated that the rule applies only to income from tax-exempt bonds purchased after August 8, 1986. Effects of this change are quite important: From 1986 to 1989, over 30 percent of property-liability

* Bruce Tuckman is Assistant Professor of Finance at the Stern School of Business, New York University. Jean-Luc Vila is Assistant Professor of Finance at the Sloan School of Management, Massachusetts Institute of Technology. The authors thank Roni Michaely, Irwin Vanderhoof, and Benjamin Wurzbarger for helpful comments and suggestions. Jean-Luc Vila wishes to acknowledge financial support from the International Financial Services Research Center at the Sloan School of Management.

¹ See the Internal Revenue Code, USCA Title 26, §832. Because tax law dating back to the 1950s discourages life insurers from holding any significant quantity of tax-exempt bonds, the particular tax change discussed here is of little importance to life insurers. We thank Irwin Vanderhoof for this comment.

insurers' financial assets were in tax-exempt bonds, and these insurers held about 16.4 percent of all tax-exempt bonds outstanding (Board of Governors of the Federal Reserve System, 1990).

The literature relating tax law to investment policy grew along two branches. The first derived tax-induced trading strategies under the assumption that all investors are taxed alike. For example, Constantinides (1983, 1984) and Constantinides and Ingersoll (1984) analyzed optimal deferral and realization of capital gains and losses in stock and bond markets. The second branch focused on the fact that not all investors are taxed alike. Schaefer (1982) showed that differentially taxed investors usually disagree on the relative value of securities and, consequently, choose to hold different sets of securities. Furthermore, the set of securities held by any class of investors may very well change over time. Subsequent work (e.g., Dybvig and Ross, 1986; Dammon and Green, 1987; Dermody and Prisman, 1988) analyzed equilibrium prices in the presence of differential taxation.

The analysis here differs from both of these approaches. Whereas the first branch studied tax-induced trading in a *particular asset*, this article analyzes tax-induced trading *across assets*. And while the second branch studied the *equilibrium implications* of differential taxation, this article assumes that price movements can induce differentially taxed investors to switch from one asset to another in order to focus on an interesting *investment problem*. Furthermore, this is the first study of the effects of a grandfathered tax change on optimal trading strategies.

The next section formalizes the investment problem of a property-liability insurer that holds exempt bonds bought before August 8, 1986. Then, using historical parameters, we show that the value of the option to switch between bond classes and the value of the grandfather clause have nontrivial magnitudes.

The Model and Optimal Investment Policy

This section first develops the model in the absence of capital gains taxation in order to illustrate clearly and simply the methodology and the main results. The second part of the section adds capital gains taxation to the model.

No Capital Gains Taxation

Assume the existence of two types of perpetuities. Both types pay \$1, before taxes, each year, but the income from one type is tax-exempt, and the income from the other type is taxable. In an equilibrium characterized by differential taxation, the prices of the exempt and taxable securities will differ in a way that reflects the level of interest rates and the relative wealths of the different tax classes. Consequently, the difference between the two prices can be modeled as fluctuating randomly over time. For simplicity, we model the spread between taxables and exemptions by fixing the

price of the exempt perpetuity at some constant, P_E , and letting the price of the taxable perpetuity, P_T , fluctuate randomly.

Now consider the investment decision facing a property-liability insurer. Assume that it must attain an annual after-tax income of \$1 to meet its financial obligations, while any additional income from investment activities can be paid immediately to shareholders. Furthermore, the property-liability insurer chooses to maximize the present value of the expected additional income, discounting after-tax cash flows at some rate r .

Current tax law governing property-liability insurers is quite complicated. For the purposes of illustrating the effects of the grandfather clause, however, the following abstraction seems reasonable. Income from an exempt perpetuity already held by the insurance company is truly exempt from taxes, but income from a newly purchased exempt perpetuity is taxed at a relatively low insurer-specific rate, τ_L . Income from the taxable perpetuity is taxed at a relatively high insurer-specific rate, τ_H . Thus, the cost to the insurer of attaining its required income stream is P_E from exempt bonds already in its possession, $P_E/(1-\tau_L)$ from newly purchased exempt perpetuities and $P_T/(1-\tau_H)$ from taxable perpetuities.² To avoid confusion, exempt perpetuities already held by the insurer will be called "old exemptions" while those subsequently purchased will be called "new exemptions."

