TAXATION, RISK-TAKING, AND HOUSEHOLD PORTFOLIO BEHAVIOR

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NBER Working Paper No. 8340
June 2001
JEL No. H2, G1

ABSTRACT

This paper summarizes the current state of research on how taxation affects household decisions with respect to portfolio structure and asset trading. It discusses long-standing issues, such as the impact of differential taxation of income flows from stocks and bonds on the incentives for households to invest in these assets, and the effect of capital gains taxation on asset sales. It also addresses a range of emerging issues, such as the impact of taxation on the behavior of mutual funds and their investors, and the effect of tax changes and tax uncertainty on investor behavior. It concludes that taxation exerts a systematic influence on the nature of risk-taking and the structure of household portfolios. Research on the effects of taxation on portfolio structure is more advanced than work on the welfare costs of portfolio distortions.

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How taxation affects household saving is one of the most-studied issues in empirical public finance. The reason for interest in this issue is clear: the supply of saving is a key determinant of the cost of capital and therefore of the amount of productive investment in an economy. By comparison, the effect of taxation on the allocation of household saving across different asset categories has received far less research attention. This is surprising, since the supply of funds to particular sectors can be just as important as the overall level of saving in determining the cost of capital for particular types of investment.

This survey considers the existing state of research on how taxation affects risk-taking, portfolio choice, and the allocation of household saving. It describes both the theoretical models that have describe how optimizing households might allocate their portfolio holdings across different assets, as well as empirical evidence that explores the link between taxation and portfolio structure. The paper considers both decisions about which assets to hold, as well as decisions about when to sell particular assets. The paper also discusses a number of emerging issues concerned with taxation and portfolio structure, such as the effect of taxation on mutual fund investors and investors who take advantage of tax-deferred investment vehicles such as Individual Retirement Accounts and 401(k) plans in the United States.

The paper is divided into six sections. The first presents a brief overview of the taxation of capital income in developed countries, with particular focus on the current tax rules in the United States. This includes a discussion of the aggregate household balance sheet, as a way of introducing the relative importance of different assets that households own. Section two considers the effect of taxation on the set of assets held in household portfolios, and the portfolio shares held in different assets. It begins with the traditional theory of taxation and the demand for risky assets. It then considers the impact of differential taxation of different types of capital income on the demand for assets that provide different income flows, for example on corporate stocks that provide returns in the form of dividends rather than capital gains.

Section three explores the effect of taxation on capital asset sales, with particular attention to the link between capital gains tax rates and the decision to realize gains. It also considers the potential effect of securities transaction taxes on financial markets and investor behavior. The fourth section explores a variety of topics related to taxation and portfolio choice, including taxation and investment in mutual funds, taxation and life insurance products, and the role of estate taxation in affecting portfolio choice. Section five considers the link between taxation and investment decisions in human capital. The sixth section concludes and raises a number of issues concerning taxation and portfolio choice that require further investigation.

1. Taxation and the Portfolio Choice Environment

How the tax system affects risk-taking and portfolio choice depends on a number of different provisions in the tax code and on the set of financial assets that are available to investors. The tax rules that apply to income from capital are the most complicated part of most modern income tax systems. The income from different types of capital assets may be taxed at different rates, different types of income from the same asset may be taxed at different rates, and different investors may face different tax rates on the same asset. In addition, there are substantial differences across countries in both the level and structure of capital income taxes.

Many of the tax provisions that affect the after-tax returns from different assets are straightforward to summarize, but it is more difficult to describe their ultimate impact on the high-net-worth households who account for a substantial fraction of aggregate net worth. Poterba (2000a) reports information from the 1998 Survey of Consumer Finances on the concentration of net worth. The households in the top 0.5 percent of the net worth distribution hold 26 percent of net worth. For some asset categories, such as publicly traded corporate stock excluding ownership through pensions or mutual funds, the concentration of ownership is even greater. Forty-one percent of directly-held stock is held by

the households in the top 0.5 percent of the ownership distribution; over 80 percent is held by households in the top five percent.

Analyzing the effect of taxation on high net worth households is difficult because these households typically receive sophisticated tax advice, and they may find strategies that enable them to avoid the tax burdens associated with simple application of the tax statutes. The fees of their tax planning advisers, and the pretax returns that they forego to maximize after-tax returns, represent implicit taxes on their capital income. The need to recognize such implicit taxes and to consider their distortionary effects is one of the central themes of Scholes, Wolfson, Erickson, Maydew, and Shevlin (2002).

While it is straightforward to describe the set of financial assets that are potentially available to investors, it is often difficult to calculate the transaction costs that are associated with holdings of these assets, and therefore the set of assets that are available at reasonable cost to many investors. Moreover, because wealth data are one of the most difficult types of survey data to collect, for many nations there is relatively little information on the composition of household net worth and the structure of household portfolios.

This section illustrates the taxation of portfolio income and the analysis of household portfolio structure by focusing on the United States. It begins with a discussion of the tax rules on investment income and then considers the current structure of household portfolios.

1.1 The Taxation of Investment Income

Most developed nations tax interest income, and many also tax dividends received by individuals. OECD (1994) provides a valuable introduction to the tax rules on capital income in a range of developed nations.

In the United States, individuals are taxed at equal rates on their dividend and interest income, and the personal income tax on dividend income is not integrated with the corporation tax. In addition to

federal income tax, state and (in some cases) local income taxes may also apply to interest and dividend receipts. For calendar year 2000, the maximum statutory federal income tax rate was 39.6 percent, although the effects of various exemption phase-outs could increase the marginal tax rate to between 40 and 42 percent. Mitrusi and Poterba (2001) show that very few taxpayers in the "top bracket" actually face the 39.6 percent rate; far more face rates over 40 percent. State income tax rates can substantially increase the total tax burden on investment income. In New York, one of the highest tax rate states, the top personal income tax rate exceeds 10 percent. The effective state income tax rate is reduced somewhat because these taxes can be deducted from federal taxable income, but even with this deduction, the top marginal tax rate on dividend and capital gains income is currently near 50 percent. Shackelford (2000) discusses the tax rules facing high-net worth households in more detail.

Realized capital gains are also taxed in the United States, although they are not taxed in all developed nations. Most conceptual discussions of comprehensive income taxation focus on accrued rather than realized gains as a part of the tax base, the practical difficulties of taxing accrued gains has led essentially all nations that tax capital gains to tax them at realization. Auerbach (1991) and Bradford (1995) discuss capital gains tax systems that have the same incentive effects as accrual-based systems, but that tax gains when realized. These systems have not yet been tried in any practical context. In the United States, realized capital gains have frequently been taxed at different rates depending on their holding period. Because one of the policy objectives of those who argue for reduced tax rates on capital gains is to encourage long-term holding of securities, long-term gains have sometimes been taxed at a lower rate than short-term gains. Poterba and Weisbenner (2001) present summary information on the changes over time in the U.S. tax code's definition of "short-term" gains, which has varied between six months and one year.

The U.S. tax system also limits claims for tax relief when security values decline and investors incur capital losses. These limits, which are known as loss-offset provisions, raise the effective tax

burden on capital investments by making the tax rate at which gains are taxed when the asset appreciates higher than the tax rate at which losses can be deducted when the asset depreciates. Since losses are measured relative to the nominal historical basis in an asset, the value of loss offsets is reduced still further.

In addition to taxing capital income, some nations also tax wealth, although these taxes do not account for a substantial share of revenues in most developed nations. The United States does not have a wealth tax, but like many other nations, it does have an estate and gift tax that accounts for a nontrivial revenue share. Estate tax is levied on the total value of a decedent's estate plus the value of his taxable lifetime gifts. Gifts of up to $10,000 per recipient per year are excluded from the tax base. In 2000, estates valued at less than $675,000 were not taxed, but taxable estates valued at more than this amount face marginal estate tax rates that range from 35 to 60 percent. Poterba (2000b) reports data from the U.S. Treasury Department showing that approximately 1.5 percent of deaths currently results in taxable estates. The nominal threshold for an estate to be subject to the estate tax is currently scheduled to rise to $1 million by 2006, but there is ongoing legislative debate about the structure of the estate tax and the threshold at which estates become taxable.

In addition to the estate tax, most localities in the United States levy property taxes on real property. These taxes raise the effective tax burden on residential and non-residential land and on tangible assets such as equipment and structures. Some jurisdictions also tax consumer durables such as automobiles under a personal property tax. Financial assets are usually not included in property tax bases.

One of the most important developments in the tax treatment of capital income in the United States during the last two decades has been the growth of various ways to hold assets in "tax deferred" accounts. The Individual Retirement Account, which was effectively introduced in the Economic Recovery Tax Act of 1981, and was substantially limited by the 1986 Tax Reform Act, and the 401(k)

retirement saving plan, are examples of such tax-deferred accounts. At the beginning of 2000, crude estimates suggest that the total market value of assets in 401(k)-type retirement saving plans exceeds $1 trillion, while the assets in Individual Retirement Accounts are at least twice as large. These assets represent more than five percent of household net worth, but for many middle-income households, they represent a much larger share. When assets in IRA and 401(k) plan assets to the assets in traditional corporate pension plans, it becomes clear that a substantial fraction of household financial assets are held in forms that do not generate current tax liability on capital income. Moreover, current trends suggest continued growth of assets in these tax-deferred accounts.

The United States is not alone in its use of tax-deferred accounts. In the United Kingdom, Personal Equity Plans provide a similar opportunity to accumulate assets and to pay tax only when income is drawn out of the account. Canadians can save on a tax-deferred basis through Registered Retirement Saving Plans. Poterba (2001a) provides an overview of the current limits on tax-deferred saving in a sample of OECD nations.

The foregoing discussion has ignored one of the most important capital income taxes in most nations: the corporate income tax. While it is impossible to discuss some issues in portfolio choice, such as debt and equity clienteles, without reference to the corporate income tax, this tax is not the focus of the present paper. Auerbach (2001) addresses many of the issues associated with the corporation tax in detail. While the corporate income tax affects the pre-tax returns that investors can earn on various assets, this chapter largely treats these pretax returns as given, and considers how households choose their portfolios in light of these returns.

1.2 The Recent Evolution of Marginal Tax Rates on Capital Income in the United States

This section summarizes the recent evolution of capital income taxes in the United States. The 1980s and 1990s have been periods of unusual change in the structure of taxation in the United States, and the reforms over this period illustrate a range of different potential tax policies.

Prior to the Economic Recovery Tax Act of 1981 (ERTA), marginal tax rates on interest and dividends ranged up to 70 percent. Short-term capital gains were taxed as ordinary income, which meant that they could also be taxed at rates of up to 70 percent. Long-term capital gains, which were defined as gains on assets held for more than a year, were taxed at 40 percent of the ordinary income tax rate, which meant a top statutory rate of 28 percent. ERTA reduced the top statutory tax rate on interest and dividends to 50 percent, and therefore reduced the top rate on long-term capital gains to 40 percent.

Marginal tax rates on interest and dividend income were reduced still further by the Tax Reform Act of 1986 (TRA86), which reduced the marginal tax rate on highest-income individuals to 28 percent. Various tax changes since the 1986 reform have raised the top statutory tax rate from 28 percent in 1986 to 39.6 percent in 2000.

The tax treatment of capital gains has also changed significantly. TRA86 eliminated the preferential tax treatment of long-term gains, so that the statutory rate on long-term gains rose from 20 percent to 28 percent. For several years in the late 1980s, the highest statutory rate on realized capital gains was 33 percent, but this rate applied to taxpayers below the highest income levels. The capital gains tax rate on the highest-income taxpayers remained at 28 percent until 1997, when the Taxpayer Relief Act of 1997 reduced the rate on long-term gains to 20 percent. In the year following the enactment of TRA97, there was an "intermediate term" gain category that was subject to a tax rate between the rate on ordinary income (short-term gains) and 20 percent (long term gains), but this intermediate classification was eliminated for years after 1999. Current legislation calls for a further decline, starting in 2005, in the statutory tax rate on very long-term capital gains (gains on assets held for more than five years). The very-long term capital gains tax rate is scheduled to fall to 18 percent.

Table 1 provides summary information on the weighted average marginal income tax rate that applied to various types of capital income over the period 1979-1999. The results through 1995 are based on actual tax return data provided by the Statistics of Income Division of the Internal Revenue

Service; the results for 1996-1999 are based on extrapolation from 1995 tax returns. These marginal tax

rates are estimated using the NBER TAXSIM program, which is described by Feenberg and Coutts

(1993). TAXSIM combines a detailed computer program for calculating individual tax liabilities with a

database of individual income tax returns, released without individual identifiers, to summarize various

aspects of the U.S. income tax system. The first column shows the weighted average marginal income

tax rate on dividend income, τ_d, which is defined as:

$$\tau_d = \frac{\sum_{i=1}^{H} \tau_{d,i} * DIVS_i}{\sum_{i=1}^{H} DIVS_i}.$$

Similar weighted average marginal tax rates for interest income and for realized capital gains are shown

in columns two and three. For comparative purposes, the last column shows the weighted average

federal marginal income tax rate on wage income.

Table 1 illustrates the impact of recent tax changes on the relative tax burdens on different assets.

The weighted average marginal tax rate on dividend income declined by five percentage points between

1980 and 1983, and by another 4.4 percentage points between 1985 and 1988. These changes were

almost exclusively due to legislative changes. The second column of Table 1 shows an even sharper

decline in the weighted average tax rate on interest income between the late 1970s and the mid-1980s;

this reflects difference in the distribution of interest and dividend income across income classes. The

weighted average marginal tax rates on both interest and dividend income rise by several percentage

points during the 1990s, primarily as a result of the increase in top marginal tax rates that was enacted in

1993.

The tax rate on realized long-term capital gains increased by 9.1 percentage points between 1986

and 1987 as a result of the Tax Reform Act of 1986, and the tax rates on realized gains in the late 1980s

and early 1990s were substantially above the rates of the late 1970s. Between 1996 and 1999, the

average statutory tax rate applying to long-term gains fell by 7.4 percentage points. This suggests that most realized long-term gains are taxed at the highest statutory rate, which declined from 28 to 20 percent.

The last column in Table 1 shows the weighted average "implied" marginal tax rate on interest from tax-exempt bonds. This tax rate is higher than the weighted average tax rate on taxable interest income, although in some years by only a few tenths of a percentage point. This nevertheless suggests that the households who own tax-exempt bonds are in higher marginal tax brackets than those who own taxable bonds.

Weighted average marginal tax rates like those in Table 1 provide some information on the incentive effects of tax policy, but they do not capture the substantial heterogeneity across households in the tax treatment of capital income. These differences play a critical role in determining which households will hold particular types of assets.

1.3 Household Financial Assets in the United States

Table 2 presents information on the relative importance of the various financial assets currently held by households in the United States. At the beginning of the year 2000, total household financial assets were valued a $35.6 trillion. Households also held tangible assets, primarily real estate and consumer durables, worth roughly one third as much as their financial assets. Within the set of financial assets, corporate stock accounted for $8.3 trillion, or approximately one quarter of the total. Mutual funds, which invest in equities more than other assets, account for another $3.2 trillion of household financial assets. Together, directly-held stock and mutual funds comprise roughly one third of household financial assets. Equity in non-corporate businesses, which is relatively illiquid and is not usually traded in an organized market, is also substantial: it represents $4.6 trillion, or 13 percent of all financial assets.

Another $5.9 trillion was held in taxable interest bearing instruments such as taxable corporate bonds, saving accounts, or Treasury bills. Table 2 illustrates the importance of tax-deferred asset accumulation:

pension fund reserves account for more than $10 trillion, or between one quarter and one third of financial assets, in early 2000.

The bottom rows in Table 2 show the value of net financial assets, subtracting either non-mortgage debt or all debt from the stock of financial assets. Roughly two thirds of the household liabilities shown in Table 2 are home mortgages; the remainder is largely consumer credit. While much of the analysis in this paper will focus on the allocation of household saving, it is important to consider how tax incentives affect borrowing behavior as well.

Table 2 shows the aggregate structure of the household balance sheet, but it does not capture the important cross-sectional heterogeneity in household asset holdings. The Survey of Consumer Finances is a rich data base on household assets and liabilities that provides such disaggregate information every third year for households in the United States. Kennickell, Starr-McCluer, and Surette (2000) and Bertaut and Starr-McCluer (2001) report on the most recent patterns of asset holding as reported in the 1998 wave of the survey. These data also form the basis for a number of the empirical studies discussed below.

