Chapter 5 – Implicit Taxes and Clienteles, Arbitrage, Restrictions, and Frictions

5.1 Tax-Favored Status and Implicit Rates: “[I]mplicit taxes arise because the prices of investments that are tax favored are bid up in the marketplace.” (p. 92) When the cost of a tax favored asset increases, the before-tax rate of return of the asset declines (because the before tax return remains constant but the cost of the investment increases).

5.1.1 You should know about the following kinds of interest income: (a) interest on federal T-Bills, bonds and notes is subject to federal income tax but not to state income tax; (b) interest on state and local bonds is exempt from federal income but, in general, is subject to state income tax; and (c) many states exempt interest on their own state bonds as well as interest from local bonds issued by a municipality within the state (no state exempts the interest on bonds issued by other states or by municipalities located in other states, though some states do not levy an income tax). Note: gain arising from the sale or exchange of a state or local bond is subject to federal income tax, though such gain rarely arises in significant amounts.

5.1.2 An investment can be tax-preferred in a variety of ways including full or partial exclusion of income, allowable tax credits, or acceleration of depreciation.

5.1.2.1 Historically, investment in depreciable equipment included an investment tax credit (ITC). The effect of such a credit is to reduce the after-tax cost of the equipment by the dollar amount of the credit. Note that the value of a tax credit is the dollar amount of the tax credit as opposed to a deduction that is worth the dollar amount of the deduction times the taxpayer's marginal tax rate.

5.1.2.2 Depreciation is allowable for investment in assets that waste over time. The economically correct depreciation in any year is the diminution in the value of the asset. For example, if investment property is purchased for $1,000 and after one year it is worth $850, then $150 should be allowable as a depreciation deduction. As a result, if the property generated receipts of $250, the net income would be $250 - $150, or $100, for a 10% pre-tax return. If depreciation is allowable in excess of the true, economic depreciation, then the taxable return will be understated for tax purposes. In this example, if the depreciation deduction were set at $200 (despite the economic decline being only $150), the investor would pay tax on $50 of net income even though the true return was $100. For equipment and machinery (but not for buildings), depreciation is considerably accelerated in the following three ways: (1) the total depreciation is larger than it should be because scrap value is treated as $0; (2) the statutory life over which the depreciation deductions are allowable is shorter than the economic life of the asset; and (3) the rate at which the depreciation deductions are allowed is overly skewed to the early years of the investment.
5.1.2.3 Example: Suppose a taxpayer invests $100,000 in an asset that will return 10% (i.e., $10,000) each year. Assume further that the asset is nondepreciating and has a three-year investment horizon. What is the investor's after-tax rate of return assuming (a) no depreciation or tax credit is allowed; (b) the cost of the investment can be deducted immediately; or (c) the asset qualifies for a 10% tax credit and depreciation can be claimed at a rate of 50% in each of the first two years? Assume the investor has significant income each year from other sources to make all deductions fully valuable and assume that the tax credit reduces the dollar amount of allowable depreciation.

5.1.2.3.1 The after-tax cost of the investment equals $100,000. The investment's after-tax return will be $6,000 after one year, $6,000 after two years, and $106,000 after three years. Because $6,000/1.06 + $6,000/(1.06)^2 + $106,000/(1.06)^3 equals $5,660 + $5,340 + $89,000, or $100,000, the after-tax annual rate of return equals 6% (i.e., the before-tax rate of return of 10% times (1 minus the annual tax rate). Thus, for a nondepreciable asset, allowing immediate expensing of the cost is equivalent to exemption of the return (i.e., the after-tax rate of return of 10% equals the pre-tax rate of return of 10%).

5.1.2.3.2 The after-tax cost of the investment equals $100,000 – 0.40($100,000), or $60,000. The after-tax return will be $6,000 after one year, $6,000 after two years, and $66,000 after three years. Because $6,000/1.10 + $6,000/(1.10)^2 + $66,000/(1.10)^3 equals $5,455 + $4,959 + $49,587, or $60,000, the after-tax annual rate of return equals 10%. Thus, for a nondepreciable asset, allowing immediate expensing of the cost is equivalent to exemption of the return (i.e., the after-tax rate of return of 10% equals the pre-tax rate of return of 10%).

5.1.2.3.3 The after-tax cost of the investment equals $100,000 - $10,000, or $90,000. The after-tax return equals [$10,000 + $35,000(0.40)] + [$10,000 + $35,000(0.40)] + $66,000, or a total of approximately $90,000, and that is an after-tax annual rate of return of about 10.65%.