The insurer will always hold enough perpetuities to meet the required after-tax income of \$1 each year. It can earn additional profits, however, by switching between the two ways of achieving this income. For example, if the insurer holds taxable bonds, switching into new exempt bonds will earn an immediate gain of $P_T/(1-\tau_H) - P_E/(1-\tau_L)$ and leave the required after-tax income stream unchanged.

Let the cost advantage of purchasing exempt perpetuities be $\Delta \equiv P_T/(1-\tau_H) - P_E/(1-\tau_L)$. The quantity Δ reflects the insurer's valuation of taxable versus exempt income given the market's relative valuation of the two. A simpler and more reasonable way of modeling the evolution of Δ is to assume that it fluctuates randomly with no drift and with an instantaneous standard deviation of σ . In mathematical notation, $d\Delta = \sigma dz$, where dz is the increment of a standard Brownian motion.³

When should the insurer switch between taxables and new exemptions or vice versa? Since Δ is as likely to rise as to fall, the expected increase in the gain is zero, and time erodes the present value of its realization. Furthermore, since taxables and new exemptions can always be repurchased, the insurer does not restrict its future opportunities by switching. Therefore,

² Because of the newly instituted alternative minimum tax, many property-liability insurers will also have to model the interaction between their asset mix and their marginal tax rates.

³ This assumption is made to illustrate the effects of a grandfather clause in the most simple way. Some results for more general processes governing the evolution of Δ are available from the authors.

the insurer should switch as soon as it is profitable to do so. Claim 1 (below) proves this and derives the present value of the optimal policy.

If the property-liability insurer owns old exempts, switching into taxables does restrict the opportunity set: after selling the old bonds, achieving the required after-tax income through exempts will cost $P_E/(1-\tau_L) > P_E$. Therefore, the insurer would not sell its old exempts until the profit were large enough to compensate for the adverse effect on its opportunity set. Claim 2 (below) solves this investment problem.

Claim 1: An insurer holding only taxable perpetuities should switch to exempt perpetuities as soon as Δ becomes positive, that is, as soon as there is a cost advantage of doing so. Similarly, the insurer should switch back to taxable perpetuities as soon as Δ becomes negative.⁴ Furthermore, the present value of this switching strategy equals $e^{\Delta\gamma/2\gamma}$, where $\gamma^2 = 2r/\sigma^2$.

Sketch of Proof: Define the following notation:

$V_T(\Delta)$ = the value of the option to switch from taxable to new exempt perpetuities, given that the insurer holds taxables,

$V_E(\Delta)$ = the value of the option to switch from new exempt to taxable perpetuities, given that the insurer holds new exempts,

$V_{OE}(\Delta)$ = the value of the option to switch from old exempt to taxable perpetuities, given that the insurer holds old exempts,

E = the expectation operator, and

t = a time index.⁵

For Δ values such that it is not optimal to switch,

$$V_T(\Delta) = E \{ V_T(\Delta + d\Delta)e^{-rdt} \}. \quad (1)$$

Equation (1) states that the value of the option to switch when one does not choose to switch equals the discounted expected value of the option to switch. From Ito's Lemma and the assumed process $d\Delta = \sigma dz$, equation (1) gives rise to the differential equation $\gamma^2 V_T' = V_T''$, where primes denote derivatives with respect to Δ . When exempts are extremely expensive relative to taxables, the option to switch away from taxables is worthless, giving the boundary condition $V_T(-\infty) = 0$. Solving for V_T ,

$$V_T(\Delta) = ae^{\Delta\gamma} \quad (2)$$

⁴ For any diffusion process, the company should switch from new exempts to taxables and, conversely, when the expected value of $d\Delta$ equals $r\Delta$. In the special case of the present analysis, the expected value of $d\Delta$ equals zero, so the optimal switch occurs at $\Delta = 0$. The more general result can be interpreted in the same way as the result about the optimal time to cut down a tree: profits should be realized when the expected return from holding the position— $E\{d\Delta/\Delta\}$ —falls to the discount factor.

⁵ V_T is not a function of t : The option to switch does not expire, so its value changes with the passing of time only through changes in Δ .

for some constant a . The solution for V_E may be obtained in the same way, except that the appropriate boundary condition is $V_E(\infty) = 0$; when taxables are extremely expensive relative to exempts, the option to switch away from exempts is worthless. Furthermore, by symmetry, the constant in the solution will also be a . Hence,

$$V_E(\Delta) = ae^{-\Delta\gamma}. \quad (3)$$

Let $\hat{\Delta}$ be the optimal switching point from taxables to new exempts. At this optimal value of Δ , one must be indifferent between waiting to switch and realizing the gains from switching. Mathematically,

$$V_T(\hat{\Delta}) = \hat{\Delta} + V_E(\hat{\Delta}). \quad (4)$$

Note that the gains from switching to new exempts equal the immediate cost advantage of $\hat{\Delta}$ plus the value of the option to switch back.