There is less empirical evidence on the aggregate structure of household portfolios for nations other than the United States than for the United States. Information for several developed nations, based on household-level surveys, is collected in Guiso, Haliassos, and Jappelli (2001).

2. Taxation and Portfolio Structure

The central question in the analysis of taxation and portfolio structure is how tax-induced distortions in after-tax returns affect investors' asset demands. Poterba (2001a) explains that one can identify such distortions along six different margins: asset selection, asset allocation, borrowing, asset location in taxable and tax-deferred accounts, asset turnover, and the choice of whether or not to hold assets through various financial intermediaries.

This section considers the link between taxation and asset choice. It begins with a summary of the theoretical models that have been proposed for analyzing taxation and portfolio choice, and then examines the available empirical evidence on the impact of taxation on the structure of household portfolios.

Before considering specific models, it is important to recognize the significant effect that taxation can have on the set of returns available to investors. Table 3 presents summary information on the vector of returns on three asset classes, large stocks, long-term government bonds, and Treasury bills, that were available to U.S. investors over the seven-decade period 1926-1996. The first panel shows the average before-tax nominal and real returns available to an investor. This panel indicates the returns available to an untaxed investor, such as a nonprofit institution. The lower panel shows the set of after-tax returns available to an investor with an income of $75,000 in 1989, under the assumption that this individual's real income remained the same in all years. The real after-tax return on equities falls 9.5 percent to 5.9 percent, or by nearly forty percent. The real after-tax return on long-term bonds falls from 2.2 percent to 0.2 percent, and for Treasury bills, the real after-tax return averages -1.1 percent. The return differentials would be even larger if the taxpayer was assumed to have a higher income and therefore to face higher marginal tax rates. Ghee and Reichenstein (1996) present further discussion of the difference between pre-tax and after-tax returns, and the importance of such differences for investor behavior.

The set of investment decisions that an investor would make would depend on whether he confronted the pretax returns or after-tax returns. Not only are the returns on all assets substantially lower on an after-tax basis, but also the relative returns on different assets are different. Equity, which generates a substantial fraction of its returns in the form of lightly taxed capital gains, becomes relatively more attractive when returns are measured on an after-tax basis than a before-tax basis.

2.1 Asset Demand in Clientele Models

To develop some insight on the effect of taxation on portfolio structure, it is helpful to begin with simple models in which two or more assets yield the same pretax returns in all states of nature. If the tax rules governing the returns on these assets are the same for all investors, and if the tax treatments of the two assets are different, then portfolio equilibrium requires that the prices of the assets adjust so that the expected after-tax returns on the two assets are identical. In this case, each investor will be indifferent between holding the two assets.

When different investors are taxed in different ways on the two assets, the analysis becomes more complex. In this case, investor clienteles will emerge in the holdings of various securities. The simplest and best-known clientele model is Miller's (1977) model of the choice between debt and equity. In his framework, debt and equity are both riskless, so investors decide which security to hold only on the basis of after-tax returns. Miller assumes that equity returns are untaxed to all investors, but that investors are taxed on interest income, and that their interest income tax rates vary. The result is a clientele equilibrium in which high tax bracket investors hold corporate equities, and those in lower tax brackets hold corporate debt. For a given set of pre-tax returns on equity and debt, r_{eq} and r_b, the asset demand functions (E^d and B^d) for an investor with net worth W can be written as:

$$E^d = W, B^d = 0 \qquad \text{if } (1-\tau_b)r_b < r_{eq}$$
$$E^d = 0, B^d = W \qquad \text{if } (1-\tau_b)r_b > r_{eq}.$$

This model predicts that investors will hold completely specialized portfolios.

Market equilibrium is determined by combining the asset demand conditions given above with asset supply functions that come from firm decisions designed to minimize the cost of funds. Because interest payments can be deducted from corporate income taxes, the after-tax cost of debt finance is $(1-\tau_{corp})*r_b$. The after-tax cost of equity finance is simply r_{eq}. Thus, if $(1-\tau_{corp})*r_b < r_{eq}$, firms will supply debt, while if the opposite inequality holds, they will supply equity. To avoid excess supply of either debt or equity, equilibrium requires $(1-\tau_{corp})*r_b = r_{eq}$.

The relative pretax returns on debt and equity determine which investors will invest in debt and which will invest in equity. Figure 1 illustrates the asset ownership clienteles that form in this model: any investor for whom $(1-\tau_b)/(1-\tau_{corp}) < 1$ will hold equity, and anyone for whom the inequality is reversed will hold debt. The "marginal investor," the investor who is indifferent between debt and equity, has a tax rate on interest income equal to the corporate tax rate: $(1-\tau_b)/(1-\tau_{corp}) = 1$. For this investor, the after-tax return on bonds, $(1-\tau_b)*r_b$, just equals the after-tax return on equity, $(1-\tau_{corp})*r_b$.

The Miller (1977) model provides a useful illustration of how asset market clienteles could emerge, and how asset demands can be combined with asset supply conditions to determine the equilibrium returns on different securities. The discussion here focuses primarily on the Miller model's clientele equilibrium structure, not its implications for corporate finance. But it is worth noting that while Miller (1977) suggests this model as a description of the debt-equity behavior of corporations in the United States, the model does not appear to perform well on this front. The model predicts that relatively few households will demand equity rather than debt, and for some configurations of tax parameters that have been observed, it predicts the complete absence of corporate equity.

This difficulty can be illustrated using tax rates in the United States in tax year 2000. The current corporate income tax rate is 35 percent. Assuming, counterfactually, that equity returns are untaxed at the investor level, the only households who should hold equity are those facing marginal tax rates on interest income above 35 percent. If equity returns are taxed, as the amount of dividends and equity capital gains reported on tax returns suggests they are, then the marginal tax rate on interest income at which investors will be indifferent between debt and equity securities is higher than 35 percent. In 2000, with the top marginal personal tax rate above 34 percent, the Miller model suggests that the only taxpayers who should hold equity rate those in the top two marginal income tax brackets (36 percent and 39.6 percent). Equity is actually held by taxpayers with marginal tax rates well below 34 percent.

In the late 1980s and early 1990s, the Miller model's difficulty in explaining observed debt-

equity ratios was even more acute. The top individual income tax rate was either 28 or 33 percent, and the corporate income tax rate was 34 percent. In this setting, the simple Miller model would have predicted the complete absence of equity in the U.S. economy! Despite the difficulties with the simple Miller model, the basic clientele insight can provide a starting point for a richer analysis of portfolio decisions. Mintz and Smart (2001) illustrate such an approach, in which investors with tax losses and traditional taxable investors interact to determine portfolio clienteles. Clientele models like the one that Miller (1977) used to study debt policy can also be applied to the analysis of dividend policy; Allen, Bernardo, and Welch (2000) provide a recent example.

2.2 Taxation and Asset Demands with Risky Returns

Before considering the effect of taxing many risky assets, it is helpful to develop some intuition using a simple framework, pioneered by Domar and Musgrave (1944), with one risky asset, and one riskless asset. This analysis draws attention to the important distinction between private and social risk-taking, and the potential effect of tax policy on the fraction of society's assets that are invested in risky securities.

Domar and Musgrave (1944) showed that when taxes are levied on the excess return from a risky asset, and when gains are taxed and losses are deducted without limit at the same rate, then the government effectively becomes the investor's partner. They argued that this could lead private risk-takers to increase their total assets at risk, since the tax would lead to equiproportional reductions in the expected return and the risk of potential projects. To consider this case, let r_i denote the return on a risky asset, and r_f the return on a riskless asset. The investor's after-tax return on the risky asset is

$$r_{i,at} = r_f + (1 - \tau) * (r_i - r_f).$$

After-tax wealth at the end of one period is

$$W_{at} = (1 - a) * r_f * W + a * [r_f + (1 - \tau)(r_i - r_f)] * W = r_f * W + a * (1 - \tau) * (r_i - r_f) * W.$$

Notice that in this expression, the term (1-τ) always enters as a product with a, the fraction of the investor's net worth that is held in the risky asset. Thus if τ rises and (1-τ) declines, the investor can preserve the same after-tax opportunity set as before the tax by increasing *a*. If *a (a')* denotes the amount that the individual would have invested in the risky asset in a no-tax (taxable) world, then provided *a'* = *a*/(1-τ), the individual's after-tax wealth is unaffected by the presence of the tax. The individual bears the same level of risk by investing *a'* in the risky asset in a taxable world and *a* in a taxless world, but the social level of risk-taking is greater in the taxable case, since *a'* > *a*.

The Domar-Musgrave analysis does not speak to the issue of how the risk of uncertain tax collections is allocated across individuals, and in particular, how risk is allocated through the tax system. Subsequent research, notably by Bulow and Summers (1984), Gordon (1985), and most recently Kaplow (1994), has embedded the Domar-Musgrave analysis in a general equilibrium setting, and recognized the effect of risky tax receipts on the government budget constraint. When individual investors are indifferent to incremental investments in the risky projects that face taxation, and the government is no more efficient than private capital markets at spreading risk through the economy, this literature shows that a proportional tax claim on all gains and losses has no market value.

Another special feature of the Domar-Musgrave analysis is its focus on taxes on excess returns. Actual tax systems usually tax total returns rather than excess returns. While taxes on excess returns have substitution effects, but still permit the investor to achieve the same riskless return, taxes on total returns affect both the relative returns on different assets and the overall level of returns. As such they have both substitution and wealth effects. When the tax rate that applies to the total return on asset i rises, the substitution effect leads investors to demand less of this asset. In addition, however, as a result of the reduction in the after-tax return to asset i, there is a wealth effect of ambiguous sign. If the wealth elasticity of demand for risky assets is positive, then an increase in the tax rate on asset i will reduce the amount held in this asset as the substitution and wealth effects will work in the same direction. This

result is derived in Sandmo's (1985) survey, which draws on Stiglitz (1969) and the generalization to multiple assets in Sandmo (1977).

One important extension of the Domar-Musgrave analysis is to the case of imperfect loss-offsets. The practical justification for limiting the losses that investors may claim is that without such limits, firms or individuals could undertake projects that generate private benefits but taxable losses, and thereby collect government subsidies for what are effectively private consumption activities. Loss-offset provisions make such transactions more difficult, but at the cost of raising the effective tax burden on legitimate projects that face some risk of generating losses. Previous work on loss-offsets, such as Mackie-Mason (1990), considers how tax systems with limited loss-offsets affect the certainty equivalent present discounted value of the after-tax project returns. The general equilibrium effect of imperfect loss-offset, and the effect of such provisions on the required returns for risky assets, has not been analyzed.

2.3 The After-Tax Capital Asset Pricing Model and Asset Demands

Actual asset markets offer investors a wide range of risky securities which generate income streams that are taxed at different rates. The pretax returns on these assets are imperfectly correlated, so the actual portfolio problem confronting households involves choosing assets on the basis of both their tax and risk characteristics. Asset demands in this setting have been analyzed by Auerbach and King (1983), Brennan (1970), Elton and Gruber (1978), Litzenberger and Ramaswamy (1979), Long (1977), and Talmor (1985). To describe the structure of asset demands, it is necessary to develop some notation. Let W_0 denote a household's beginning-of-period investable wealth, and E_i denote the household's investment in risky asset i. Assume that the riskless rate of return is r_f, that this asset pays all of its return in the form of interest, and that interest income is taxed at rate τ_b. Assume that all risky assets are taxed at a rate of τ_{eq} (generalizing to the case of different tax rates on different risky securities is tedious, but straightforward), and that pretax returns on equity securities are given by r_i, where i = 1, ... ,N. The

expected pretax return on equity security i is μ_i. Denote the vector of mean returns on equity securities $\{r_1, ..., r_N\}$ by μ, and assume that Σ denotes the N-by-N covariance matrix of risky returns.

The individual investor is assumed to maximize a utility function that can be written in terms of the mean and variance of final wealth, $U(W, \sigma^2_W)$. Using the foregoing notation to define expected end-of-period wealth, and its variance, as a function of the return generating parameters and the amounts invested in each equity security, and substituting into the utility function, yields the function to be optimized:

$U([W_0 - \Sigma E_I]*(1-\tau_b)r_b + \Sigma E_I*(1-\tau_{eq})r_i , \Sigma E_I E_I*(1-\tau_{eq})^2*\sigma_{ii}j)$.

The first order condition for optimal holdings of risky asset i is given by:

$$U_W * [-(1 - \tau_b) r_b + (1 - \tau_{eq}) r_i] + 2 * U_{\sigma^2} * (1 - \tau_{eq})^2 * \sum_j * \sigma_{ij} = 0.$$

If we define

$$\delta = \frac{U_W}{2 * U_{\sigma^2} * (1 - \tau_{eq})^2}$$

then the first order condition for optimal asset holding can be rewritten as

$$\delta * [-(1 - \tau_b) r_b + (1 - \tau_{eq}) r_i] = \sum_j E_j * \sigma_{ij}.$$

This expression can be rewritten in matrix notion, using $E = \{E_1, ... , E_N\}$ as a column vector and **1** as a column vector of ones, as:

$$\delta * (1 - \tau_{eq})\mu - \delta * (1 - \tau_b) r_b * 1 = \Sigma * E.$$

The resulting set of optimal holdings of the risky assets then satisfy

$$E* = \delta * \Sigma^{-1} * [(1 - \tau_{eq})\mu - (1 - \tau_b) r_b * 1].$$

In the special case of no taxes on interest income or equity returns, this expression reduces to the standard asset demand expression, $E* = \lambda*\Sigma^{-1}(\mu - r_b*1)$, where $\lambda = U_W/2U_{\sigma2}$. When returns are taxed,

Auerbach and King (1983) show that the optimal portfolio can be interpreted as a weighted average of two portfolios, one of which is the market portfolio, and the other of which is a portfolio that is chosen on the basis of tax but not risk considerations. The relative weights on these two basic portfolios depend on the investor's tax rates in comparison to the tax rates of other investors, and on the investor's degree of risk aversion. A more risk averse investor will place greater weight on the portfolio that is efficient from the perspective of diversification, and correspondingly down-weight the portfolio that derives from tax specialization.

While several studies have explored the structure of asset demands in the presence of heterogeneous investor taxation, the general equilibrium structure of asset markets in this setting has received much less attention. The essential problem is that differential tax rates on different investors present opportunities for tax-motivated arbitrage. Unless there are limits on the size of the net positions that investors can hold in various assets, asset market equilibrium may not exist. A simple example illustrates this point. Consider an economy with two risk-neutral investors. One is an untaxed institution, and the other is a taxable investor who is not taxed on the income from equities, but who is taxed at rate τ on interest income and is permitted to deduct interest payments. If there are no restrictions on long or short sales, then the taxable investor will borrow an infinite amount from the untaxed investor, and pay tax-deductible interest at a rate r. The untaxed investor will offset these transactions by issuing corporate stock, which will be purchased by the taxable investor. Since neither investor is taxed on equity income, the two investors will collect $\tau*r$ dollars from the government, in the form of a tax rebate for interest deductions, for every dollar of debt and equity that is issued. Unless a constraint prevents this tax arbitrage, it will continue without limit.

Several studies, including Ross (1985), Dammon and Green (1987) and Basak and Croitoru (1999), have derived strong conditions under which such tax arbitrage will not take place and explored the nature of the resulting market equilibrium. These results serve primarily to underscore the difficulty

of achieving equilibrium in a capital market without transaction costs but with heterogeneous investor taxes. Auerbach and King (1982, 1983) explore the effect of short-selling constraints on the asset market equilibrium, and address related issues such as whether or not investors in a firm will agree on the firm's optimal debt-equity mix. Further work remains to be done both on the nature of equilibrium in asset markets with plausible imperfections, such as short selling limits or transactions costs, and on the welfare effects of tax policy in such markets. Basak and Gallmeyer (1998) is a recent study that addresses some of these issues.

There is growing recognition that the asset allocation probem in the presence of taxes is much more complex than the analogous problem without taxes. For example, Meehan, Yoo, and Fong (1995) resort to numerical solutions to evaluate the after-tax asset allocation problem. The problem of asset selection in the presence of taxes is currently attracting growing attention both from academics and from practitioners interested in delivering advice to high net worth taxable clients.

2.4 Empirical Evidence on Taxation and Portfolio Choice

A number of empirical studies have investigated the links between the structure of household portfolios and the taxation of capital income. These studies broadly suggest that taxes do affect asset ownership patterns, in contrast to much earlier surveys, such as Butters, Thompson, and Bollinger (1953) and Barlow, Brazer, and Morgan (1966), that conclude that taxes have little effect on the portfolio decisions of high net worth households. A range of data and statistical difficulties, however, besets many of these empirical studies. It is important to identify two of these issues at the outset.