5.1.2.3.4 If an investment costs $I at time zero and yields only a single payment of $A after n compounding periods, then the IRR is that value of r for which $I = $A/(1 + r)^n. Solving for r yields r = ($A/$I)^{1/n} – 1, a formula we have seen before.

5.1.2.3.5 If an investment costs $I at time zero, compounds at a rate R per compounding period, and yields only a single payment after n compounding periods, the accumulation will equal $I(1 + R)^n$. The IRR is that value of r for which [$I(1 + R)^n]/(1 + r)^n = $I$, or $r = R$. 

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5.1.3 Equilibrium Analysis: If there were no frictions or restrictions and the laws of supply and demand had time to adjust all goods to their market-clearing price, every risk-adjusted, after-tax return would be equal. So, for example, a taxable bond would pay interest at the tax-free rate, grossed-up by the tax rate, assuming no risk. Similarly, if an investment is tax-favored, then its price should be bid up until its after-tax rate of return equals the return of all other assets. That is the basis for equation 5.2 on page 95, where we assume the investment is deductible when made (at a tax rate of $t_0$) and is fully taxable after $n$ years at a rate of $t_n$, assuming the equilibrium rate of return equals $r_b$. [Work this problem again, assuming the tax rate is a constant 30% and the initial investment is not deductible. On these facts, $R = 9.51\%$, slightly less than 10% because of the deferral.]

5.2 The Implicit Tax Rate. The Explicit Tax Rate, and the Total Tax Rate

5.2.1 Computing the Implicit Tax: The implicit tax rate on an investment ("a") is that tax rate which, if applied to a fully taxable investment ("b"), would reduce the return to that offered by investment a (pre-tax). For example, if investment "a" yields a before-tax return of 6% and fully-taxable bonds yield a return of 10%, then the implicit tax rate equals 40% (because 10%$(1 - 40\%) = 6\%$). See equation 5.3 at page 96, for deriving the implicit tax rate. Note that an implicit tax is not paid to the taxing authority but instead is extracted by the market.

5.2.2 Total Tax Rates in a Competitive Market

5.2.2.1 The total tax imposed on an investment equals the sum of the implicit tax and the explicit tax. Our book uses $r^*$ as the rate of return paid by a fully taxable investment.

5.2.2.2 Look at Table 5.1 (p. 98) for a comparison of three different assets with different implicit and explicit tax rates (but equivalent total taxes).

5.3 The Importance of Adjusting for Risk Differences: Riskier assets must offer a higher yield to offset the risk of nonpayment. On average, the risk premium is a return of capital, but for specific taxpayers the risk premium is treated as nothing but additional interest (with a deduction allowed to those taxpayers do not fully recover their capital because, for example, their counterparty goes bankrupt). There is no direct way to measure the riskiness of an asset, although the relative risk of an asset can be inferred using an equilibrium analysis (an analysis necessarily inaccurate because of frictions and restrictions that prevent market clearing).

5.3.1 Note that it is hard to even define the riskiness of a specific asset. For events that happen repeatedly, a statement of probability is nothing but a statement of frequency. But for events that will happen only once, it is hard to even define what probabilities mean. For example, what does it mean to say that President Obama's odds for re-election were 65%? There is no way to prove that statement true or false because he will run for re-election only once. Leonard J. Savage in his book, The Foundations of Statistics (originally published in 1952...
and now available as a Dover reprint) tries to make sense of non-frequency based probabilities.

5.3.2 If we accept that probabilities can be defined and we assume that the market is in equilibrium, then we can compute an asset's relative riskiness even though it cannot be measured. We know that the after-tax return, adjusted for risk, is equal for all assets in equilibrium. Given level of risk, equilibrium return, and tax rate, we can compute an asset's necessary pre-tax risk-adjusted return. Using that same equation and rearranging the variables, we can solve for the risk-premium given the equilibrium return, the applicable tax rate, and the before-tax return from a particular security.