Substituting equations (2) and (3) into equation (4) and maximizing with respect to a yields the result $\hat{\Delta} = 0$ and $a = 1/2\gamma$, proving Claim 1. ■

Claim 2: An insurer holding old, tax-favored exempt perpetuities should sell them and purchase taxables when $\Delta = \Delta^*$, $\Delta^* < 0$ and satisfying the equation

$$\gamma(-\Delta^* - K) + e^{\Delta^*\gamma} = 1,$$

where $K = P_E\tau_L/(1-\tau_L)$. Furthermore, the present value of this strategy is

$$\frac{1 - \gamma(\Delta^* + K)}{2\gamma} e^{(\Delta^* - \Delta)\gamma}.$$

Sketch of proof: Proceeding as above, one can show that the value of switching away from old exempts, for some constant a_{OE} , is given by

$$V_{OE} = a_{OE}e^{-\Delta\gamma}. \quad (5)$$

At the optimal switching point into taxables, Δ^* , the immediate cost advantage is $P_E - P_T/(1-\tau_H) = -\Delta - K$. Therefore, optimality requires that

$$V_{OE}(\Delta^*) = -\Delta^* - K + V_T(\Delta^*). \quad (6)$$

Applying the "smooth-pasting" condition (see, for example, Constantinides and Ingersoll, 1984) gives

$$V'_{OE}(\Delta^*) = -1 + V'_T(\Delta^*). \quad (7)$$

(For readers not familiar with this condition, a brief intuitive explanation follows. The function $V_{OE}(\Delta)$ gives the value of the option to switch from old exempts to taxables assuming an optimal switching policy, and the function $-\Delta - K + V_T(\Delta)$ gives the value of switching immediately. For any Δ the former must be at least as large as the latter by the definition of optimality. Combining this fact with equation (6), which states that the two functions are equal at Δ^* , implies that the derivatives of the two must be equal at Δ^* as well. Equation (7) expresses this derivative condition.)

Using equations (6) and (7) to eliminate a_{OE} yields the first part of Claim 2. Using the same equations, solve for a_{OE} and substitute the result into equation (5) to obtain the second part of Claim 2. ■

A number of comments can be made about the results of Claim 2. First, the equation governing Δ^* reveals that $\Delta^* = 0$ if and only if $K = 0$, that is, when $\tau_L = 0$. Swapping old exempts for taxables as soon as it is profitable is optimal if and only if the new exempt bonds are taxed as favorably as the old ones. Second, it is not difficult to show that Δ^* decreases in K . As the tax disadvantage of the new exempts rises, a larger profit must be available in order to trigger a switch.

Both property-liability insurers and public policy-makers should be interested in the value of the grandfather clause. To compute this value, consider the optimal actions of a property-liability insurer if the grandfather protection were removed. The insurer would either hold on to its exempts (even though they have been transformed into new exempts), or it would sell its exempts and purchase taxables. The decision would depend on the cost advantage of new exempts relative to taxables. Therefore, when taxables enjoy the cost advantage ($\Delta \leq 0$), the value of the grandfather clause can be defined as the value of holding the old exempts minus the value of switching into taxables and investing optimally thereafter. Similarly, when new exempts enjoy the cost advantage ($\Delta > 0$), the value of the grandfather clause can be defined as the value of holding the old exempts minus the value of having been thrown into new exempts and investing optimally thereafter. The following corollary computes the value of the grandfather clause.

Corollary: The value of the grandfather clause, $G(\Delta)$, is given by

$$G(\Delta) = \begin{cases} 0 & \Delta \leq \Delta^* \\ [1 - \gamma(\Delta^* + K)]e^{(\Delta^* - \Delta)\gamma/2\gamma - e^{\Delta\gamma/2\gamma + K + \Delta}} & \Delta^* \leq \Delta \leq 0 \\ [1 - \gamma(\Delta^* + K)]e^{(\Delta^* - \Delta)\gamma/2\gamma - e^{-\Delta\gamma/2\gamma + K}} & \Delta \geq 0. \end{cases}$$

Sketch of Proof: When $\Delta \leq \Delta^*$, Claim 2 reveals that the property-liability insurer optimally sells its old exempts and buys taxables. Therefore, the grandfather clause—the right to hold on to its old exempts—is irrelevant and without value.