The first is that there are very few datasets that include any information on the high net worth households whose behavior is central to studies of taxation and portfolio behavior. Most household surveys that are based on random population samples have very low response rates among high-income, high-net-worth households. Moreover, these surveys rarely collect sufficiently disaggregated information on asset holdings to permit the type of data analysis that is required to test tax-based theories

of portfolio choice. For example, tax-oriented theories suggest that it is important to distinguish between corporate stock held through mutual funds and shares held directly, because these alternative means of holding equities have different tax consequences. It is also important to distinguish between mutual funds invested primarily in corporate stocks and those that hold government and corporate bonds. Yet most surveys that inquire about asset holdings, if they ask about assets at all, group together stocks and mutual funds, and do not inquire about the types of mutual funds held.

The second important difficulty in developing empirical tests of portfolio behavior is conceptual. The set of asset classes that investors may choose to invest in is large. It includes corporate stock, mutual funds invested in stocks or bonds, taxable bonds (government or corporate), short-term interest bearing accounts such as saving accounts, CDs, and money market accounts, tax-exempt bonds, investments in venture capital startup firms or similar partnership ventures, owner-occupied real estate, commercial real estate, and international securities (stocks or bonds). In addition, with the exception of owner-occupied housing, any of these assets could be held directly, in a taxable form, or in a tax-deferred form such as through a defined contribution pension plan or an Individual Retirement Account.

Almost no households hold assets in each of the broad categories described above. This raises questions about the value of theories that emphasize that all investors should hold the market portfolio, and it also raises an empirical problem for studies of how taxes affect the portfolio shares allocated to different assets. Asset demands must be modeled conditional on the set of assets that a household owns, and this requires first-stage modeling of why investors hold incomplete portfolios.

A small literature has focused on the extent of portfolio incompleteness and tried to explain this phenomenon. King and Leape (1998) document the incompleteness of household portfolios using data from a special high-net-worth survey conducted by the Stanford Research Institute in 1978. Leape (1987) discusses potential explanations for this incompleteness, emphasizing the information costs of learning about different assets. Haliassos and Bertaut (1995) have recently addressed the incompleteness

issue from a different perspective, asking in particular why so few households own corporate stock. They rule out explanations involving minimum investment requirements and risk aversion, and argue that inertia and departures from expected utility maximization provide more promising explanations for the observation that, in the 1980s, nearly three quarters of U.S. households did not hold corporate stocks.

While the explanation of the "non-stock-ownership" puzzle is important, the empirical magnitude of the puzzle has declined in the last decade. Data from the 1998 Survey of Consumer Finances, reported for example in Kennickell, Starr-McCluer, and Surette (2000), as well as the Investment Company Institute (1999), suggest that roughly half of the households in the United States currently own some corporate stock.

The endogeneity of the set of assets held makes it essential to treat asset demand decisions as a two-step process. The first involves the decision of what assets to hold, and the second concerns the decision of how much to hold in each asset class. The endogeneity of the set of assets with positive holdings is a difficult empirical problem, and one that has been addressed in a variety of ad hoc ways in previous empirical studies. These approaches may in part explain why it has proven easier to identify important effects of taxation on the set of assets held than on the level of assets held in different forms, conditional on ownership.

Feldstein (1976) presented the first systematic econometric analysis of taxation and portfolio choice. He used data from the 1962 Survey of Financial Characteristics of Households, which was a precursor to the Survey of Consumer Finances. He studied the probability that a household owned corporate stock, which is a tax-favored asset because at least part of the returns are earned in the form of capital gains which are taxed less heavily than interest and dividend income. He found that higher current income was associated with a higher probability of equity ownership, conditional on household net worth, and he therefore concluded that higher marginal tax rates, which are associated with higher income, discourage equity ownership. He also presented results for several other asset categories,

including taxable and tax-exempt bonds. His results for corporate equities suggested that a ten-percentage point increase in the marginal tax rate on interest and dividend income could lead to a 3.7 percentage point increase in the probability of equity ownership. Because the maximum federal marginal tax rate was 91 percent at the time of the survey, the potential for substantial tax-induced distortions to portfolio behavior was large.

Feldstein's (1976) study, while pioneering, left several issues unresolved. Most importantly, the fact that all of the identification for marginal tax rate variation was generated by income differences raises issues of interpretation. While wealth rather than income is the traditional argument in asset demand models, and his estimating equations included household net worth, income might still be correlated with asset ownership for non-tax reasons. If higher income households have different asset demands than lower income households with the same net worth, as they might if high current income indicates high future income and therefore different amounts of human capital, then the observed differences in asset holdings could be due to the correlation between human capital, asset holdings, and current income.

Feldstein's (1976) analysis also ignored the statistical problems that arise when substantial numbers of households report no holdings of major asset classes. The subsequent study that has addressed this problem most carefully is King and Leape (1998). This study models the set of discrete choices that are associated with the decisions to hold assets in particular classes. It uses the results of this discrete choice analysis to correct for the econometric biases that could result from estimating asset demand equations without a selection correction for those households with positive holdings. The central empirical conclusion is that taxes have substantial effects on the set of assets held by different households, but they have relatively small effects on the portfolio shares conditional on ownership.

Hubbard (1985) provides further support for the Feldstein (1976) conclusion. He uses a unique data set collected by the U.S. President's Commission on Pension Policy in 1979 and 1980. This data

makes it possible to construct a measure of a household's future pension income and Social Security benefits, and to control for these components of wealth in modeling asset demands. This work provides valuable information on how the liquid component of household financial assets is allocated.

The advent of the Survey of Consumer Finances database, which begins in 1983 and has been extended every three years since then, has permitted a number of more recent studies of taxation and household portfolio structure. The major tax reforms of the 1980s have also created valuable opportunities for studying how taxation affects asset demands. Scholz (1994) studies the portfolio patterns in the 1983 and 1989 SCFs, and while he finds an important effect of TRA86 on the level of tax-deductible borrowing, he does not find any clear evidence of other portfolio shifts. One provision of the 1986 reform eliminated the deductibility of interest on non-mortgage debt, and this induced high-income taxpayers who itemize deductions on their tax returns to shift toward home equity lines of credit, or mortgage indebtedness, and away from other types of consumer credit.

Scholz' (1994) finding of increased mortgage borrowing at high income levels has been confirmed, using other data sources, by Maki (1996). However, his conclusion that TRA86 did not affect the structure of household portfolios does not appear to be robust.

Poterba and Samwick (1999) use changes in tax rates as well as cross-sectional tax rate heterogeneity to identify the effects of taxation on asset demands in the 1983, 1989, 1992, and 1995 Surveys of Consumer Finances. They do not address the endogeneity of asset holdings in as much detail as King and Leape (1998), but they estimate probit and tobit models for asset ownership. They include covariates similar to those in Feldstein (1976) and control for both income and wealth in asset demand equations, although they, like other studies, encounter the problem of controlling for differences across households in risk tolerance that are not correlated with other observable variables. Poterba and Samwick (1999) find a substantial effect of a household's marginal tax rates on its probability of owning corporate stock, tax-exempt bonds, or a tax-deferred account. Their results on the effect of taxation on

the share of a portfolio held in different assets are weaker than the findings for ownership structure.

The explanation of disparities between Scholz (1994) and Poterba and Samwick (1999) is most likely due to differential opportunities for investors to respond to the major tax reform of 1986. Scholz (1994) compares the 1983 and 1989 SCFs, and it is possible that households take time to modify their portfolios, so that few differences were observable only three years after the tax reform took effect. Other researchers have also noted some anomalies in the 1989 Survey of Consumer Finances, such as a decline in the total value of corporate equity held by households between the 1983 and 1989 SCFs, despite the rapid rise in share prices over this six year period. Data anomalies in the 1989 SCF could also contribute to explaining the difference in results.

Samwick (2000) has also examined the impact of taxation on portfolio structure, focusing on time series changes in household asset ownership. He chronicles the set of tax changes in the United States during the last two decades, and concludes that taxes can explain only a small fraction of the changes in household portfolio structure over this time period. One difficulty with focusing on time-series rather than cross-sectional changes, however, is that it becomes essential to consider general equilibrium effects associated with corporate as well as personal tax rules.

The lack of household-level data on portfolio structure in countries other than the United States has limited the scope of research on taxation and household portfolios. One notable study that does parallel the recent work in the United States is Agell and Edin's (1990) investigation of asset data reported on the annual Swedish income distribution survey. This study recognizes and treats the incomplete portfolio problem in the same fashion as King and Leape (1998), but it aggregates assets in order to facilitate estimation. The results support an important effect of taxation on portfolio choice. With respect to common stock, for example, a one percentage point increase in the marginal tax rate on interest income is predicted to increase the percentage of net worth allocated to equities by two percent, i.e. from 20 percent to 20.4 percent. The effect on participation in tax-advantaged saving schemes is

even larger.

The foregoing analysis has focused on how taxation affects the allocation of household financial assets, without considering the role of real assets in household portfolios. Ioannides (1989) and Berkovec and Fullerton (1992) estimate demand functions for owner-occupied real estate and other assets on the household balance sheet. The relationship between real and financial assets requires further investigation. It attracts particular attention with respect to elderly households, many of whom have accumulated substantial stocks of real assets, such as owner-occupied housing, but relatively small balances of financial assets. Tax-induced distortions in the demand for real estate, particularly owner-occupied housing, can also play an important role in calculations of the welfare cost of the existing tax system.

2.5 Taxation and Investor Clienteles for Corporate Stock: Dividends vs. Capital Gains

The empirical studies described above considered how the marginal tax rates faced by different households affected the probabilities that they held particular assets, and the fraction of their wealth that they allocated to different assets. A distinct literature has focused on the choice of assets within broad asset classes, and in particular the effect of marginal tax rates on investor's decisions to hold corporate stocks with high rather than low dividend yields. When capital gains are taxed at lower marginal tax rates that dividends, households who face high marginal tax rates on dividend and interest income have an incentive to hold more of their portfolio in stocks and to concentrate their portfolio in shares that generate capital gains rather than dividends.

The empirical literature on equity portfolio yields and marginal tax rates dates at least to Blume, Crockett, and Friend (1974). Using a unique data file based on dividend income reported on tax returns from the late 1960s, and with information on the individual securities that investors held, they examined the relationship between a household's adjusted gross income and its portfolio dividend yield. The results suggested that households facing higher marginal tax rates, and therefore higher burdens on

dividend income relative to capital gains, held portfolios with lower dividend yields, but the absence of

control variables for household wealth or other household characteristics makes it difficult to evaluate

their findings.

A number of subsequent studies have provided further evidence on the correlation between

investor marginal tax rates and the dividend yield on common stock holdings. Both Petit (1977) and

Lewellen, Stanley, Lease, and Schlarbaum (1978) analyze the same data set on portfolio holdings and

transactions by the clients at a major U.S. brokerage house during the 1960s. They reach different

conclusions, with the former providing support for the clientele hypothesis and the effect of taxes on

portfolio yields more generally, and the latter finding relatively small effects of taxation on yield. Petit's

(1977) results are more transparent, since they are based on regression methods, but the substantial

differences in the study findings is puzzling and possibly attributable to small differences in the set of

observations being analyzed. Chaplinsky and Seyhun (1987) also present evidence on clientele models,

in their case relying on data from tax returns. They show that the ratio of dividends received to realized

capital gains declines as household marginal tax rates on dividend income increase, but this finding does

not necessarily support clienteles with respect to dividend yield. Numerous studies, as noted below, have

found that capital gains realizations are sensitive to tax rates, and since realized gains are the

denominator for the ratio that is used as the dependent variable, the tax sensitivity of realizations could

be driving the results.

Scholz (1992), who analyzed the Survey of Consumer Finances data from 1983, reports the most

recent evidence on dividend clienteles. He controls for the constraint that households cannot hold

portfolios with negative yields, and finds that a very pronounced effect of taxes on portfolio yields. He

estimates a very large effect of tax rates on dividend yields. The difference the predicted dividend yield

assuming that the marginal tax rate is 50 percent, and the predicted yield assuming that there are no

taxes, is 5.4 percentage points. This differential is substantially larger than the disparity in dividend

yields between the highest-yield and lowest-yield deciles of traded equities, so there is some question of whether the estimated effect is implausibly large. One concern is that unobserved differences in risk tolerance might explain some of the findings.

The magnitude of the findings notwithstanding, there are strong reasons for preferring results from the Survey of Consumer Finances to all of the previous empirical studies in this area. The SCF has the important virtue of providing direct information on the market value of corporate equity holdings, so it is possible to calculate an actual dividend yield, and it also provides far more control variables relating to demographics and household characteristics than other studies using tax return data. It is striking that some of the clearest evidence of dividend yield clienteles with respect to corporate stock ownership comes from a period when marginal tax rates on dividends, which were capped at 50 percent in 1983, were lower than when the other data sets were collected.

Most of the previous research on investor clienteles with respect to dividend yields has focused on the case of individuals, and there is much less evidence on how taxation affects the behavior of institutional investors. Strickland (1996) presents some informative evidence on this issue, and finds that taxable institutions such as mutual funds and money managers exhibit a preference for low-yield stocks, while untaxed institutions, such as pension funds, do not display any investment preference with respect to a firm's dividend yield. This represents further evidence that taxation affects the structure of investor's equity portfolios.

2.6 Asset Market Evidence on Investor Valuation of Dividends and Capital Gains

The empirical research described above presents direct evidence on how taxation affects investor demand for dividends and capital gains, but it does not consider the effect of tax-induced shifts in investor demand affects the market prices of securities that generate returns in the form of dividends and, alternatively, capital gains. Because the market prices of such securities represent key signals to corporate managers who are trying to determine their firms' financial policies, understanding how

taxation affects the equilibrium market valuation of dividends and capital gains is a critical empirical task. Moreover, given the heterogeneity in the relative tax burdens on capital gains and dividend income for different investors, researchers have been interested in trying to identify the tax rates of the "marginal investor" who sets prices.

This task has attracted substantial research attention in both financial economics and public finance. The voluminous literature on this topic can be explained both by the central role of this issue in understanding corporate payout policy, as well as by the accessibility of data and the straightforward nature of the empirical tests that are associated with it.

The test that one would like to perform is to compare the prices of two otherwise securities, one of which produces returns in the form of taxable dividends, the other generating the same pretax returns but in the form of capital gains. Such a comparison is typically not possible, because there are virtually no pairs of securities that generate returns that are taxed in different ways. One notable exception is the Citizens Utilities Company, a Connecticut utility firm, which has two classes of common stock that pay dividends that are taxed in different ways. Long (1978) and Poterba (1986a) analyze the relative prices of these shares, and found mixed evidence on the impact of taxation.

A much larger literature focuses on the relative value of dividends and capital gains in dividend-paying firms. This literature, which involves two types of tests, is well surveyed by Allen and Michaely (1995). One set of tests asks whether the pretax return on corporate shares is systematically related to their dividend yields. This involves comparing ex post returns over periods when dividend paying firms are paying dividends, and even when they are not, with the returns on comparable firms that do not pay dividends. In essence, the key question is whether a high-yield firm is required to earn a higher, or lower, return at all times than a lower-yield firm. Evidence on this issue is mixed. Litzenberger and Ramaswamy (1979, 1980) find that higher yield securities generate higher pre-tax expected returns, which is consistent with the after-tax capital asset pricing model. Naranjo, Nimalendran, and Ryngaert

(1998) also present evidence supporting such a relationship between yield and return, although they conclude that their empirical findings are too large to be accounted for by tax effects alone.

The second strand of literature, and the primary focus of the discussion below, asks whether the pretax return on dividend paying firms differs from that on non-dividend firms ~~on the days when dividends are paid~~. This is the "ex-dividend day" pricing literature, which compares the share price decline on the day when investors are no longer eligible to receive a dividend, with the amount of the dividend payment, and uses this ratio to estimate the relative tax burden on dividends and capital gains. One reason that ex-dividend day pricing tests have received so much attention is that they offer a relatively straightforward test of the valuation of two income flows with different tax treatment.