5.3.3 Look at Table 5.2 (p. 99). Three assets are considered: a fully taxable bond (taxed at a rate of 40%) with a pre-tax return of 20%, a partially taxable bond with a pre-tax return of 12%, and a tax-exempt bond with a return of 12%. If we assume the market risk premium on the assets are 5%, 2%, and 3%, then we see that the risk-adjusted pre-tax return to the assets is 15%, 10%, and 9%. As a result, the implicit tax rate on the assets is 0%, 33% (i.e., [15-10]/15), and 40% (i.e., [15-9]/15). The explicit tax rates are 40% (i.e., [15-9]/15), 6.7% (i.e., [10-9]/15), and 0%. Equivalently, we can measure the percentage of each asset subject to tax (called $g$ in Table 5.2). For the three assets, this is 100%, 25%, and 0%. How do we get the 25% value? The risk-adjusted pre-tax return on the partially taxable asset is 10%, and the equilibrium, risk-adjusted, after-tax return is 9%. Thus, the explicit tax rate is 10% (since a 10% tax rate on a pre-tax return of 10% gives a post-tax return of 9%). A 10% effective tax rate is the same as a 40% effective tax rate on 25% of the asset's pre-tax return (since 25% of 40% equals 10%).

5.4 Clienteles: Because there are cross-sectional variations among taxpayers, there will be inframarginal investors. Inframarginal investors can obtain an above-market after-tax return on their investments by exploiting their special tax circumstances.

5.4.1 Evidence on the Existence of Implicit Taxes and Clienteles: The authors observe that there is some evidence (though not much) that tax-preferred assets pay reduced pre-tax returns. In the case of state and local bonds, that clearly is true. Beyond this simple case, the evidence is much more mixed. Why? Risk-premium is not measured well; frictions and restrictions can dominate other explanations; the theory of how investors behave may be inaccurate.

5.4.2 Example: High-bracket taxpayers should purchase tax-exempt securities because the implicit tax rate on tax-exempt securities is based on mid-bracket taxpayers. Consider the case of a few taxpayers in the 40% bracket, many taxpayers in the 25% bracket, taxable bonds return 10% on a pre-tax basis, and a flood of tax-exempt securities. To attract the marginal (i.e., 25%) investor, the issuers of exempt securities must offer a yield of 7.5%. But if such bonds are held by high-bracket taxpayers, they will enjoy an above-market return.
Implicit Taxes and Corporate Tax Burdens: Our authors address the debate concerning corporate exploitation of tax loopholes. Our authors clearly believe that the payment of implicit taxes should be treated on a moral level as equivalent to the payment of explicit taxes. Note, however, that the payment of implicit taxes will not cover the cost of roads or schools or national defense. When two private taxpayers together engage in a tax-favored transaction, the tax savings will be captured by the two taxpayers: some of the tax savings will be shifted from the nominal payor of taxes to the counterparty through implicit taxes, but that does not change the fact that reduced revenue is flowing to the government. (One important reason why large corporations pay little federal income tax is that they pay substantial foreign taxes, and in general US law permits taxpayers to avoid double taxation on foreign earnings.) In any event, if US taxpayers substitute implicit taxes for explicit taxes, the questions are (1) why has Congress permitted revenue to escape the taxing system?; and (2) Is it escaping because some activity is deliberately being encouraged or because a tax advisor has found a way to reduce taxes without engaging in activity intended by Congress to be tax favored?

Tax Arbitrage: "Tax arbitrage" refers to investment strategies that exploit tax rules to increase after-tax return. "Organizational-form" arbitrage refers to taking offsetting positions in assets to exploit differential rates of taxation on the assets; "clientele-based" arbitrage refers to low-bracket taxpayers selling tax benefits to higher-bracket taxpayers (or to high-bracket taxpayers buying tax benefits from lower-bracket taxpayers).

Organizational-Form Arbitrage

Immediate Tax Rebates When Taxable Income Is Negative: Assume that tax deductions in excess if taxable income yield immediate benefits in the form of an immediate refund. (Note that for a taxpayer having significant other income, this assumption accurately describes an investment yielding current deductions in excess of current income.)

Suppose a taxpayer directly invest in an asset compounding with an annual pre-tax return of $R$, and no tax due until the investment is terminated after two years. Assume further that this taxpayer can borrow at the same rate $R$, that interest is payable annually, and that interest is deductible when paid. If the taxpayer borrows to invest and then borrows again to pay the interest due at the end of year one, the taxpayer's after-tax return after the two year investment will equal \([1 + R]^2(1 - t) + t] - [1 + R(1 - t)]^2\), or \(R^2t(1 - t)\). This is a positive after-tax yield on a $0 net investment, for an infinite after-tax return.

What drives this transaction is taking offsetting positions in differently-tax activities: the taxpayer invests in a favorably-taxed activity (here, an investment offering deferral) and simultaneously borrows with full deductibility of the costs.