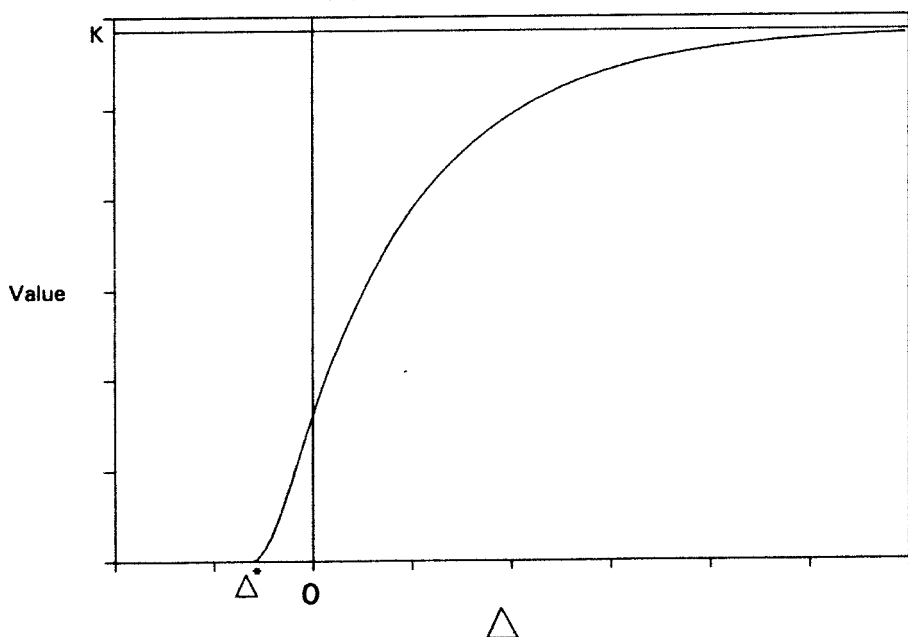
When $\Delta^* \leq \Delta \leq 0$, Claim 2 reveals that the insurer should hold its old exempts under the grandfather protection, obtaining the value given in Claim 2. Without this protection, the insurer's exempt bonds become new

exempts. Furthermore, since $\Delta \leq 0$, Claim 1 reveals that it should trade these exempt bonds for taxables, realizing $-K - \Delta$, and then invest optimally, realizing the value given in Claim 1. Thus, the value of the grandfather clause in this region is the value given in Claim 2 minus the value given in Claim 1 plus Δ plus K .

Finally, when $\Delta > 0$, Claim 2 states that the insurer should keep its old exempts under the grandfather protection, as in the previous region. Without this protection, the old exempts become new exempts, and, since $\Delta > 0$, Claim 1 reveals that the insurer should hold on to these new exempts. But, since the transformation of old exempts into new exempts lowers the insurer's after-tax income, it would need to buy an additional $1/(1-\tau_L) - 1$ exempt bonds at a cost of $P_E/(1-\tau_L) - P_E = K$. After this cash infusion the insurer will invest optimally and realize $V_E(\Delta)$, which is given in the proof of Claim 1. Thus, the value of the grandfather clause in this region is the value given in Claim 2 minus $V_E(\Delta)$ plus K . ■

Figure 1 illustrates the value of the grandfather clause as a function of Δ . As Δ increases—that is, as the attractiveness of taxable bonds falls relative to exempt bonds—the insurer increasingly prefers to hold its old exempts and, consequently, the value of the grandfather clause rises. Also note that for large Δ the insurer expects to hold exempts for a very long time, or, equivalently, the value of the option to switch out of exempts is negligible. Consequently, the value of the grandfather clause approaches the cost of

Figure 1
Grandfather Clause Value



buying enough additional new exempts to meet its required income. As discussed above, this cost is $P_E/(1-\tau_L) - P_E = K$.

Capital Gains Taxation

It was argued above that the optimal policy switches between new exempts and taxables as soon as it is profitable to do so. This result does not hold in the presence of capital gains taxation. To understand this, recall from the proofs of Claims 1 and 2 that, at the optimal switching point, the value of switching immediately equals the value of the option to switch in the future. Including capital gains taxation lowers both of these values, but, because taxes due from switching now are worth more than those due from switching later, the value of immediately switching falls more than the value of the option to switch. Therefore, capital gains taxation causes the insurer to require a larger cost advantage before switching out of its old exempts. The qualitative result of Claim 2, however, is unaffected by capital gains taxation. The favored tax status of the old exempts still delays the sale of those bonds.