The basic logic of the ex-dividend day testing strategy can be illustrated as follows. Consider a setting in which all investors face tax rates of τ_d and τ_{cg} on dividends and capital gains, respectively, and when their required after-tax return is ρ. In this case the equilibrium condition that ensures that all investors are indifferent to holding more or less of a security with a dividend yield of d_i and an expected capital gain of g_i is

$$\rho = (1 - \tau_d) * d_i + (1 - \tau_{cg}) * g_i.$$

This equation implies that cross-sectional variation in dividend yields should be reflected in differences in the total pre-tax return on different shares. In particular, since the pretax return on a security is $R_i = d_i + g_i$, manipulation using the foregoing equilibrium condition reveals that:

$$R_i = \frac{\rho}{1 - \tau_{cg}} + \frac{(\tau_d - \tau_{cg})}{1 - \tau_{cg}} * d_i.$$

Thus, if dividend income is taxed more heavily than capital gains income for the investors who determine market prices, higher dividend yield securities should earn higher pretax returns. Because there is substantial heterogeneity in the dates on which firms pay dividends, there is a great deal of variation in the firm-specific, day-specific dividend yield that can be used to identify the link between dividend yield

and pretax return.

The difficulty of determining the marginal tax burden on capital income flows is illustrated, in the dividend valuation context, by Miller and Scholes (1978) and several subsequent studies. Miller and Scholes (1978) noted that even for individual investors, who face current income taxation on dividends but not capital gains, it was possible for the effective tax burden on dividends to be low. They noted that IRS rules restrict tax-deductible individual borrowing to the larger of $10,000 or total capital income, which includes cash dividends. Receiving another dollar of cash dividends would therefore relax the borrowing constraint on an individual, and this could in effect make dividend income untaxed at the margin. Peterson, Peterson, and Ang (1985) and Feenberg (1981) have explored the importance of this specialized tax provision, and they suggest that it does not play an important role in the dividend valuation of many households.

The interpretation of empirical evidence on the price movements of shares around their ex-dividend days depends critically on whether or not the shareholders who "typically" hold the firm are also holding the shares and setting prices around the ex-day. Allen and Michaely (1995) distinguish between "static clientele" theories in which long-term investors determine the ex-dividend day pricing relationships and "dynamic clientele" models in which investor clienteles in a given firm may be different on the ex-day and other days. Many studies of ex-day share price movements implicitly assume that clienteles do not change over time. In this case the share price decline around the ex-dividend day, when scaled by the dividend payment, may provide information on the marginal dividend and capital gains tax rates on a firm's long-term investors. In more plausible models with time-varying clienteles, however, such inferences are more difficult.

Elton and Gruber's (1970) seminal study of ex-dividend day price movements is an example of a study assuming static clienteles. This study found clear evidence that the share price decline on ex-dividend days was smaller than the amount of the dividend payment, particularly for firms with relatively

low dividend yields. They interpreted this finding as demonstrating that investors form clienteles on the basis of their tax rates, and that high yield firms attract investor clienteles with low marginal tax rates on dividend income. Their analysis was premised on the view that ex-day share price movements reflect the tax rates of the long-term holders of the corporation's shares.

Elton and Gruber (1970) analyzed returns using monthly returns data, and other studies using monthly returns have reached different conclusions regarding the valuation of dividends and capital gains. Miller and Scholes (1982) argued that previous empirical findings such as those in Elton and Gruber (1970), which suggest that share prices decline by less than the value of dividend payouts, had been marred by statistical biases. They presented evidence using monthly stock returns over a long sample period that suggested that biases such as the coincidence of ex-dividend days and dividend announcement days, which would raise share prices, could account for a spurious positive relationship between pretax returns and dividend yields.

Gordon and Bradford (1980) also present evidence that is consistent with the Miller and Scholes (1982) conclusion in monthly data: they do not reject the null hypothesis that dividends and capital gains are valued equally. They study monthly stock returns over the period 1926-1978. One important innovation of their study is its explicit use of the after-tax capital asset pricing model to motivate the estimation strategy. This involves linking the after-tax asset demand equations derived in the last section, with no limits on individual investor short sales, with information on asset supplies. The resulting equilibrium return relationship is:

$$r_i + v * d_i - r_z = \beta_i * (r_m + v * d_m - r_z)$$

where r_i represents the pretax return on security i, d_i the dividend yield on security i, r_m and d_m the analogous return concepts for the market portfolio, and r_z the return on a zero-beta portfolio.

The crucial parameter in this expression is v (α in Gordon and Bradford's (1980) notation). It denotes a weighted average of the relative tax burdens on dividends and capital gains on different

households:

$$v = \sum_h \frac{s_h}{\gamma_h} * \frac{(1 - \tau_d^h)}{(1 - \tau_{cg}^h)}$$

where s^h denotes the share of household h's wealth in total household wealth, γ^h denotes relative risk

aversion for household h, and the tax parameters are defined as usual. This expression indicates that the

relative price of dividends and capital gains is the same for all securities, and that it is determined as a

weighted average of marginal tax rates with weights increasing in a household's wealth, and declining in

its relative risk aversion. This expression implies that in the absence of short-selling constraints, the

relative valuation of dividends and capital gains for all firms should be the same. This prediction is not

consistent with a substantial body of empirical evidence that suggests the presence of dividend clienteles,

and it raises questions about which of the various assumptions underlying this expression need to be

relaxed.

Gordon and Bradford (1980) perform empirical tests of the model described above, under the

maintained assumption that all firms face the same relative valuation of dividends and capital gains.

They find evidence of substantial fluctuation in the relative valuation of dividends and capital gains

across five-year intervals, but they do not reject the null hypothesis that on average, this relative

valuation is equal to unity. They also find evidence that the relative valuation of dividends and capital

gains tends to move in tandem with Tobin's q, which is an empirical pattern that has not yet been

investigated in subsequent research.

While empirical studies relying on monthly returns data find mixed evidence on the relationship

between dividend yields and pretax returns, studies using daily returns tend to find clearer evidence that

for many companies, dividends appear to be valued less than capital gains. One notable study using daily

data is Barclay's (1987) analysis of ex-dividend day pricing before the adoption of the federal income tax

in 1913. His results suggest that share prices declined by approximately the full amount of their dividend

payouts before 1913, while in the early 1960s, the comparison period he considers, prices declined by less than the full amount of the dividend. This finding is consistent with taxation playing a key role in determining ex-day pricing. Auerbach (1983) also presents evidence that ν, as defined above, does not equal unity when it is estimated using daily data for the 1962-1977 period. There are some puzzles in these data, however. Eades, Hess, and Kim (1984) study ex-dividend day price movements in the United States, and they find that even for some distributions that are taxed in the same way as capital gains, the market seems to value the payouts less than dollar-for-dollar. This suggests that taxes may not be the only factor influencing returns around the ex-day. Michaely (1991) also presents evidence that is difficult to reconcile with the standard tax-based explanation of ex-dividend day price movements. He finds no evidence that TRA86 affected the magnitude of price declines around ex-dividend days, even though this tax reform affected marginal tax rates for many investors.

Other higher-frequency comparisons of ex-day pricing around substantial tax reforms, and in other nations, reach varied conclusions regarding the effects of taxation and tax changes on ex-day pricing. Poterba and Summers (1984), for example, present evidence that the integration of the British corporate and personal income taxes was associated with a change in ex-dividend valuation. Morgan and Thomas (1998) and Bell and Jenkinson (2000) are more recent studies of ex-dividend pricing behavior in the United Kingdom, with different conclusions about the importance of tax considerations. Lakonishok and Vermaelen (1983) and Booth and Johnston (1983) study the effect of the 1971 Canadian tax reform that introduced capital gains taxation. Green and Rydqvist (1999) present an intriguing analysis of ex-day pricing for lottery bonds in Sweden, and conclude that prices move as an after-tax ex-day model would suggest.

One interpretation of the rather mixed empirical findings in the ex-dividend day pricing literature is that they are confounded by high-frequency fluctuations in shareholder clienteles, which implies that ex-day pricing does not reflect the stable, long-term clienteles in particular securities. A number of

recent studies, beginning with Kalay (1982), have focused explicitly on the changes in ownership that take place around ex-dividend days. Kalay (1982) suggested that the bounds on short-term profitable trading opportunities, which are a function of transaction costs, were the primary determinant of ex-dividend price movements. Several recent studies, including recent contributions such as Bali and Hite (1998), Bhardwaj and Brooks (1999), and Frank and Jagannathan (1998) have considered the extent to which market microstructure issues or other factors that are not related to taxes can explain the observed pattern of pricing.

The degree to which firms experience high-frequency changes in their tax clientele has also attracted substantial attention. Michaely and Vila (1995) document that volume around ex-dividend days is substantially greater than on average days, suggesting that some clientele changes are taking place. Karpoff and Walkling (1988, 1990) suggest that some investors engage in "dividend capture," trading in dividend-paying stocks around their ex-days. Koski (1996) also analyzes the short-term trading question, and devotes particular attention to the trading incentives facing corporations. She concludes that the combination of tax and regulatory changes in the early and mid-1980s sharply reduced the opportunities for profitable ex-dividend arbitrage that may have existed in the early 1980s. Koski and Scruggs (1998) focus on a single time period, 1990-91, and present evidence of cross-sectional variation in the pattern of trading around ex-dividend days, with particular support for greater trading by securities dealers in stocks that have high dividend yields. Eades, Hess and Kim (1994) track the time series fluctuation in the ex-day return patterns for high-yield securities, and they argue that these patterns are consistent with less dividend capture during periods when the costs of such trading was higher.

Research on high-frequency clientele changes suggests that there may be some incentive for such trading for securities with very high dividend yields. Recognizing the role of dividend capture traders in determining share prices around ex-dividend days has been an important research insight of the last fifteen years. For many stocks with smaller dividends, however, ex-day arbitrage does not generate high

returns because the transaction costs are too large to make such trading profitable. For these firms, the ex-day price movement may represent the relative valuation of dividends and capital gains by long-term investors. There may be more stable, longer-term clienteles in the ownership of these firms; Dhaliwal, Erickson, and Trezevant (1999) present some empirical evidence on the importance of dividend policy in affecting the ownership of firms. For firms without short-run changes in dividend clienteles, the balance of evidence suggests that dividends are valued less than capital gains. This finding raises a puzzle with respect to corporate financial policy: the perennial question of "why do firms pay dividends?" Black (1976) concisely poses this puzzle, and Auerbach (2001) offers a review of contemporary work.

3. Taxation and Asset Sales

The last section considered the influence of taxation on the set of assets that individuals choose to hold in their portfolios, and the fraction of their wealth that they choose to hold in different assets. The theory of portfolio selection underlying that discussion is well developed. This section considers a different set of issues: the effect of taxation on decisions about when to buy and sell assets. The tax which has the greatest influence on this decision is probably the capital gains tax, and while there is a voluminous empirical literature directed at measuring the effect of capital gains taxation on asset sales, the theoretical literature that underlies this work is poorly developed. There is no generally accepted model of why investors choose to sell assets, so it is difficult to embed the literature on capital gains taxation in a theoretical framework in which welfare analysis is possible.

One of the reasons that capital gains taxation has attracted so much research and policy attention is that it is one of the few situations in which there is a plausible empirical argument that reducing marginal tax rates may _raise_ government revenues. Public finance scholars have long recognized the possibility, popularized by economist and presidential advisor Arthur Laffer in the early 1980s as the "Laffer curve," that lowering marginal tax rates could increase total government revenue. There are few

instances in which careful empirical research suggests that this possibility is a practical reality. Capital gains taxation is one such case.

To understand the effects of the capital gains tax rate on current tax revenue, it is helpful to write revenue, R, as the product of the tax rate on realized gains, τ_{cg}, and the tax base, which equals realized gains (REALIZATIONS): $R = \tau_{cg}*\text{REALIZATIONS}$. The condition for a "Laffer effect," $dR/d\tau_{cg} < 0$, is:

$$\frac{dR}{d\tau_{cg}} = REALIZATIONS + \tau_{cg}*\frac{d(REALIZATIONS)}{d\tau_{cg}} < 0.$$

This can be rewritten in terms either of the elasticity of realized gains with respect to the marginal tax rate, $\eta_{real,\tau} = d\ln(\text{REALIZATIONS})/d\ln(\tau_{cg})$, as $\eta_{real,\tau} < -1$, or (in what may be a more natural elasticity to consider) the elasticity of realizations with respect to the after-tax income associated with a realization, $\eta_{real,1-\tau} = d\ln(\text{REALIZATIONS})/d\ln(1-\tau_{cg})$, as $\eta_{real,1-\tau} > (1-\tau_{cg})/\tau_{cg}$. Empirical work on the link between capital gains realizations and marginal tax rates has focused on whether this condition is satisfied. It is important to recognize that this expression considers only the effect of the capital gains tax rate on current capital gain realizations. It is possible for changes in the tax rate at one date to affect realizations at other dates, and the associated revenue effects need to be considered in thinking about the effect of capital gains tax rate changes on the present discounted value of government revenues.

One of the difficult problems in evaluating the revenue effects of capital gains tax rate changes is that even if realizations increase, it is possible that there are effects elsewhere in the tax system. If one source of realized capital gains is relabelling of other types of income, so that labor income declines when realized gains increase, then it is possible that a simple analysis of the link between capital gains tax rates and capital gains realizations may not fully describe the revenue effects of capital gains tax reform.

3.1 Capital Gains Tax Avoidance and Loss-Generation Behavior

Before turning to the empirical evidence on capital gain realizations and tax rates, it is helpful to

describe optimal investor behavior in the presence of a realization-based capital gains tax. Even a cursory review of optimal asset trading strategies in an efficient capital market with such a tax may generate startling outcomes. In particular, astute investors and tax planners could in some cases generate negative capital gains tax liability in all periods until their death, and then to use basis-step up to extinguish all of their lifetime capital gains tax liability on accrued gains.

A number of studies have considered the optimal realization policy for an investor with a security that has an accrued gain or loss. Some features of optimal realization policy are straightforward. For example, an investor who holds securities that have declined in value since he purchased them can maximize the present discounted value of his tax deduction by realizing the loss immediately. In contrast, an investor with an accrued capital gain might defer the taxes on this gain by holding the gain for as long as possible, and ideally, until he dies and the value of the asset's basis is stepped up.

While there is agreement that depreciated assets should be sold immediately, there is disagreement concerning the appropriate treatment of appreciated assets. Constantinides (1984) argues that gains should be held until they must be realized to satisfy consumption needs or until basis step-up. Dammon and Spatt (1996), however, show that for low enough levels of transaction costs, it can be optimal to sell appreciated assets as well, as soon as their gains qualify for long-term status. The reason is that by selling the appreciated asset, and then repurchasing it, the investor can generate an opportunity for a short-term loss realization in the future.

A number of recent studies have developed new theoretical or empirical insights on the tax-timing issue. Leland (2000) examines the optimal trading rule in the presence of taxes, and he finds that with transactions costs there is a "region of inaction" in which investors do not trade, but that with low enough trading costs (or large enough gains and losses) the Dammon-Spatt strategies are still optimal. Dammon, Spatt, and Zhang (2001) also explore optimal consumption behavior, and realization decisions, in the presence of capital gains taxation.

Empirical research on the value of tax-timing options is limited. Brickley, Manaster, and Schallheim (1991) investigate how the discount on closed end mutual funds is related to the volatility of the underlying securities held by the fund. They argue that the value of the tax-timing option on the fund is worth less than the portfolio of tax-timing options on the individual securities, and that this differential should become larger as volatility rises. Their empirical results support this implication of the tax-timing analysis, although they might be consistent with other explanations as well. Chay, Choi, and Pontiff (2000) also test the value of tax-timing options, in this case by studying the market value of forced capital gain realizations. They conclude that the effective tax rate is about ninety percent of the statutory tax rate on realized gains. There has also been some work on tax-timing behavior in bond markets. Prisman, Roberts, and Tian (1996), for example, find evidence that investors take advantage of "tax timing options" in the Canadian bond market.

One can move beyond the analysis of optimal realization policy for assets that an investor already holds to ask a more general question: can investors pursue portfolio strategies that will reduce their capital gains or income tax liability, and if so, what will these strategies involve? Several studies have noted that if investors can take large positions in securities with negatively correlated returns, they can generate capital losses that can be used to offset other types of capital income.