There are two ways to preclude this tax arbitrage: deny deferral to the investment return or postpone deductibility of the borrowing cost.
However, the borrowing side of the equation is something of a red herring: if a taxpayer makes the same investment but without the borrowing, the same deferral will be obtained. All the borrowing side of the equation adds is that the investment opportunity will not be limited by the taxpayer’s available cash. Note the book (at p. 148) shows that for a $1,000 investment (and offsetting borrowing) with $R = 10\%$ and $t = 0.40$, the net accumulation from the arbitrage equals $1.05$. Note also that if the taxpayer invests \textit{without} the borrowing, the accumulation will equal $1,000\left[(1 + 0.10)^2(1 − 0.40) + 0.40\right]$, or $1,126.00$ while the same investment without deferral would yield $1000\left[1 + (0.10(1 − 0.40))\right]^2$, or $1,123.60$, and the difference is the same $2.40$. Thus, as expected, all of the benefit from the arbitrage arises from the deferral.

5.7.2 No Tax Rebates on Negative Taxable Income: If excess losses are not immediately deductible, tax arbitrage cannot produce a money pump but can reduce other income to zero. Note that to offset unrelated income of $X$ with an interest deduction, the taxpayer must borrow $X/I$, where $I = \text{the interest rate}$. If the tax-preferred investment offers deferral rather than exemption, then the tax liability from the unrelated income will be pushed forward (that is, deferred).

5.7.3 Restrictions on Organizational-Form Arbitrage: There are a host of statutory and common law limitations on tax arbitrage investment strategies.

5.7.3.1 I.R.C. Section 163(d) disallows interest deduction in excess of net investment income. Deductions disallowed by section 163(d) are carried forward and can be claimed when investment net investment income arises. This provision would eliminate the arbitrage return on the money pump in section 5.7.1.1, but it does it in the wrong way, leaving the deferral opportunity available as described in section 5.7.1.3.

5.7.3.2 I.R.C. Section 800 denies income exclusion otherwise available to taxpayers holding life insurance policies at death if the policy did not include a sufficiently high percentage of true insurance (i.e., protection against risk of mortality).

5.7.3.3 In \textit{Knetsch v. United States}, 364 U.S. 361 (1960), the taxpayer purchased a deferred annuity, almost entirely on credit from the seller of the annuity. Each year when interest was due, the taxpayer borrowed almost the entire amount then due. Because the annuity included a guaranteed annual return, at no time was the taxpayer economically at risk for any additional payment. And because the annuity was pledged to secure repayment of the loans, the annuity seller was at no risk that the loans would not be repaid. The Supreme Court held that the nominal annual interest could not be deducted because there was no true loan between the taxpayer and the seller of the annuity (and so no true investment in an annuity). Note that the nominal lender (the seller
of the annuity) did not incur any credit risk with respect to the nominal loan.

5.7.3.4 In *Goldstein v. Commissioner*, 364 F.2d 734 (2d Cir. 1966), the taxpayer won $140,000 in 1958 from the Irish Sweepstakes. The taxpayer borrowed $465,000 from a bank at 4% annual interest, immediately pre-paying about three years of interest for $52,000. The taxpayer then purchased $500,000 of T-bills, maturing in 1961. She claimed a deduction of $52,000 in 1958 (reducing her income in that year substantially) and reported a capital gain (under current law, the gain on the T-bills would now be ordinary income) of about $38,000. While she lost money on the net transaction, she (a) was able to divide her income across two years, thereby avoiding the very highest marginal rates then in effect, (b) obtained deferral on about $38,000, and (c) converted the same amount of ordinary income into capital gain. The court held that the taxpayer was not entitled to an interest deduction. Note that it is clear that the loan was bona fide because the bank had no relationship with the US Treasury and so really was extending credit to the taxpayer (to be sure, largely protected by the T-Bills as security. But what if the federal government defaulted or the bills were fraudulently obtained?). The basis of the courts holding was that entering into a transaction producing a before-tax loss simply to reduce one's tax liability was an abuse of the tax system: the deduction was denied because of the taxpayer's *tax avoidance purpose*.

5.7.4 Full Taxation with Deferral and Organizational-Form Arbitrage: The value of deferral.

5.7.5 The Effects of Frictions of Organizational-Form Arbitrage: If frictions are present, then there will be costs incurred to obtain arbitrage gains, reducing the benefit of the arbitrage opportunity and, if the costs are sufficiently high, eliminating the benefit in full. Note that because the taxpayer can elect to disregard the arbitrage investment, a fully-informed taxpayer should never be forced to accept a return less than obtained in a fully-taxable investment.