To solve for the optimal policy with capital gains taxation, the technique used above must be changed in two ways. First, gains from switching immediately must be reduced by the capital gains tax liability. Second, the Δ used to trigger bond purchases determines the basis when the bonds are sold. While closed-form solutions to this more complicated problem do not exist, numerical solutions can be found. The next section reports some results on optimal switching with capital gains taxation.⁶ Readers may obtain a complete derivation by writing to the authors.

Empirical Motivations

Moody's Municipal and Government Manual reports ten-year yields on Treasury bonds and on Aaa state bonds. Assuming that the ten-year yield can be used for the perpetuity rate, one can create a time series for P_E and P_T . Monthly data from January 1986 through December 1989 gave an average P_E value of about \$15. To conform with the previous section's assumption of a constant P_E , one can normalize P_E to \$15 and adjust P_T accordingly. For any two tax rates τ_L and τ_H , these adjusted prices can then be used to generate a time series of Δ values. Next, the sample standard deviation of changes in Δ can be used to estimate an annual σ . Finally, a reasonable choice for the firm's discount factor of after-tax flows, r , is the rate implied from its current investments in old exempts: $1/P_E$ or 0.0667.

According to the tax code pertaining to the example of this article, τ_L should be set to 15 percent of τ_H . The level of the high tax rate will depend

⁶ The results do not incorporate optimal realization of capital losses for two reasons. First, this effect has been studied elsewhere, as mentioned earlier. Second, insurers are extremely reluctant to realize losses because of the adverse effects on their surplus.

on the particular insurer and can range from 20 percent (the newly instituted alternative minimum tax rate) to 34 percent (the regular tax rate), but for most property-liability insurers the marginal rate will fall between these two extremes.

As it turns out, at $\tau_H = 34$ percent, the smallest value of Δ is just barely negative: The potential gain was almost never large enough to justify a swap out of new exempts and into taxables, let alone a swap out of old exempts. The situation changes dramatically, however, at a tax rate of 25 percent. Figure 2 shows the evolution of Δ over the time period. The fact that Δ varies as much as it does indicates that the switching options discussed in this article are likely to be valuable.

Figure 2
Delta: January 1986-December 1989
(tax rate = 25%)

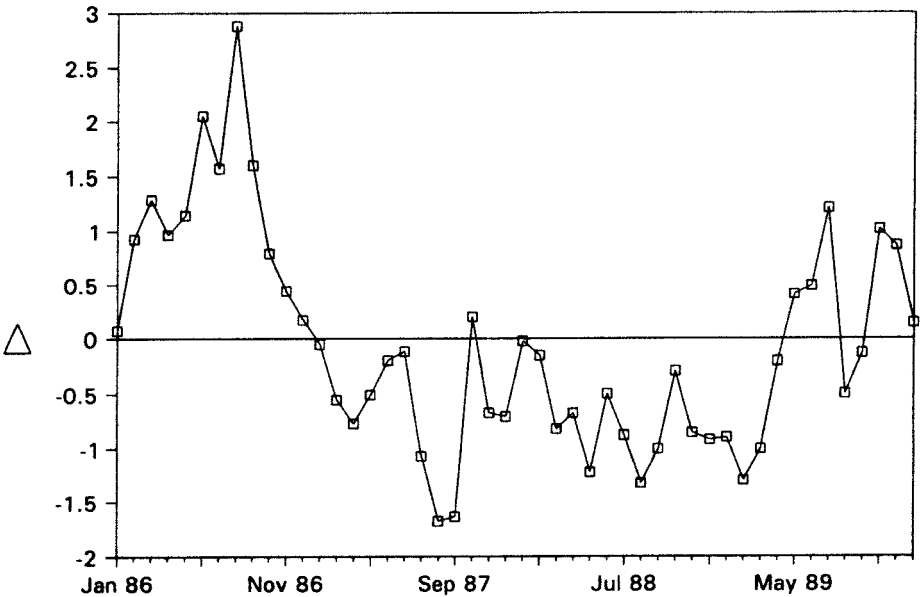


Table 1, using the above parameter values, reports values of Δ^* , $V_{OE}(0)$, and $G(0)$, the latter two as percentages of portfolio value. The perpetuity values were obtained from the results and discussions of the previous section. The values for finite maturity bonds were estimated by making an adjustment to the standard deviation of Δ in order to reflect the smaller price volatility of 10-, 20-, and 30-year bonds.⁷

⁷ The standard deviation of the Δ of a perpetuity was adjusted for shorter maturities by multiplying by the ratio of the shorter bond's duration to the perpetuity's duration.