The simplest illustration of a loss-generation strategy, which has been explained in Constantinides and Scholes (1980) and Stiglitz (1983), involves two securities with perfectly negatively correlated returns. A long and a short position in the same security are a good illustration. At the beginning of a tax year, an individual purchases 100 shares of stock in Company X, and at the same time, he sells short 100 shares of this stock. This pair of transactions requires no commitment of net worth, at least in a frictionless financial market. The investor holds the two positions until the end of the tax year, at which time he either sells his shares or closes out his short position. Which transaction he undertakes depends on the performance of Company X's stock price over the year. If the stock has appreciated, the

investor will have a gain on his long position in the stock, so he will close out his short position and generate a capital loss. If the stock price has fallen, however, he will sell his shares, thereby realizing a loss, and he maintains the short position. This strategy yields a certain capital loss in the current tax year, and a certain carryforward of an accrued gain to the next year.

The transaction sketched above would not result in an allowable capital loss under current tax rules, because an investor with both a long and a short position in the same security would not be "at risk" in the underlying security. However, it is possible to pursue strategies similar to that described above using either two highly but imperfectly correlated securities, such as stocks in two oil or steel companies, or by using derivative securities. The attractiveness of strategies of this type depends critically on the transactions costs associated with establishing the various positions.

The degree to which investors pursue capital loss generation strategies is an empirical issue. Poterba (1987) presented data based on the 1985 IRS Sales of Capital Assets data file. These data show that less than one fifth of investors, and possibly only one tenth, realize the maximum deductible level of net capital losses, as the foregoing analysis would suggest. It is important to note that capital losses of more than $3000 cannot be deducted from ordinary income. Seyhun and Skinner (1994) find evidence consistent with Poterba (1987), in that relatively few investors appear to have net realized losses as we would expect if investors were using Constantinides-Scholes-Stiglitz strategies to generate losses. Auerbach, Burman, and Siegel (2000) find that data for tax years in the 1990s suggests that a much higher fraction of investors (as many as one third) reporting net capital losses. This may reflect a growth in investor sophistication, or a shift in the underlying distribution of returns on the assets that are being sold for tax purposes. Further work is needed to explain this shifting pattern.

One general difficulty with the literature on taxation and optimal trading behavior remains something of a mystery. Odean (1998) and Shefrin and Statman (1985) suggest that individual investors are reluctant to realize their losses, partly because there are psychological costs to acknowledging that

one has participated in a loss-generating trade. Grinblatt and Keloharju (2000) further explore the factors

that induce trading with a rich data set on Finnish investors; their data provide some support for the role

of tax-loss trading by investors. Future work is needed to link this literature with the studies of what

optimal realization behavior would be in perfect capital markets.

3.2 Asset Turnover and the Capital Gains Tax: Empirical Evidence

The empirical study that launched the modern literature on how capital gains taxation affects

realization behavior is Feldstein, Slemrod, and Yitzhaki (hereafter FSY) (1980). This study used data

from individual income tax returns for tax year 1973 that were released as part of an IRS Statistics of

Income - Sales of Capital Assets file. The key regression equation related a taxpayer's long-term capital

gains on sales of corporate stock (LTG), divided by the taxpayer's dividend income (DIV, as a proxy for

total holdings of corporate stock), to the taxpayer's marginal tax rate on realized capital gains. The

estimation sample was limited to taxpayers who reported at least $3000 of taxable dividends. The results

are shown below, with standard errors shown in parentheses:

$$LTG/DIV = 35.0 - 49.7*\tau_{cg} + 0.18*AGE65+ - 1.23*\ln(DIV) - 0.50*\ln(AGI)$$
$$(1.3)\quad(3.8)\qquad(0.35)\qquad\quad(0.12)\qquad\quad(0.12)$$

These results imply that a ten percentage point reduction in the marginal tax rate on capital gains would

raise the ratio of long term gains, which averages 3.50 in the sample, by nearly 5. The estimates can also

be interpreted in elasticity terms. Since the average value of the marginal tax rate on capital gains is

0.264, the implied elasticity -3.75, so gains respond to tax rates by more than enough to generate revenue

gains from reductions in marginal rates.

One of the critical empirical issues in studies of capital gains realizations, as well as related

taxpayer behaviors such as charitable giving or borrowing, is that the marginal tax rate on the last dollar

of realized gains may be affected by the level of realizations. This induces a fundamental endogeneity

between the independent variable of interest, the marginal tax rate on realizations, and the dependent

variable. FSY (1980) tackle this problem by also constructing a first dollar marginal tax rate on realized

gains. This is a measure of the marginal tax burden assuming that the taxpayer had not realized any

gains, and it is therefore independent of actual realizations. This marginal tax rate can either be used as

the independent variable for the regression model above, or, as more recent studies have done, it can be

used as an instrumental variable for the actual, last-dollar marginal tax rate. FSY report that including

the first-dollar tax variable in their specification, in place of the last-dollar marginal tax rate, results in a

coefficient estimate of -37.1 rather than -49.7. This still implies a large elasticity of gains with respect to

the tax rate.

      The FSY study suggested that if marginal tax rates on realized gains were reduced from their

levels in the early 1970s, the total revenue collected from the capital gains tax would increase. This

conclusion has been questioned, however, by a number of subsequent studies that have focused on some

the empirical difficulties in estimating a realization elasticity from tax return data.

      One critical empirical difficulty that arises in any study of how current realized gains depend on

the current marginal tax rate involves distinguishing transitory and permanent effects on realization

decisions. There are several dimensions of this problem. One is that if a given household experiences

year-to-year fluctuations in income, which are associated with fluctuations in marginal tax rates, the

household may try to time capital gain realizations to coincide with low marginal tax rate years. This

possibility was recognized by FSY (1980), but it was not possible to address this difficulty using only a

single cross-section data set. If households engage in this type of retiming behavior, however, then the

estimated elasticity of realizations with respect to marginal tax rates in a single cross-section may not

indicate how a permanent reduction in the capital gains tax would affect realization behavior.

      A second dimension of the transitory-permanent problem arises when capital gains tax rates are

known to be changing in the near future. There may be substantial re-timing of realizations, and the

short-run elasticity of realizations with respect to the marginal tax rate may be high, even if the long-run

elasticity is low. The circumstances surrounding the Tax Reform Act of 1986 illustrate the potential

importance of retiming behavior. In that case, it was clear by mid-1986 that the top marginal tax rate on gains realized after January 1, 1987 would be 28 percent, while the top rate on gains realized before that date was 20 percent. The time series of realized long-term gains for the mid-1980s indicates the impact of such an anticipated capital gains tax increase. These realizations, measured in $1986 billion for the five years beginning in 1983, were $129.8, $145, $171.2, $324.8, and $144.4. The empirical challenge posed by findings such as this is separating the transitory and permanent effects of capital gains tax changes.

A number of studies have extended the FSY (1980) methodology by allowing for both permanent and transitory realization elasticities. Burman (1999), Gravelle (1994), and Maringer (1995) discuss a number of these studies. Auten and Clotfelter (1982) use a panel of tax returns for the period 1969-1973, and their empirical strategy involves the inclusion of both the current marginal tax rate on long term gains, as well as the average of the individual's tax rates over the years in the panel data set. The statistical results suggest that there are important differences between the impact of the current tax rate, and the impact of the average or permanent tax rate, on realized gains. The estimated elasticity of long-term gain realizations with respect to the permanent tax rate is -0.37, while the estimated elasticity with respect to transitory fluctuations in the tax rate is -1.05. These findings suggest that the long-run realization effect of cutting the capital gains tax rate may be smaller than that required to increase revenues. Auten and Joulfaian (1999) present more recent evidence using panel data, and they also find substantial differences between the impact of permanent and transitory changes in tax rates.

One of the most widely discussed studies on capital gains taxation and realization behavior is by Burman and Randolph (1994). They use a panel of tax returns for the period 1979-1983, and they use variation in marginal tax rates due to the state a taxpayer lives in, and thus the state income tax rate on reported gains, as a source of "permanent" tax rate variation. Their basic empirical specification is given by:

$$LTG_t^* = X_t\alpha_0 + \tau_{cg,perm}{}^*\alpha_1 + \tau_{cg,t}{}^*\alpha_2 + \tau_{cg,t-1}{}^*\alpha_3 + \varepsilon_t.$$

LTG^* denotes the desired level of long-term gain realizations; it can be negative, and the estimation

relies uses a Tobit estimator to handle truncation at zero. This specification allows for a separate effect

of the permanent tax rate on capital gains ($\tau_{cg,perm}$), the current tax rate on capital gains ($\tau_{cg,t}$, which one

can alternatively view as the deviation of the current tax rate from the permanent level), and the lagged

deviation of the tax rate from its permanent level ($\tau_{cg,t-1}$).

The empirical findings suggest a large transitory elasticity of capital gains realizations with

respect to the marginal tax rate, with an elasticity estimate of -6.42 (0.34) in the base case. The estimate

of the realization elasticity with respect to permanent tax changes, however, is much smaller, and it is

statistically insignificantly different from zero: -0.18 (0.48). Thus these findings confirm the earlier

suggestion that the long-run realization elasticity may fall short of the value needed to imply that

reducing capital gains tax rates would raise revenue.

The debate on the effect of capital gains taxation on gain realizations is likely to continue, since

one can raise objections to essentially all of the existing empirical work. For example, Burman and

Randolph's (1994) identification using cross-state differences leads to questions about whether state of

residence is itself endogenous. There is some empirical evidence that wealthy, elderly taxpayers are

somewhat sensitive to capital income and estate tax rates in choosing their state of residence; this makes

it difficult to evaluate the Burman-Randolph results. Moreover, for addressing the question of how

taxpayers would respond to an actual change in the federal tax rate on long-term gains, it is important to

ask what taxpayers would believe about the likely permanence of such a change. If taxpayers viewed

such a change as transitory, then the short-term realization effects could be as indicated by the transitory,

rather than permanent, capital gains tax rate variables in the foregoing specification.

In addition to the cross-sectional and panel data studies described above, there have been some

studies of aggregate capital gains realizations and the effect of marginal tax rates using time series data.

The substantial literature on this issue is surveyed by the Congressional Budget Office (1988) report on capital gains taxation. Auerbach (1988) represents the most careful analysis of the time series record to date. The findings in this literature parallel those in the studies that have used taxpayer data: they show clear evidence of high-frequency effects of the capital gains tax rate on the flow of realizations, but much weaker evidence that permanent changes in capital gains tax rates affect the flow of realizations. Auerbach (1988), for example, finds that when only the contemporaneous capital gains tax rate is included in a regression equation for capital gains realizations estimated over the period 1955-1985, the coefficient on the tax rate variable is -4.3, with a t-statistic of -2.4. When the current tax rate and the tax rate change from the previous period are both included in the specification, however, the coefficient on the contemporaneous tax rate falls to -1.8 (t-statistic of -0.7), and the coefficient on the tax rate change variable is -1.8 (t-statistic of -0.9). These findings illustrate the limited amount of information in the time series evidence, and the sensitivity of time series findings with respect to minor changes in specification. Eichner and Sinai (2000) show that even with a longer time series running through the mid-1990s, the elasticity estimates are still very sensitive to particular sample periods, especially the inclusion of the years 1985-1987.

The lack of robust results from the time series analysis is unfortunate, because in some ways the aggregate data may be the best source of information on the effect of tax changes on realizations. It describes the effect of tax changes when all of the general equilibrium effects of the tax cut, such as asset price changes and changes in the advice of financial intermediaries, are allowed to take place. Cross-sectional evidence does not provide any information on the potential magnitude of effects through these channels.

Before leaving the discussion of how capital gains taxation affects the flow of gain realizations, several additional points deserve comment. First, there are strong reasons to think that the effect of a capital gains tax change on realizations will depend on the past history of asset returns and tax rates.

Cutting capital gains tax rates after they have been high, and after assets have risen sharply in value, is likely to have a larger effect on the flow of realizations than a similar-sized reduction in rates starting from a lower base tax rate or after a less robust period of asset returns. There is an emerging literature, illustrated for example by Shackelford and Verrechia's (1999) analysis of capital gains tax rates, on how taxpayers respond to anticipated changes in taxes. One interesting finding, reported in Auerbach and Siegel (2000), is that long-run responses to changes in the tax code, as well as short-run "timing" responses, may vary across taxpayers with different levels of tax sophistication.

Second, virtually none of the previous research on the capital gains tax has considered how changes in this tax might affect the reporting of non-capital gains income. In particular, there is little work on whether there is substantial re-labeling of ordinary income as capital gains income when the capital gains rate is below the rate on interest, dividends, and wages. One of the primary activities of tax planners is transforming ordinary income into capital gains; the key issue is how important this is at an aggregate level. Third, there has been relatively little research on the degree to which realization elasticities vary across asset categories. The mix of assets generating gains has shifted over time, with the fraction of gains on due to sales of corporate stock rising in the last decade. For less liquid assets, such as commercial real estate or the effect of changing the capital gains tax rate on realizations may be smaller than for more liquid assets such as corporate stock.

Finally, the foregoing discussion has not mentioned one of the most important features of the U.S. capital gains tax, which is the "basis step-up at death" provision. A taxpayer who dies with an appreciated asset can leave this asset to an heir, and the heir will inherit the asset with a new, "stepped-up" basis equal to the asset's value at the time of the first person's death. Basis step-up effectively extinguishes the tax liability on capital gains that accrued during the decedent's lifetime. This tax provision has two important effects. First, it reduces the effective capital gains tax rate to a rate substantially below the statutory rate; Bailey (1969) estimates that this provision reduced the effective

tax burden on capital gains by about 50%. Protopopadakis (1983) presents related calculations using the rate of capital gain realizations to estimate the effective tax rate. Second, for elderly individuals with relatively short life expectancies, the basis-step up provision creates a transitory and predictable fluctuation in the capital gains tax rate, and it may lead to particularly pronounced "lock-in" effects for those near the end of the lifecycle.

There is little empirical evidence, however, on the effect of basis step-up on asset sales; this is an issue that deserves further analysis. Poterba and Weisbenner (2001a) present evidence on the distributional effects of shifting from the current estate tax, with basis step-up, to a system that included unrealized capital gains in the taxable income of decedents for their final year. There is some experience in Canada in the early 1970s with a shift from an estate tax to a capital gains tax at death, but this has not yielded insights on the behavioral effects of such a change.

3.3 Taxation and the January Effect

One issue involving portfolio behavior and taxation, which has attracted some attention in both financial economics and public finance, is the link between tax-motivated investor trading and the so-called "January effect" in stock returns. The "January effect" is the systematic finding that the average return on common stocks is higher in January than in any other month, as least in the U.S. equity market. This effect is somewhat more pronounced among small stocks and stocks that have experienced losses in the previous year. While there is suggestive evidence that investors sell shares with losses as the year-end approaches, as efficient tax-management would dictate, there is only limited empirical evidence linking this trading to the January effect, or showing that it is large enough to explain the abnormal January returns.

Badrinath and Lewellen (1991) is the clearest study of year-end tax-motivated trading. This study uses transactions data from individual accounts at a major brokerage firm. It finds a higher concentration of transactions that generate losses in December than in any other month. This evidence is

consistent with the studies that consider aggregate volume in individual companies, such as Dyl (1977) and Slemrod (1982), and relate it to the firm's recent return performance. While there is usually a negative relationship between trading volume in January and the security's historical return, Bolster, Lindsey, and Mitrusi (1989) suggest that this pattern reversed in 1986, a year when rising capital gains tax rates made it attractive to realize gains before year-end. This evidence all points to an important link between tax considerations and investor trading decisions. Seida and Wempe (2000) move beyond an analysis of volume by using intra-day transaction data that makes it possible to identify stock sales by individual investors. Their findings also suggest a sharp increase in sales of appreciated assets in late 1986.

Three recent empirical studies provide further evidence linking tax considerations with end-of-year stock trading and stock returns. Sims (1995) shows that firms that have experienced losses during the calendar year that is about to end experience more negative returns just before the end of the year than other stocks do. This is consistent with a "return rebound" for the shares in these firms after the turn of the year. Poterba and Weisbenner (2001b) show that the relationship between past stock returns and January returns is a function of the precise features of the capital gains tax. In particular, changes in the definition of short-term and long-term losses appear to affect the link between past returns and January returns. Grinblatt and Moskowitz (2000) present additional evidence that confirms this general finding. The discovery that parameters of the tax code affect the relationship between lagged returns and current returns provides some support for the role of tax-loss trading in generating abnormal January returns. The leading alternative hypothesis to explain this pattern, "window dressing" on the part of institutional money managers, would not suggest such a pattern.

One interesting extension of the "January effect" literature is the possibility of a "November effect" associated with trading at the end of the tax year for mutual funds. Bhabra, Dhillon, and Ramirez (1999) suggest that as mutual funds have become more important investors in the equity market, there

has been a growing pattern of return abnormalities around the end of their tax year.