5.7.5.1 Frictions might arise in either of two ways: (1) the taxpayer may incur special costs in purchasing the long side of the investment or (2) the taxpayer may incur a higher cost (that is, a higher interest rate) in the short side of the investment. In either case the effect is the same.

5.7.5.2 For example, suppose the taxpayer can get only a 9% annual return on the SPDA when fully taxable investments return 10%. Thus there is a 10% friction on the tax-preferred investment, meaning that the for every $100 the taxpayer defers she will accumulate only $90[(1 + R)\(n\)(1 - t) + t].

5.7.5.3 As a second example, suppose that the taxpayer can obtain a 10% annual return on the tax-preferred investment but that the taxpayer
must pay 12% annual interest on any borrowing to make such an investment. If the taxpayer wants to defer taxes on $I, the taxpayer need borrow only $I/12%, or 8.33 times $I.

5.7.5.4 If the taxpayer must pay 12% annual interest to invest in a tax-preferred investment paying only 9%, then for every $100 of income deferred, the taxpayer will accumulate on $75[(1 + R)^n(1 - t) + t], because 90% of $83.33 equals $75.00. Thus, on these numbers there is an implicit tax of 25% (benefitting in part the seller of the investment and in part the lender). If the tax benefit of the deferral does not exceed 25%, the taxpayer should reject the arbitrage opportunity. Note that if the benefit of the deferral exceeds 10% and the taxpayer has available cash, she should invest in the tax-preferred opportunity without borrowing.

5.7.6 Bankruptcy Rules and Organizational-Form Arbitrage: Recall that Roth-IRAs offer complete exclusion and traditional IRAs (because of the initial deduction) effectively offer the same advantage. Thus, if the implicit taxes arising from the frictions are less than the explicit tax that would be payable on a fully taxable investment, the taxpayer should continue to fund pension contributions with debt. This is limited, however, in three important ways: (1) there are significant limits on the amount of pension contributions that can be made in any one year; (2) taxpayers must begin drawing down their pension accumulations no later than the calendar year in which they turn 70.5; and (3) pension benefits generally cannot be used to secure debts.

5.7.7 Buying and Selling Implicitly Taxed Assets to Effect Organizational-Form Arbitrage: Absent special rules now in place, a taxpayer could hedge against the realization doctrine, creating a tax arbitrage opportunity. For example, the taxpayer could sell an asset short and then use the proceeds to buy the asset (or take any other long position in the asset). Ignoring transaction costs, these two investments perfectly hedge one another, whichever side declines in value can be closed out in the current year and the winning side can be closed out in the following year, yielding one year of deferral. Repeating the transaction keeps the deferral alive.

5.7.7.1 The capital loss limitation tries to protect the realization doctrine by limiting excess capital losses to $3,000 for individuals and $0 for corporations, with excess losses available for limited carryovers for corporations and unlimited carryforwards for individuals.

5.7.7.2 The wash sale rules deny losses if the taxpayer covers the loss position with a substantially equivalent investment within 30 days.

5.7.7.3 The hedging rules deny losses from one side of a hedge until the other side is closed.

5.7.7.4 The constructive sale provisions imposes an immediate tax on any transaction involving an appreciated financial position that is economically sold (such as by constructing a hedge).
5.8 Clientele-Based Arbitrage: Because there are too few taxpayers in the highest bracket to purchase all exempt securities that states and municipalities want to sell, they must be priced for mid-bracket taxpayer. For example, to capture taxpayer in the 25% bracket, exempt securities must pay interest at a rate of at least 3.75% if fully taxable securities with the same risk offer 5.0%. But if such securities are then acquired by a 40% taxpayer, the tax-free 3.75% return exceeds the 3.0% after-tax return that she could get from the fully taxable bonds. Note that such bonds should not be purchased by taxpayers in a tax bracket below 25%.

5.8.1 A taxpayer who is losing money gets no immediate benefit from additional deductions. If such a taxpayer needs to use depreciable equipment or machinery, it often will be profitable to have a fully-taxable taxpayer purchase the equipment and then have that taxpayer rent the equipment to the loss taxpayer. Assuming the nominal purchaser satisfies the test required to be treated as the owner of the property, the depreciation has in effect been sold to a taxpayer better able to use the deductions. Presumably the rental price will be set sufficient to give some of the after-tax benefit to the loss taxpayer.