Table 1

The Optimal Switching Policy and the Value of the Grandfather Clause

	Perpetuities	30-Year Bonds	20-Year Bonds	10-Year Bonds
No Capital Gains Taxation				
Δ^*	-2.96	-2.84	-2.68	-2.28
$V_{OE}(0)$	18.72%	16.92%	14.63%	9.49%
$G(0)$	.98%	1.03%	1.09%	1.27%
Capital Gains Taxation at the Income Tax Rate^a				
Δ^*	-5.17	-4.82	-4.37	-3.33
$V_{OE}(0)$	16.11%	14.58%	12.65%	8.29%
$G(0)$	1.98%	1.99%	2.02%	2.09%

Note: Δ^* = optimal switching point from old exempts to taxables. $V_{OE}(0)$ = value of being in old exempts and switching optimally thereafter when $\Delta = 0$, as a percentage of portfolio value. $G(0)$ = value of the grandfather clause when $\Delta = 0$, as a percentage of portfolio value.

^a Income tax rate = 25 percent.

The value of the switching options and of the grandfather clause have nontrivial magnitudes. Furthermore, values change in a reasonable way with maturity and capital gains taxation.

Since longer maturities are characterized by higher price volatilities, standard option theory predicts that the value of the switching option will increase in maturity. It follows that smaller switching gains—that is, smaller absolute values of Δ^* —are sufficient to outweigh the value of holding the switching option. Finally, the grandfather clause has the least value when volatility is highest: As switching out of old exempts becomes more valuable, the protection granted to old exempts becomes less valuable.

Capital gains taxation lowers the value of the switching option and increases the cost advantage required to trigger a switch, as discussed above. Also, lowering the value of the option to switch out of old exempts raises the value of the grandfather clause.

Conclusion

Grandfather clauses that protect a security from an adverse change in the tax law can be expected to affect optimal portfolio revisions. In the case of property-liability insurers that switch between exempt and taxable bonds, it has been shown that the Tax Reform Act of 1986 should cause companies to hold on to their protected exempts longer than they would have otherwise.

The simple model presented in this article was meant to illustrate the problem and the method of its solution. In applying the analysis to actual investment decisions, a property-liability insurer would want to adapt the model to bonds with realistic maturities, model the stochastic process governing Δ in a more sophisticated way, incorporate term structure effects,

and capture other complexities in the tax code, such as the alternative minimum tax.

References

- Board of Governors of the Federal Reserve System, September 1990, *Flow of Funds Accounts: Assets and Liabilities* (Washington, D.C.: Federal Reserve System).
- Constantinides, George M., 1983, Capital Market Equilibrium with Personal Tax, *Econometrica*, 51: 611-636.
- Constantinides, George M., 1984, Optimal Stock Trading With Personal Taxes, *Journal of Financial Economics*, 13: 65-89.
- Constantinides, George M. and Jonathan E. Ingersoll, Jr., 1984, Optimal Bond Trading with Personal Taxes, *Journal of Financial Economics*, 13: 299-335.
- Dammon, Robert M. and Richard C. Green, 1987, Tax Arbitrage and the Existence of Equilibrium Prices for Financial Assets, *Journal of Finance*, 42: 1143-1166.
- Dermody, Jaime Cuevas and Eliezer Zeev Prisman, 1988, Term Structure Multiplicity and Clientele in Markets with Transaction Costs and Taxes, *Journal of Finance*, 43: 893-911.
- Dybvig, Philip H. and Stephen A. Ross, 1986, Tax Clienteles and Asset Pricing, *Journal of Finance*, 41: 751-763.
- Moody's Investor Service, 1990, *Municipal and Government Manual* (New York: Moody's Investor Service).
- Schaefer, Stephen M., 1982, Taxes and Security Market Equilibrium, in: W. Sharpe and C. Cootner, eds., *Financial Economics: Essays in Honor of Paul Cootner* (Englewood Cliffs, N.J.: Prentice-Hall), 159-177.

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