3.4 The Welfare Effects of Capital Gains Taxation

While there is a large empirical literature directed at measuring the effects of capital gains taxation on investor behavior, there is relatively little theoretical work addressed to the welfare effects of realization-based capital gains taxation. The capital gains tax contributes to the overall tax burden on capital income, and the general analysis of the welfare cost of capital income taxation in the spirit of Feldstein (1978) and Atkinson and Sandmo (1980) is therefore relevant. In addition, however, the unique behavioral effect of a realization-based capital gains tax is that it creates disincentives to sell appreciated assets, and it thereby creates a "lock in" effect. The welfare consequences of such lock-in have only begun to be studied.

There have been several attempts to develop models of how capital gains taxes affect asset realization decisions. Balcer and Judd (1987), for example, explore the optimal structure of asset purchase and liquidation in a lifecycle model. They abstract from uncertainty about rates of return on different assets, and assume a constant rate of asset price appreciation in all periods. In this setting, they show that it is optimal for an investor liquidate assets with the highest basis (purchase price) at any point in time; these will be the most recently-purchased assets. In addition, they show that it is impossible to refer to "the" effective capital gains tax rate, because the burden of a realization-based tax depends critically on holding period and the pretax appreciation of the underlying asset. Balcer and Judd (1987) do not present any explicit calculations of the welfare cost of capital gains taxation, and their model is not well suited to studying the problem of lock-in across securities with different historical returns.

Keifer (1990) represents a second attempt to study capital gains taxation and its effect on investor behavior. This paper uses a simple simulation model, in which investors share expectations about the prospective rate of return on assets that they do not own, but have heterogeneous expectations about the rates of return on assets they do own. This structure determines which investors will sell assets

at a given point in time, and it can be used to study the hypothetical reaction of investors to a change in the capital gains tax rate. Unfortunately, the link between this simple model and actual investor behavior is unclear, and the simplified structure of the model makes it difficult to calibrate it. There is also no attempt to address the welfare consequences of realization-based capital gains taxation.

Auerbach (1992) also explores the welfare cost of capital gains taxation in a stylized three-period model. The model suggests that the equivalent variation associated with a shift from the current realization tax system, to an equal-revenue accrual-based system, could be equal to several percent of household wealth. Auerbach (1992) also indicates that by reducing the lock-in effect, a switch to accrual taxation could depress personal saving in the years surrounding the tax transition.

Kovenock and Rothschild (1987) present another analysis of portfolio lock-in and its welfare consequences. They consider an investor's expected utility from following different portfolio investment strategies in a multi-period investment problem. One strategy, the optimal strategy in a world without realization-based taxes, is to rebalance the portfolio weights in every period to reflect current information on prospective returns. The other strategy, which may prove optimal with high rates of realization based taxation, is to follow a "buy and hold" strategy without any rebalancing. The paper does not derive an optimal portfolio adjustment strategy in the presence of realization-based taxation, but it does consider the types of strategies that would be more attractive with realization-based taxes than without them. Kovenock and Rothschild (1987) show that investors experience lower expected utility when they do not rebalance their portfolios. As in Balcer and Judd (1987), the focus in presenting results is on the comparison of effective tax rates rather than on more direct welfare comparisons, but the results are suggestive about the costs of realization-based taxation. One limitation of the analysis is that it does not endogenize the decision of whether or not to sell a given asset. If the expected utility gains from realizing an appreciated asset, paying capital gains tax, and re-investing in a balanced portfolio are positive, investors should do this, yet the paper does not allow this option.

There is very little empirical evidence on the extent to which investors are locked-in to particular

assets. One notable study by Landsman and Shackelford (1995) investigates how an investor's basis in

the stock of a single firm, R.J. Reynolds, relates to the price at which they tendered the stock to a

takeover bidder. This study finds that investors who had purchased RJR stock at low prices were more

likely to wait until later in the takeover process before selling out; this supports the view that capital

gains basis can affect the reservation price that individual's demand for selling their shares. Reese (1997)

presents a related, and clever, test of how capital gains affects trading behavior. He studies recent initial

public offerings (IPOs) of common stock, so that he knows the maximum possible holding period for an

investor in the security. He finds that for IPOs that appreciate in their first year of trading, there is a

substantial increase in trading just after the IPO has been traded for one year. There is an analogous

effect just before the IPO reaches the one-year mark for shares that have declined in value. This pattern

is consistent with investors holding shares with accrued gains longer than they might otherwise to qualify

those shares for a long-term gain. Klein (1999) more generally explores, in a theoretical setting, the link

between locked-in investors and the required return on different securities. He shows that when a

substantial number of investors are locked in to an asset, the expected return on that asset may be lower

than the expected return on other securities.

Another related study is Burman, Wallace, and Weiner's (1997) analysis of sales decisions by

homeowners. This paper presents weak evidence that in the United States, the probability of

homeowners with accrued capital gains sell their homes and purchase smaller homes rises after they

reach age 55. During the period of their data, those who sold homes with gains before age 55, and who

did not roll the gains over into a new home, had to pay tax on the full amount of the gains. After age 55,

$125,000 of capital gain could be excluded from taxation. This represents another example of lock-in

behavior, but its welfare effects have not been explored. The tax rules that generated this lock-in effect

were modified in the Taxpayer Relief Act of 1997. Housing capital gains of less than $500,000 are no

longer subject to capital gains tax. This change has presumably reduced the potential role of lock-in in the residential real estate market.

A small but expanding body of research has documented an effect of capital gains taxes on asset prices, particularly the prices of common stock. Amoako-Adu, Rashid, and Stebbins (1992) find that the introduction of the Canadian capital gains tax was associated with substantial asset revaluations. Lang and Shackelford (2000) and Shackelford (2000b) present evidence for the United States, showing that the stocks that were best positioned to benefit from lower capital gains tax rates rose the most when legislators moved toward capital gains tax reduction in 1997. Parallel evidence on the capitalization of the dividend tax burden is shown in Ayers, Cloyd, and Robinson (2000), for the 1993 tax change in the United States, and in Poterba and Summers (1985), for dividend tax changes in the United Kingdom. Blouin, Raedy, and Shackelford (2000) investigate the incidence of the capital gains tax burden on existing shareholders in a company that experiences an exogenous shift in demand; they find that new buyers must compensate existing holders, at least in part, for their tax burden.

3.5 The Securities Transactions Tax and Capital Market Equilibrium

Taxes on realized capital gains are the tax policy instrument that are most often discussed in studies of asset turnover, but they are not the only tax that can affect the decision to sell assets. Another tax instrument that periodically attracts substantial policy discussion is the securities transactions tax (STT) which Tobin (1984) proposed as a device for throwing "sand in the gears" of the markets in which financial securities are traded. Tobin's basis for suggesting such a tax was that some speculative trading imposes negative externalities on the financial system, so that a STT could be viewed as a corrective Pigouvian tax. Recent research on the role of "noise traders" in securities markets has provided a theoretical framework for considering the potential externalities associated with trading behavior, and in this context, Summers and Summers (1989) suggest that there might be welfare gains from adopting a securities transactions tax. The substantial volume of financial transactions on the major stock markets,

and in markets for derivative securities, has drawn policy makers to the STT. Assuming, as is very unlikely, that the volume and location of trade was not affected by a transactions tax, the revenue potential of the STT is substantial.

Most of the debate on the welfare gains or losses from adopting a securities transactions tax involves a comparison of alternative theoretical models. Schwert and Seguin (1995) provide a valuable introduction to this research. Because relatively few nations have imposed, or changed, securities transactions taxes in recent history, there is little empirical evidence on the effect of such taxes. Sweden provides a notable exception to this lack of tax variation: in 1984, Sweden imposed a 50 basis point tax on all purchases and sales of equities, and in 1986, the one-way tax rate was raised to 100 basis points. Umlauf (1993) provides a careful analysis of the impact of the Swedish STT. He shows that when Sweden raised its securities transfer tax, trading volume in Swedish securities in Sweden declined, but that much of this volume moved offshore, where trades could be consummated without paying the transactions tax. Lybeck (1991) estimates that the elasticity of trading in Swedish money market instruments within Sweden, with respect to the transactions tax rate, is approximately minus three. Campbell and Froot (1995) report that the revenue collected by the Swedish STT was less than one twentieth of the initial revenue projections.

Hubbard (1995) discusses more generally the extent to which securities trading is likely to move "offshore," or to move to different types of securities, as a result of a unilateral national tax on securities transactions. Because the location of securities transactions is a relatively elastic decision variable, changes in transaction taxes are likely to have substantial effects in altering the location of trade. Thus it is possible to imagine securities transaction taxes that reduce the domestic volume of trade but have no effect on the total international volume of trade in a given security.

4. Taxation and the Markets for Particular Financial Products

Many of the issues and research questions involving taxation and portfolio structure are specific, involving particular financial institutions, assets, or financial products. This section considers a number of these issues, with an emphasis on topics that are likely to attract growing attention in the future.

4.1 The Tax-Exempt Bond Market

One of the most direct applications of the theories of taxation and portfolio choice described above is with respect to the market for tax-exempt securities. In the United States, most of the bonds issued by state and local governments are exempt from federal interest income taxation. If the risk characteristics of these bonds were identical to those of taxable bonds, for example Treasury securities, then simple models of portfolio equilibrium would suggest that investors in high tax brackets would hold these securities. The lowest tax bracket individual holding tax-exempt bonds would be the "marginal investor" in these bonds, and his marginal tax rate would determine the yield spread between taxable and tax-exempt interest rates: $R_{exempt} = (1-\tau_{marginal})*R_{taxable}$. Auerbach and King (1983) and McDonald (1983) discuss this prediction in the context of clientele portfolio models like those presented above.

The observed yield spread between taxable and tax-exempt bonds in the United States, particularly at long maturities, has often been much smaller than this analysis would suggest. Kochin and Parks (1988) suggest that there have been periods when the long-term yield spread (R_{exempt} - $R_{taxable}$) has been so narrow that implied future short-term rates on tax-exempt bonds have been higher than comparable short-term interest rates on taxable bonds. This is not to suggest that taxation does not affect the yield spread on taxable and tax exempt bonds. The event study evidence, provided for example by Poterba (1986b) and Slemrod and Greimel (1999), demonstrates that tax reforms do affect the yield spread between taxable and tax exempt bonds.

Various explanations for observed yield differentials have been suggested, but none have completely explained the observed pattern. Fortune (1988) discusses this work in some detail. Some studies have suggested that risk differences may explain narrow yield spreads, but Chalmers (1998)

presents data on tax-exempt bonds that are effectively riskless, because their future payouts have already been funded by the borrower. He concludes that risk adjustments cannot explain the relatively narrow yield spread between taxable and tax-exempt securities.

Green (1993) emphasizes that fully-taxable investors would not compare the tax-exempt bond rate with that on taxable bonds that yield only interest income, but rather would construct a taxable bond portfolio of bonds that sell below their par values and therefore generate some capital gains as well as some interest. This suggests that the implicit interest income tax rate on long-term bonds is higher than the foregoing calculation would suggest. The tax rates of the investors who hold fully taxable bonds are lower than those of investors who hold other (less heavily taxed) bonds, and who are comparing such bonds with tax-exempt bonds. This calls into question the standard "implicit tax rate" that is also computed based on the yields on fully taxable and tax-exempt par bonds. The observation that investors may form tax-based clienteles in the bond market does not apply only to tax-exempt bond markets. Green and Odegaard (1997) present evidence of clientele formation in the market for U.S. Treasury bonds.

Evidence on the ownership of tax-exempt bonds is broadly consistent with tax-based clientele models, although there are some puzzles. Poterba and Samwick (1999) show that household tax rates are strongly correlated with the likelihood that the household owns tax-exempt bonds and with the portfolio share in such bonds. Feenberg and Poterba (1991) present information from 1988 individual income tax returns, on which individuals were asked to report their tax-exempt interest income even though this income was not included in the federal income tax base. The results illustrate that roughly households in the lowest federal marginal income tax bracket received one fifth of the tax-exempt interest that was received by households in 1988. Similar tabulations for more recent years confirm this finding. Why such individuals hold tax-exempt bonds is an open question. It might be because these are illiquid securities that they never chose to purchase, but instead received as an inheritance. It might be that their

marginal tax rates fluctuate from year to year, and that when they are observed in a cross-section, their

tax rates are transitorily low. This is an empirical issue that can be resolved with further study.

4.2 Taxation and Mutual Funds

One of the most significant changes in the structure of household portfolios in the United States

during the last two decades has been the decline in direct individual ownership of corporate stock, and

the corresponding rise in stock ownership through intermediaries such as mutual funds. The Investment

Company Institute (1999) reports that 41 percent of U.S. households own mutual funds, either through a

retirement plan or through a directly taxable account. The rapid expansion of mutual fund ownership

during the 1990s has been one of the important forces behind the growth of stock ownership.

The growth of mutual funds is something of a puzzle from the standpoint of both tax-efficient

investing and pretax return management. From a tax perspective, investors who hold assets through a

mutual fund forego the opportunity to manage their capital gains realizations. They also forego the

opportunity to select assets with a mix of dividends and capital gains income that best suits their tax

status. From the standpoint of pretax returns, Gruber (1996) explains that the puzzle associated with

mutual funds is that their average return is substantially <u>below</u> that of most stock market indices, largely

as a result of transaction costs and expenses. While mutual funds do offer individuals a convenient and

time-efficient way to manage their assets, and they perform a set of record-keeping functions that may

also be valuable to investors, it remains unclear whether these advantages justify the tax and expected

return penalty associated with these investments.

Research on taxation and mutual fund investments has focused on two issues. The first concerns

the measurement of after-tax returns on mutual funds, and the extent to which mutual fund investors

consider after-tax returns in allocating their assets. The second concerns the behavior of mutual fund

managers, particularly with respect to capital gain realization decisions.

With respect to the measurement of after-tax returns, Dickson and Shoven (1995) show that the

focus on pre-tax returns can yield a misleading measure of how a mutual fund ranks relative to other comparable funds, and they recompute performance on an after-tax basis. Jeffrey and Arnott (1993) and Arnott, Berkin, and Ye (2000) present evidence on the substantial tax cost of holding many actively managed equity mutual funds. Bergstresser and Poterba (1999) build on this work by studying the link between after-tax returns and the inflows of funds to mutual funds. They find that both the pretax return and the tax burden on a fund are related to the inflow, the former with a positive and the latter with a negative effect.

The taxation of mutual fund returns is complicated, at least in the United States, by a set of rules that were specified in the Investment Company Act of 1940. If an individual purchases an individual stock and the stock rises in value, the individual is not liable for capital gains tax until he sells the stock and realizes the gain. With a mutual fund, however, the key realization decision is that of the fund manager, not the individual investor. When a fund sells assets with a realized capital gain, these gains are immediately passed-through to investors holding shares in the fund. Thus even if the investor does not sell his shares in the mutual fund during the year, he could be liable for capital gains taxes. Funds differ substantially in the degree to which they realize gains, and therefore in the size of the potential tax burden that they impose on long-term investors in the fund.

The pass-through rules for mutual fund capital gains also raise the possibility that an investor can purchase a fund, experience no price appreciation on the shares in the fund during a given tax period, but still face capital gains tax liability as a result of the fund investment. Many funds have an "overhang" of unrealized capital gains. This overhang is the result of unrealized gains in past years. Whenever the fund manager decides to sell assets with unrealized gains, these gains will be distributed on a pro rata basis to all shareholders in the fund. Someone who has just purchased the fund could therefore face a capital gains tax bill even though this investor might not have earned any capital gains since buying the fund. This capital gains tax liability alters the timing of taxes relative to what they would be if the

investor's behavior, rather than the manager's, determined the realization date for gains. The new investor's tax basis in the mutual fund will be increased by any distributed gains on which he pays taxes. When he does sell his shares, he will therefore be liable for a smaller capital gains tax bill than he would if his own realization decisions were the sole determinant of his taxes.

Managers deciding to sell one asset and buy another can trigger gains in a mutual fund, but realizations can also be generated by redemption decisions on the part of some fund shareholders. Within a mutual fund, redemptions by one set of investors impose externalities on the other investors. Dickson, Shoven, and Sialm (2000) explore a number of strategies that mutual funds might use to reduce the externalities that investors impose on each other as a result of their redemption decisions. These include exit charges, which can be used to compensate the shareholders who must bear the increased tax burden, or the creation of "tiered" mutual funds that would avoid co-mingling funds that were invested in the mutual fund at different dates.