5.8.2 Clientele-Based Arbitrage with Investments in Tax-Favored Assets Other Than Tax-Exempt Bonds: Interest on indebtedness used by a taxpayer to acquire or hold exempt securities is disallowed by I.R.C. section 265. Note that section 163(d) plays a similar role in the context of taxable securities that accumulate rather than pay interest or dividends.

5.8.3 Market-Equilibrium with Tax-Exempt Entities: If tax-exempt entities could issue tax-exempt bonds in an unlimited quantity, no one would pay taxes! To see this note that the issuing entity makes money on any exempt security issued below the fully-taxable rate of return because the proceeds can be reinvested in T-bills. Accordingly, the market will become flooded, raising the interest rate the exempt bonds will have to pay. As the market continues to flood, the rate will continue to climb, making the exempt securities rate very close to the fully taxable rate (that is, eliminating the implicit tax). Once the implicit tax is removed, all investment should take the form of the exempt securities now offering the same rate as a fully taxable return.

5.9 Discussion Questions (p. 116):

5.9.1 Question 1:

5.9.1.1 Part (a): True, because the implicit tax is defined as the tax rate that if applied to a fully taxable investment would reduce its pre-tax return to the return of the pre-tax return of the alternate investment. So, for example, if a fully taxable investment returns 10% before taxes while a partially taxable alternative investment returns 8.5% before taxes, then the implicit tax rate on the alternate investment equals 15%.

5.9.1.2 Part (b): False: For an investment that is taxed more harshly than a fully-taxable investment, the implicit tax rate is negative, implying that the
pre-tax return from such an investment is expected to return a higher premium before taxes.

5.9.1.3 Part (c): False. This statement is ambiguous: for any particular asset, the explicit tax rate can vary from zero to the statutory maximum while the implicit tax rate is potentially unbounded. To be sure, if the implicit tax rate exceeds the statutory maximum, it would be disadvantageous for any taxpayer to purchase the asset. But for any particular asset, the actual explicit tax may be much lower than the statutory maximum (e.g., tax-exempt bonds or SPDAs), and for such assets, the implicit tax often will exceed the explicit taxes.

5.9.1.4 Part (d): True, because implicit taxes are extracted by the market rather than by the taxing authority.

5.9.2 Question 9: Organizational-form arbitrage is the taking of a long position in an asset or a productive activity through a favorably taxed organizational form and a short position in an asset or a productive activity through an unfavorably taxed organizational form. I would call this "loophole-based" tax arbitrage, though the names do not matter.

5.9.3 Question 10: Clientele-based arbitrage is carried out by taking long and short positions in differentially taxed assets so that the net investment cost is zero and the after-tax return is positive. I would call this "rate-based" arbitrage, though the names do not matter.

5.10 Exercises (p. 117):

5.10.1 Exercise 1: Note that we ignore any differential between the tax rate on ordinary income/deductions and capital gain/losses. In addition, we assume all deductions will yield an after-tax benefit of the dollar amount of the deduction times the tax rate.

5.10.1.1 Part (a): The taxpayer should be willing to pay the present discounted value of the after-tax income stream that the bond will generate. Each interest payment of $60.00 will yield $41.40 after taxes. The facts say the investor is willing to accept a 6% pre-tax annual return, which means the investor requires a 4.14% after-tax annual return (because the investor has a tax rate of 31%, and 6% times (1 – 0.31) equals 4.14%). Thus, the value of the bond is $41.40/(1.0414) + $41.40/(1.0414)^2 + . . . + $41.40/(1.0414)^5 + $1,000/(1.0414)^5, or $1,000.00.

5.10.1.2 Part (b): Now, the after-tax interest payment is $60.00 because the interest is tax exempt. Accordingly, the value of the bond increases to $60/1.0414 + $60/(1.0414)^2 + . . . + $60/(1.0414)^5 + $1,000/(1.0414)^5, or $1,082.48. However, this answer is not quite right because if the taxpayer pays $1,082.48 for the bond, the taxpayer will incur a deductible loss of $82.48 on redemption, and that loss is worth $82.48 times 0.31 divided by (1.0414)^5, or $20.87, further increasing the value...
of the bond. The true value of the bond requires an iterative solution and is very close to $1,110.

5.10.2 Exercise 2:

5.10.2.1 Part (a): The implicit tax rate, \( t_a \), is given by the formula \( t_a = (R_b - R_a)/R_b \). Here, \( R_b = 7\% \) and \( R_a = 5\% \), so \( t_a = 28.57\% \) (or two-sevenths). That is, a tax of 28.57\% in an investment returning 7\% yields 5\%.