When fund managers decide to realize gains, they deprive their investors of the benefits of deferring capital gains taxes into the future. This raises the second major question about taxation and mutual fund behavior: to what extent do fund managers consider their taxable investors' taxes in managing their assets? Dickson and Shoven (1994), they show that by following simple realization strategies, such as always selling the high-basis stock in any security that they wish to reduce their holdings of, managers could significantly increase their after-tax returns. They would also increase the unrealized capital gain "overhang" in their funds. A central issue is therefore whether managers try to avoid building up capital gains overhang, or whether they accumulate unrealized gains to reduce their investors' current tax burden.

Several studies have addressed this issue. Huddart and Narayanan (2000) report some evidence of tax-sensitive trading on the part of mutual fund managers. They find that there are differences in the year-end realization behavior of institutional money managers at untaxed institutions and at mutual

funds, and that mutual fund managers do appear to consider, at least to some degree, the tax burden that realizations will impose on their shareholders. Barclay, Pierson, and Weisbach (1998) argue that fund managers have an incentive to realize gains and avoid a large overhang, even if this is not the way to maximize after-tax returns for existing fund shareholders, because this maximizes the fund's appeal to prospective investors. They argue that because mutual fund managers are usually compensated based on their assets under management and their pre-tax return performance, they are concerned more with attracting new money into their fund than with maximizing the after-tax return to existing investors. This analysis does not consider the dynamic consistency problems associated with following a strategy that is attractive to new investors at the expense of old investors, i.e. the fact that new investors will be old investors in the future. Kraft and Weiss (1998) present intriguing evidence on the difference in realization behavior between open-end and closed-end mutual fund managers. They find that closed-end fund managers, who do not need to consider the attractiveness of their shares for prospective investors, time their tax realizations in a fashion that minimizes tax burdens for individual investors, while most open-end fund managers do not.

The growing interest in the after-tax return to mutual fund investments has led to some changes in the mutual fund marketplace. Khorana and Servaes (1999) find evidence that when the existing mutual funds in a market niche are characterized by high levels of unrealized capital gains, there is a greater likelihood of new funds (with no embedded capital gains) entering the market. During the mid-1990s, a number of mutual fund families introduced "tax managed mutual funds" that operated with reduced levels of capital gain realizations. The growth of "exchange traded funds" in the late 1990s, as a way to further reduce the tax burdens associated with holding a broad portfolio of securities, is another response to this development. At the end of 1999, however, assets in "tax managed" mutual funds represented just over one percent of the equity mutual fund marketplace, so these funds had not yet attracted a large share of the assets invested in the mutual fund sector.

4.3 Taxation and Asset Holding in Tax-Deferred Accounts

One of the most dramatic developments in the structure of household portfolios during the last two decades has been the growing importance of assets held in defined contribution pension plans. In the United States, the combined effects of growing regulatory burdens on defined benefit pension plans, and increased worker mobility and the associated demand for portable pension arrangements, has led to a shift from defined benefit to defined contribution pension plans. Kruse (1995) and Gustman and Steinmeier (1992) discuss the reasons for these shifts. Samwick and Skinner (1998) explore how these changes in the structure of pension arrangements are influencing the nature of risk-bearing by households and the firms that offer various pension plans.

The fastest-growing type of defined contribution plan in the United States is the so-called 401(k) pension plan, which permits workers to defer a share of their current earnings and the associated taxes while earning returns at the pre-tax rate. Poterba, Venti, and Wise (2000) present summary information on the growth of these plans. Other tax-deferred methods of accumulation, such as Individual Retirement Accounts and 403(b) plans, have also grown in total assets, although their participant growth is slower than that for 401(k) plans. There has also been rapid growth in defined contribution pension arrangements outside the United States. Personal Equity Plans in the United Kingdom, and Registered Retirement Saving Plans in Canada, for example, provide individuals with opportunities for tax-deferral on investment income.

Assets held in tax-deferred accounts are a large and growing component of household net worth, and the portfolio allocation issues that arise in connection with these accounts have not been widely investigated. Most of the research to date on tax-deferred accounts, which is summarized in Bernheim (2001), has concentrated on the extent to which assets held in these accounts have "crowded out" other assets, or equivalently, on whether saving in tax-deferred accounts represents new saving. Very little research has considered the implications of tax-deferred accumulation opportunities for the structure of

household portfolios, although this is an emerging topic that is attracting current research attention.

One aspect of the growth of defined contribution plan assets, with particularly important implications for studies of household portfolio behavior, is the growing importance of the set of households that must make asset allocation decisions in both taxable and tax-deferred accounts. Shoven (1999) outlined the "asset location problem," the problem of deciding whether to hold particular assets in a taxable account or in a tax-deferred retirement saving account. A number of subsequent studies, including Dammon, Spatt, and Zhang (2000), Huang (2001), Poterba, Shoven, and Sialm (2001), Shoven (1999), and Shoven and Sialm (1998, 1999), have considered various aspects of the asset location problem. The key insight with respect to portfolio structure follows from an earlier literature on optimal corporate pension funding policy, such as Black (1980) and Tepper (1981). It is that investors should hold their highly taxed assets in their tax-deferred account and hold lightly taxed assets in their own taxable account. This advice is sometimes translated, loosely, as "stocks on own account, bonds in the tax-deferred account."

A key question in the recent asset location literature concerns the identification of low-tax assets. If investors follow a buy-and-hold strategy with individual stocks in building their equity portfolio, the tax burden on their equity investments will be substantially smaller than if they purchase an average actively-managed equity mutual fund. If they hold fixed-income assets by purchasing taxable corporate or government bonds, the total tax burden (considering both the implicit and explicit taxes on interest income) will be higher than if they hold tax-exempt bonds. It is possible, for some investment horizons and marginal tax rate configurations, for investors to find that holding actively-managed equity mutual funds in their tax-deferred accounts is the preferred asset location strategy.

Available evidence on asset allocation in tax-deferred accounts does not offer clear conclusions on the extent to which investors have "solved" the asset location problem. Bodie and Crane (1997) present the most direct evidence to date on the extent to which investors recognize taxes in configuring

their portfolios between taxable and tax-deferred accounts. They study an unusual data base on participants in TIAA-CREF, the defined contribution pension system that covers most academics and other employees of college and universities in the United States. Their data combines a survey of TIAA-CREF participants with information on asset allocation decisions within the retirement system. The results suggest that investors pursue similar asset allocation strategies with respect to their taxable and tax-deferred accounts, and do not suggest clear understanding of the advantages to holding highly-taxed assets in tax-deferred accounts.

Poterba and Wise (1998) present evidence on asset allocation patterns in both IRAs and 401(k) plans. Roughly 46 percent of IRA and 401(k) assets are held in corporate equities, which are lightly-taxed assets from the perspective of most taxable individuals. Bergstresser and Poterba (2001) use the Survey of Consumer Finances to explore asset holding by individual households, but the SCF data do not permit very precise inferences about portfolio holdings.

There are other issues associated with tax-deferred accounts and portfolio structure that have just begun to receive attention. One of the least-studied but potentially important taxes for young households in the United States is the "tax" that is imposed by the financial aid formula that colleges and universities use to determine student eligibility for scholarships and loans. Feldstein (1995) and Dick and Edlin (1997) argue that the tax rates implicit in the scholarship formula can be greater than those in the income tax system for many households. The reason tax-deferred accounts are affected by this formula is that assets held in these accounts, which are deemed retirement saving, are not included in a household's net worth for the financial aid determination. Kim (1997) shows that households that are likely to face a higher marginal tax rate under the financial aid rules are more likely to hold assets in IRAs and 401(k) plans, and are likely to hold more assets in these accounts, than are similar households whose financial or family situations expose them to lower tax rates under the financial aid rules. Experience with the financial aid system is particularly relevant for understanding how means-tested transfer programs might

affect saving by the elderly or other groups, and the impact of this tax on both the level and composition of this tax is worth further analysis.

4.4 Taxation and Insurance Products

Another class of assets that often receive specialized tax treatment, and that can represent an important share of household portfolios, is the class of insurance products. Many insurance policies, such as whole life insurance, deferred annuities, and variable annuities, combine both an insurance function and an investment component. For a variety of historical reasons, in many nations the "inside build up" on life insurance products is not taxed on accrual. In the United States, for example, if an individual purchases a deferred annuity policy when he is 45, but the annuity is not scheduled to begin until he reaches age 65, the capital income earned on his initial premium is not taxed until after the annuity payouts begin. Similarly, the income from variable annuities is not taxed until it is distributed to the investor. Whole life insurance policies offer a related opportunity to defer taxes on accruing interest and dividends.

The tax treatment of insurance products and the effect of tax rules on the demand for insurance is a potentially rich field for research, but it has attracted relatively little attention to date, especially from public finance scholars interested in broad issues relating to taxation and capital accumulation. Several recent studies have described the tax treatment of insurance products and investigated the role of taxes in stimulating demand for these products. For example, Gentry and Milano (1994) explain how tax considerations affect the demand for variable annuities, which combine the investment flexibility of mutual funds with the favorable tax treatment of insurance products. Mitchell, Poterba, Warshawsky, and Brown (1999) describe the tax treatment of life annuity products, but they do not attempt to measure the demand for these products.

The role of insurance products in wealth accumulation is smaller in the United States than in many other nations. Investigating the role of taxation in encouraging capital accumulation through

insurance thus seems like an important issue for study in many nations.

4.5 The Estate Tax and Portfolio Structure

Some nations levy taxes on wealth, particularly when wealth-holders die and bequeath their assets to others. In the United States, the estate and gift tax currently raises one third of the estimated revenue from the capital gains tax, but it is collected from a very small pool of decedents. Just over thirty thousand taxable estate tax returns are filed in a typical year. In 2000, decedents with net estates worth more than $675,000 were subject to estate tax. There is active political debate about raising this limit substantially, with elimination of the estate tax in the United States a serious possibility.

Studies of the estate tax typically recognize that there are a wide range of estate tax avoidance strategies available to high-net-worth individuals. The extent to which these strategies are used to avoid taxes remains an open question, however. Cooper (1979) is the classic statement of the voluntary character of the estate tax. Scholes, Wolfson, Erickson, Maydew, and Shevlin (2002) and Schmalbeck (2001) discuss a range of estate tax planning techniques that high net worth households can use to reduce their tax liabilities. These include complex trust arrangements as well as simpler strategies such as donating assets to charity. The extent to which households avail themselves of estate tax avoidance strategies is an open issue. Wolff (1996) presents evidence suggesting that the estate tax base in the United States is substantially eroded, while Poterba (2000b, 2001b) offers data suggesting that many households do not take advantage of even low-cost avoidance strategies.

The impact of estate taxes on wealth accumulation, and more specifically on the structure of household portfolios, has attracted substantial research attention in the last decade. These issues are difficult to address because of the very limited data on high-wealth households and their financial affairs in the public domain. Gale and Slemrod (2000) summarize much of the recent work on the economic impact of the estate tax. Researchers have studied how the estate tax affects charitable giving, for example in Joulfaian (1991), and a number of other behaviors. One issue of particular importance for

portfolio structure concerns the interaction between the estate tax and the capital gains tax. The current

U.S. tax code allows for the recipients of bequests to "step up their basis," which eliminates capital gains

tax liability on any appreciation of assets that are bequeathed. This creates a trade-off between capital

gains tax liability and estate tax liability for wealthy households contemplating estate tax avoidance

strategies, such as lifetime giving, versus bequests. Auten and Joulfaian (1997) and Poterba (2001a)

show that higher estate tax rates are associated with a smaller effect of capital gains taxation on

realization behavior.

One of the difficulties with modeling the behavioral impact of the estate tax involves the need to

specify how it affects household budget sets. Poterba (2000b) suggests that the estate tax raises the

required return on portfolio assets, although the magnitude of this effect depends critically on difficult-

to-measure parameters involving estate tax avoidance techniques. He argues that the expected value of

the after-tax income that an individual will pay on his capital income, assuming for simplicity that all

asset income comes in the form of interest, is $(1-\tau_b)^*r + p^*(1-\tau_e)^*(1+(1-\tau_b^*r)$. In this expression, p is the

probability of death over the time period when the rate of return is r. This illustrates that the estate tax

operates as a tax on capital, and that it raises the effective tax burden on capital income. Holtz-Eakin and

Marples (2000) attempt to quantify the welfare cost of the estate tax under one set of assumptions about

the nature of intergenerational transfers. Their study represents an important step toward modeling and

evaluating the efficiency costs of this tax.

Moving from the impact of the estate tax on after-tax returns, to a conclusion about how the tax

affects wealth accumulation, is complicated by the lack of agreement on why households save and leave

bequests. Gale and Perozek (2001) note that the ultimate impact of the estate tax on saving decisions is

ambiguous, and is likely to be quite sensitive to the reason households are saving and the structure of

bequest motives.

The interaction between the estate tax and other tax provisions is potentially central to any

analysis of the tax. Shoven and Wise (1998) observe that this interaction can lead to particularly high tax rates for households that save through tax-deferred retirement accounts. Bernheim (1986) makes the ingenious argument that the estate tax may actually reduce the revenue collected by the federal government, because one way to avoid the tax is to transfer assets from the older generation to younger generations well before death. If older taxpayers tend to be in higher tax brackets than the younger ones who receive asset transfers, then the process of estate tax avoidance may result in lower taxes on capital income while the donor is alive. This is a complex argument and it has not yet been subject to enough empirical analysis to permit a judgement on its validity.

4.6 Stock Options: Another Portfolio Component

One aspect of portfolio behavior that has become increasingly important is the use of stock options as part of compensation packages. In a growing fraction of firms in the United States, employees receive wage and salary compensation as well as either a grant of corporate stock or options to purchase corporate stock. For employees at such firms, the value of stock options can become an important component of their total wealth. The interplay between decisions with respect to portfolio assets, and decisions about stock option exercise, is an issue of growing importance that has yet to receive substantial attention from public finance researchers. Huddart (1998) explains the tax consequence of various strategies with respect to the exercise of employee stock options. He also presents some evidence that many option holders do not exercise their options in a manner that would be consistent with tax-minimizing behavior. Huddart and Lang (1996) present a broader analysis of the factors that lead households to exercise employee stock options.

5. Taxation, Risk-Taking, and Human Capital

One issue that has received relatively little discussion in most analyses of the tax code and risk-taking is the impact of taxation on choice of occupation and more generally on the human capital

investments that individuals choose to make. In part, this reflects the difficulty of quantifying the dimensions along which individuals make choices regarding their both their human capital acquisition and about their labor supply.

Public finance researchers have long recognized that the tax treatment of returns on financial investments can affect the attractiveness of human capital investments. Boskin (1975) and Heckman (1976) note that when capital income taxes reduce the after-tax return on financial assets, they will induce individuals to acquire more human capital since the required rate of return on human capital will decline. Whether this insight carries over to a world with an income tax, rather than just a capital income tax, depends on the structure of the tax. If the wage tax is proportional, and the cost of acquiring education is only foregone earnings, then the after-tax comparison between foregone earnings and the earnings increment associated with a human capital investment will not be affected by the wage tax rate. With a progressive tax schedule, the returns to human capital investment may be taxed at a higher rate than the tax rate at which the foregone earnings associated with training or education can be deducted. A progressive tax schedule therefore may discourage human capital investment, although the wage progressivity effect can be offset by the rate of return effect described above.

These well-known results on income taxation and human capital acquisition are derived in models of certainty. Eaton and Rosen (1980) move beyond this setting to explore how income taxes affect human capital investment choices in a world of uncertainty. They find that the impact of earnings uncertainty on the distortionary costs of a wage tax depend on the structure of household preferences. The assumption of constant relative risk aversion, for example, can yield different results than constant absolute risk aversion. Hamilton (1987) presents further results on the structure of optimal taxes when the return to human capital is uncertain. He finds because individuals must bear idiosyncratic risk on their human capital investments, they acquire less than the socially efficient level of human capital. An interest income tax can encourage human capital acquisition, and it may therefore be part of an optimal

tax regime. Judd (1998) intergrates the discussion of human capital taxation in a world of uncertainty with recent insights about the long-run optimality of capital income taxation. He concludes that the impact of taxes on both financial assets, and on wages, on the level of human capital investment are likely to be sensitive to many detailed features of the utility function and of the political setting in which human capital inputs, such as public schools, are provided.