5.10.2.2 Part (b): The explicit tax reduces the pre-tax return of 5\% down to the equilibrium after-tax return of 4\% (assuming the asset is held by the marginal investor), so the explicit tax rate is \((5\% - 4\%)/7\), or 14.28\%. Thus, the marginal investor faces three equivalent choices: (a) purchase the fully taxable bond paying 7\% pre-tax but subject to an explicit tax of 42.86\% for an after-tax return of 4\%; (b) purchase a tax-favored bond paying 5\% pre-tax, subject to an explicit tax rate of 14.28\% (imposed on the pre-tax return grossed up by the implicit tax), for an after-tax return of 4\%; or (c) purchase a tax-exempt bond subject to no explicit tax but subject to an implicit tax of 42.86\% (on the pre-tax return grossed-up by the implicit tax).

5.10.3 Exercise 5: We are told that each of these assets has the same after-tax risk premium (called \( r_{rp} \)). Looking at the first asset, we see two things: (1) since the risk-adjusted pretax return \( (R^a) \) equals 10\% while the risk-adjusted after-tax return \( (r^a) \) equals 6\%, the investor is in the 40\% tax bracket; and (2) since the expected pretax total return \( (R^o) \) equals 20\% while the risk-adjusted pre-tax return \( (R^a) \) equals 10\%, it must be the case that the after-tax risk premium \( (r_{rp}) \) equals \((20\% - 10\%)(1 - 0.40)\), or 6\%. Thus, the chart is easy to fill in, see below (and note that a 25\% tax rate on a return of 8\% yields a 6\% after-tax return).

Asset class I would include a risky corporate bond when capital gains are taxed at the same rate as ordinary income; asset class II would include a home used as a personal residence; asset class III would include risky municipal bonds: held to maturity: the return is exempt but if sold early, the gain or loss is capital; and asset class IV would include risky corporate bonds when capital gains are taxed at a rate lower than ordinary income.
### Tax Planning Problems (p. 118):

#### 5.11. Problem 1:

<table>
<thead>
<tr>
<th>Asset</th>
<th>Expected Pretax Total Return R_o</th>
<th>Tax Treatment of Risk Premium, R^p</th>
<th>Risk-Adjusted Pretax Return R^{ra}</th>
<th>Tax Treatment of Risk-Adjusted Return</th>
<th>Risk-Adjusted After-Tax Return r^{ra}</th>
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<td>Fully taxable</td>
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<td>Tax-exempt</td>
<td>6%</td>
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<tr>
<td>III</td>
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<td>Taxed at t=25%</td>
<td>6%</td>
<td>Tax-exempt</td>
<td>6%</td>
</tr>
<tr>
<td>IV</td>
<td>18%</td>
<td>Taxed at t=25%</td>
<td>10%</td>
<td>Fully taxable</td>
<td>6%</td>
</tr>
</tbody>
</table>

5.11.1 Part (a): The tax-exempt investment will return 5% after taxes in all events. The fully taxable investment will yield 7%(1 – t), and that will be greater than 5% only if 0.07 > .05 + 0.07t, or 28.57 > t. Thus, if the tax rate is less than 28.57%, prefer the fully taxable asset to the exempt asset. The partially taxable asset will yield 6%(1 – 0.5t), and that will be greater than 5% only if 0.06 > .05 + .03t, or 33.33%. Accordingly, prefer the partially-taxed asset to the exempt asset of the tax rate is below 33.33%. Finally, the fully taxable asset will be preferred to the partially taxable asset only if 0.07(1 – t) > 0.06(1 – 0.5t), or 0.25 > t. Accordingly, the fully taxable asset will be preferred to the partially taxable asset for tax rates below 25%. Combining all this, we get: if the tax rate is less than 25%, purchase the fully taxable asset; if the tax rate is between 25% and 33%, purchase the partially taxable asset; if the tax rate is above 33%, purchase the exempt asset.

5.11.2 Part (b): We compute the total tax burden if the $150,000 is invested in each asset. If $150,000 is invested in the fully taxable asset, the pre-tax return will equal 7% times $150,000, or $10,500. The tax burden on that amount will equal $1,000 + $1,500 + $200, or $2,700. Accordingly, the after-tax return will equal $10,500 - $2,700, or $7,800. If the $150,000 is invested in the partially taxable asset, the pre-tax return will equal 6% times $150,000, or $9,000. Because only half of the partially taxed asset is subject to taxation, the tax burden will equal 20% of $4,500, or $900. Accordingly, the after-tax return will equal $9,000 - $900, or $8,100. Finally, if the $150,000 is invested in the tax exempt asset, the pre-tax return will equal 5% of $150,000, or $7,500, which is...
also the after-tax return. Thus, the partially-taxed asset should be purchased.

5.11.1.3 Part (c): This problem is very tricky! If we invest the entire $150,000 in the partially taxable investment, the gross return will equal $9,000, the taxable income will be $4,500, and so the entire return will be taxed at 20%. But this is wasting $500 of the low bracket. Accordingly, we should move some of the investment into the fully taxable investment until we fully consume that 20% bracket (that is, until total taxable income equals $5,000). For every dollar we move from the partially taxed investment to the fully taxable investment, taxable income increases by $0.04. Accordingly, if we move $500/0.04, or $12,500 into the fully taxable investment, we will again have taxable income of $5,000 but a higher return of $12,500 times 7% plus $137,500 times 6%, or $875.00 + 8,250, for a total pre-tax return of $9,125 and an after-tax return of $8,125. (Note that we know from part (a) that if we had only $71,429 to invest, it should all be invested in the fully taxable asset (since a 7% return on $71,429 equals $5,000, and the tax rate on $5,000 is only 20%)). Thus, for every dollar we have to invest above $71,429, we should not only invest the dollar in the partially-taxed asset but should also move $0.75 from the fully-taxed asset to the partially-taxable asset. Why $0.75? Because the taxable income on a $0.75 investment in the taxable asset equals the taxable income on a $1.75 investment in the partially taxable asset. Thus, for investment amount of $71,429, invest everything in the fully taxable asset. For every dollar above that, move $0.75 out of the fully taxable asset and into the partially taxable asset. No investment in the fully taxable asset should be made if the amount to invest exceeds $71,429 + $71,429/0.75, or $166,667. Once investment amount exceeds $333,333, the excess should be placed in the exempt asset. Why $333,333? Because the gross return will equal $20,000, so the taxable income will equal $10,000, and that fully exhausts the two low brackets.

5.11.2 Problem 8:

5.11.2.1 Part a: Straight-line depreciation equals $166,667 per year (assuming the investment credit does NOT reduce basis). Thus, the value of the investment credit plus the value of the depreciation equals $50,000 + $166,667(0.35) + $166,667(0.35)/1.10 + $166,667(0.35)/1.10 or $50,000 + 58,333 + $53,030 + 48,209 = $209,572. If the cost of the equipment were expensed immediately, the after-tax benefit of the expensing would equal $500,000 times 0.35, or $175,000. Thus, the investment tax credit plus the rapid depreciation is worth an extra $34,572 in present value.
5.11.2.2 Part (b): The pre-tax internal rate of return equals $(805,255/500,000)^{1/5} - 1$, or 10%. The after-tax rate of return equals $[(805,255(1 – 0.35))/(500,000 - 209,572)]^{1/5} - 1$, or $[(523,416/290,428)]^{1/5} - 1$, or 12.5%. Thus, this is a highly tax-favored investment because the after-tax rate of return exceeds the pre-tax rate of return times $(1 – 0.35)$. In fact, because the after-tax rate of return equals the pre-tax rate of return, the investment bears a negative effective tax rate.

5.11.2.3 Part (c): For the corporate bonds, the annual, after-tax percentage return equals $0.12(1 – 0.35)$, or 7.8%. For the non-dividend paying equity, the total return will equal $5,000,000[(1 + 0.12)^5(1 – 0.35) + 0.35]$, or $7,477,610.47$, so the annual, after-tax percentage return equals $(7,477,610.47 / 5,000,000)^{1/5} - 1$, or 8.38%. For the dividend-paying equity, the annual, after-tax percentage return equals $0.10 – 0.10(1 – 0.70)(0.35)$, or 8.95%. This is the greatest after-tax internal rate of return. This assumes the investments are equally risky or the specified rates of returns are already risk-adjusted.

5.11.2.4 Part (d): The firm faces a marginal tax rate of 35%. Clientele-based arbitrage could involve (1) issuing fully-taxable securities (corporate bonds) and investing in tax-favored assets (municipal bonds) but interest deductions are limited on corporate borrowings when the loan proceeds are invested in municipal bonds, see section 265, or (2) investing in preferred stock and buying tax-favored equipment. The firm could also undertake organizational-form based arbitrage of the type discussed in the text for individual taxpayers. See chapter 9 for the Black-Tepper pension arbitrage strategy.