The assumption that the foregone earnings associated with schooling or training are the primary cost of human capital acquisition has been challenged in a number of recent studies. King and Rebelo (1990), Rebelo (1991), and Trostel (1993) find that when there are out-of-pocket school costs and tuition, then even a proportional wage tax can have a negative impact on investment in human capital. Lord and Rangazas (1998) present simulation findings that question this conclusion; they argue that the insurance effect of progressive wage taxation may be large enough to outweigh the decline in investment associated with higher tax burdens on returns than on the inputs to human capital investments. Heckman, Lochner, and Taber (1998) present findings from a very detailed general equilibrium model that incorporates endogenous human capital acquisition as well as realistic descriptions of other aspects of household life-cycle behavior. They conclude that general equilibrium responses in both the labor market and the capital market can substantially weaken conclusions about taxes and human capital investment from partial equilibrium models. Most of their results suggest relatively limited effects of income taxation on human capital investment.

The amount of human capital that individuals acquire is the primary focus of most models of taxes and human capital. It is also possible, however, that the tax system may affect the type of human capital that individuals acquire. There is little evidence, however, on the link between taxes and occupational choice, which is one measurable dimension of human capital type. One strand of research that does provide some insight on this issue concerns decisions about whether to enter self-employment or paid employment. Self-employment is often viewed as coincident with working in the entrepreneurial

sector, a particularly high-risk sector of the labor market. Equating self-employment with founding of

potentially high-growth firms is probably inappropriate; many self-employed individuals may simply be

engaged in providing services such as painting or cleaning for which the growth opportunities are

limited. However, those who do start new firms in various fields will be counted among the self-

employed. Bruce (2000) and Schuetze (2000) present evidence that the combined level of income and

payroll taxes on employed vs. self-employed workers affects the mix of workers in these two segments of

the labor market.

Self-employment, particularly the type associated with starting new firms, may be affected by

wage tax rates as well as capital income tax rates. Since a substantial part of the labor income of self-

employed individuals may be reinvested in the firm, it is possible that it will ultimately be taxed at the

capital gains tax rate rather than the labor income tax rate, which may include both the payroll and the

personal income tax rates. Thus the tax rate differential (τ_{cg} - τ_{labor}) may affect the supply of

entrepreneurial talent. The level of self-employment may also be affected by the "demand" for

entrepreneurs, or alternatively, by the supply of capital to start-up enterprises. This in turn is potentially

affected by the relative tax treatment of the capital gains that investors in such start-ups might expect to

receive, by comparison with the after-tax returns that they might expect on other investments. Thus, the

tax rate differential (τ_{cg} - τ_{int}) may be a relevant factor in the supply of funds to start-up enterprises.

Poterba (1989) discusses these two channels for tax effects in more detail. The influence of

taxation on the supply of funds may be greater at an earlier stage in the start-up process, when a

prospective entrepreneur contacts the "informal" capital market to secure funding for a new enterprise.

The so-called "angels," individuals who supply start-up capital, are likely to be sensitive to the capital

gains tax rate in making their capital supply decisions. Holtz-Eakin, Joulfaian, and Rosen (1994a,

1994b) investigate another aspect of the tax system, the estate tax, and its impact on the rate of new firm

start-ups. They study the probability individuals who receive substantial inheritances will report income

from self-employment in the years after they receive their inheritance. They find that the probability that a self-employed person will remain self-employed rises if they receive a bequest, and that the chance that someone will enter self-employment is also an increasing function of intergenerational transfers. These findings are consistent with the view that self-employed individuals are capital constrained, and that the supply of capital (which may be affected by tax rules) is in important determinant of the level of self-employment in the economy.

6. Conclusions and Unresolved Issues

The substantial theoretical and empirical literature on how taxation affects household portfolio behavior and risk-taking suggests a wide range of potential distortions. The empirical literature, while not offering universal support, generally suggests that taxation plays an important role in determining the set of assets households own, the amount that they invest in each of the available assets, when they sell assets, and the way risk is shared throughout the private economy. Measuring behavioral effects has proven easier than quantifying the welfare cost of behavioral distortions. There are few convincing estimates of the deadweight burdens associated either with distortions in portfolio structure or with changes in the timing and level of asset sales. Developing models of household portfolio behavior, and using these models to evaluate the welfare effects of tax policy, is an important research priority.

One of the challenges in studying taxation and household portfolio structure is the ever-changing nature of the tax and financial environment. Many studies summarized above assume, for example, that when individuals hold "stocks," they are taxed on their dividend income and realized capital gains, while if they hold "bonds," they are taxed on dividend income. This is an accurate depiction of the situation in which the household invests in stocks and bonds directly. But there are a wide range of ways for households to hold the risky streams that are associated with "stocks" and "bonds." A "stock" investor, for example, might buy a portfolio of individual stocks, or he might buy shares in a mutual fund, or he

might buy futures on the S&P 500, or he might invest in an insurance product such as a variable annuity, or he might hold stocks or a mutual fund in an Individual Retirement Account. Each of these alternatives would have _different_ tax consequences. The menu of ways to hold "stocks" is changing, even as this chapter is written. The rise of "exchange traded funds" in the last half of the 1990s offers a new set of vehicles for holding common stocks. Tracking the effect of changes in the financial environment on household portfolio choices, and identifying the impact of taxation on these links, is a key ongoing subject of research.

Another challenge in analyzing taxation and portfolio behavior is that many of the households with substantial net worth receive sophisticated tax planning advice. This advice may change the effective tax rates that these households face in important ways, yet it is difficult for academic researchers to incorporate such effects into empirical models. Henriques and Norris (1996) and Jacobs (1995) suggest that there is substantial opportunity to use sophisticated tax planning strategies to avoid taxes. Scholes, Wolfson, Erickson, Maydew, and Shevlin (2002) also describe tax avoidance opportunities, and they also outline some of the distortions associated with such activities. Quantifying the cost of tax planning advice, and documenting the implicit taxes that high-income taxes face as they try to reduce their income and estate tax liabilities, is another important avenue for future study.

Besides modeling the changing financial system, and the impact of tax-planning advice on effective tax burdens, there are several other issues that call for further research. One concerns the dynamics of portfolio adjustment, and the factors that influence household decisions with regard to portfolio change. A significant literature in behavioral economics suggests that purely rational models of asset selection and asset management may not characterize household decision-making, and that households use rules of thumb and take time to adjust their behavior. One interesting issue is whether these behaviors apply to the high net worth households with substantial assets to invest. Another is how long it takes investors to respond to a substantial tax change, such as that in the United States in 1986.

When tax systems are continuously subject to reform, the time to adjust can be an important determinant of the revenue effects and deadweight costs of the prevailing tax rules on portfolio income. Studies of household portfolio holdings are typically concerned with explain the balance sheet "snapshot" at a given point in time, and in most cases they relate current holdings to current tax rules. With adjustment lags, however, the tax system in previous years can also have an important effect on current asset holdings.

Another issue that requires further research is the role of tax code uncertainty in affecting portfolio choices. Most of the discussion in this paper also assumes that investors know the tax code with certainty when they make investment decisions. Yet as Dickson (2000) and Sialm (2000) demonstrate, households face substantial uncertainty in the pattern of future tax rates. This uncertainty applies both with respect to the structure of marginal tax rates, and with respect to specific tax provisions that may apply to accumulated wealth. Capital gains tax rules, and the rules that apply to withdrawals from retirement saving accounts, are examples of such detailed provisions. While there has been some research on the impact of tax code uncertainty on corporate investment, for example Hassett and Metcalf (1999), this issue has received less attention with respect to household decision-making. Recognizing "tax code uncertainty" and incorporating it in models of household portfolio choice represents a useful avenue for future work.

A final issue that warrants attention is the effect of taxation on the overall level of asset prices. A number of studies cited in this paper present evidence of some "tax capitalization," i.e. of a link between the level of tax rates and the value of particular assets. McGrattan and Prescott (2000) address a broader issue, and argue that changes in both dividend tax rates and in the composition of stock ownership in the United States have contributed substantially to the rise in the market value of U.S. stocks during the 1990s. The tax changes in the United States and several other nations during the last two decades have been large enough to admit the possibility of non-trivial effects on asset prices; further work could explore this relationship.

The impact of taxation on household portfolio behavior is an issue that already attracts attention in both applied tax policy debates and in the academic disciplines of public economics and financial economics. But this issue is likely to become even more important prospectively. The aging of the "baby boom" generation in the United States, and the entry of large birth cohorts throughout the developed world into the age ranges in which asset accumulation becomes an important priority, suggests growing concern with issues associated with asset accumulation. The impact of taxes on asset accumulation, asset choice, and ultimately on the draw-down of wealth and the transfer of assets to the next generation is therefore likely to be a topic of growing interest and importance.

REFERENCES

Agell, J. and P. Edin, 1990, Marginal taxes and the asset portfolios of Swedish households, Scandinavian Journal of Economics 92, 47-64.

Allen, F. and R. Michaely, 1995, Dividend policy, in R. Jarrow, V. Maksimovic, and W. Ziemba, eds., Handbook of Operations Research and Management Science: Finance (Amsterdam, North Holland).

Allen, F. A. Bernardo, and I. Welch, 2000, A theory of dividends based on tax clienteles, Journal of Finance 55, 2499-2536.

Amoaku-Adu, B., M. Rashid, and M. Stebbins, Capital gains tax and equity values: Empirical test of stock price reaction to the introduction and reduction of capital gains tax exemption," Journal of Banking and Finance 16 (1992), 275-287.

Arnott, R., A. Berkin, and J. Ye, 2000, How well have taxable investors been served in the 1980s and 1990s?, Journal of Portfolio Management 26 (Summer), 84-93.

Atkinson, A. and A. Sandmo, 1980, Welfare implications of the taxation of savings, Economic Journal 90, 529-549.

Auerbach, A., 1983, Stockholder tax rates and firm attributes, Journal of Public Economics 21, 107-127.

Auerbach, A., 1988, Capital gains taxation in the United States: Realizations, revenue, and rhetoric, Brookings Papers on Economic Activity 2, 595-631.

Auerbach, A., 1991, Retrospective capital gains taxation, American Economic Review 81, 167-178.

Auerbach, A., 1992, On the design and reform of capital gains taxation, American Economic Review 82 (May), 263-267.

Auerbach, A., 2001, Taxation and corporate financial policy, in A. J. Auerbach and M. S. Feldstein, eds., Handbook of Public Economics: Volume 3 (Amsterdam, North Holland).

Auerbach, A., L. Burman, and J. Siegel, 2000, Capital gains taxation and tax avoidance: New evidence from panel data, in J. Slemrod, ed., Does Atlas Shrug? (New York: Russell Sage Foundation), 355-388.

Auerbach, A. and M. King, 1982, Corporate financial policy with personal and institutional investors, Journal of Public Economics 17, 259-285.

Auerbach, A. and M. King, 1983, Taxation, portfolio choice, and debt-equity ratios: A general equilibrium model, Quarterly Journal of Economics 98, 587-609.

Auerbach, A. and J. Siegel, 2000, Capital gains realizations of the rich and sophisticated, American Economic Review 90 (May), 276-282.

Auten, G. and C. Clotfelter, 1982, Permanent vs. transitory tax effects and the realization of capital gains, Quarterly Journal of Economics 97, 613-632.

Auten, G. and D. Joulfaian, 1997, Bequest taxes and capital gains realizations, mimeo, U.S. Treasury Department, Office of Tax Analysis, Washington, D.C.

Auten, G. and D. Joulfaian, 1999, How income taxes affect capital gains realizations: Evidence from a long panel, mimeo, U.S. Treasury Department, Office of Tax Analysis, Washington, D.C.

Ayers, B., C . Cloyd, and J. Robinson, 2000, Capitalization of shareholder taxes in stock prices: evidence from the Revenue Reconciliation Act of 1993, mimeo, University of Texas-Austin Graduate School of Business.

Badrinath, S. and W. Lewellen, 1991, Evidence on tax-motivated securities trading behavior, Journal of Finance 46, 369-382.

Bailey, M., 1969, Capital gains and income taxation, in A. Harberger and M. Bailey, eds., The Taxation of Income from Capital (Washington, The Brookings Institution).

Balcer, Y. and K. Judd, 1987, Effects of capital gains taxation on life-cycle investment and portfolio management, Journal of Finance 42, 743-61.

Bali, R. and G. Hite, 1998, Ex-dividend day stock price behavior: discreteness or tax-induced clienteles?, Journal of Financial Economics 47, 127-159.

Barclay, M., 1987, Dividends, taxes, and common stock prices: The ex-dividend day behavior of common stock prices before the income tax, Journal of Financial Economics 19, 31-44.

Barclay, M., N. Pearson and M. Weisbach, 1998, Open end mutual funds and capital gains taxes, Journal of Financial Economics 49, 4-43.

Barlow, R., H. Brazer, and J. Morgan, 1966, Economic Behavior of the Affluent (Washington, Brookings Institution).

Basak, S. and M. Gallmeyer, 1998, Capital market equilibrium with differential taxation, mimeo, Wharton School, University of Pennsylvania.

Basak, S. and B. Croitoru, 1999, Nonlinear taxation, tax arbitrage, and equilibrium asset prices, mimeo, Wharton School, University of Pennsylvania.

Bell, L. and T. Jenkinson, 2000, New evidence of the impact of dividend taxation and on the identity of the marginal investor, mimeo, Department of Economics, Oxford University.

Bergstresser, D. and J. Poterba, 1999, Do after-tax returns affect mutual fund inflows?, NBER Working Paper 7595, Cambridge, MA.

Bergstresser, D., and J. Poterba, 2001, Household asset location decisions: Evidence from the Survey of Consumer Finance, mimeo, MIT Department of Economics.

Bernheim, B., 1986, Does the estate tax raise revenue?, in L. Summers, ed., Tax Policy and the Economy, volume 1 (Cambridge, MIT Press).

Bernheim, B., 2001, Taxation and saving, in A. J. Auerbach and M. S. Feldstein, eds., Handbook of Public Economics: Volume 3 (Amsterdam, North Holland).

Berkovec, J. and D. Fullerton, 1992, A general equilibrium model of housing, taxes, and portfolio choice, Journal of Political Economy 100, 390-429.

Bertaut, C. and M. Starr-McCluer, 2001, Household portfolios in the United States, in L. Guiso, M. Haliassos, and T. Jappelli, eds., Household Portfolios (Cambridge: MIT Press, forthcoming).

Bhabra, H., U. Dhillon, and G. Ramirez, 1999, A November effect? Revisiting the tax loss selling hypothesis, Financial Management 28, 5-15.

Bhardwaj, R. and L. Brooks, 1999, Further evidence on dividend yields and the ex-dividend day stock price effect, Journal of Financial Research 22 (Winter), 503-514.

Black, F., 1976, The dividend puzzle, Journal of Portfolio Management 2 (Winter), 5-8.

Black, F., 1980, The tax consequences of long-run pension policy, Financial Analysts Journal (July/August), 21-28.

Blouin, J., J. Raedy, and D. Shackelford, 2000, Capital gains holding periods and equity trading: Evidence from the 1998 tax act, NBER Working Paper 8011.

Blume, M., J. Crockett, and I. Friend, 1974, Stockownership in the United States: Characteristics and trends, Survey of Current Business 54 (November), 16-40.

Bodie, Z. and D. Crane, 1997, Personal investing: Advice, theory, and evidence, Financial Analysts Journal 53 (November/December), 13-23.

Bolster, P., L. Lindsey and A. Mitrusi, 1989, Tax induced trading: The effect of the 1986 Tax Reform Act on stock market activity, Journal of Finance 44, 327-344.

Booth, L. and D. Johnston, 1984, The ex-dividend day behaviour of Canadian stock prices: Tax changes and clientele effects, Journal of Finance 39,457-476.

Boskin, M., 1975, Notes on the tax treatment of human capital, in U.S. Treasury Department, Conference on Tax Research, 1975. Washington: U.S. Treasury Department.

Bradford, D., 1995, Fixing realization accounting: Symmetry, consistency, and correctness in the taxation of financial instruments, Tax Law Review 50, 731-786.

Brennan, M., 1970, Taxes, market valuation, and corporate financial policy, National Tax Journal 23, 417-427.

Brickley, J., S. Manaster, and J. Schallheim, 1991, The tax-timing option and discounts on closed end investment companies, Journal of Business 64, 287-312.

Bruce, D., 2000, Effects of the United States tax system on transitions into self employment, Labour Economics 7, 545-574.

Bulow, J. and L. Summers, 1984, The taxation of risky assets, Journal of Political Economy 92, 20-39.

Burman, L., 1999, The Labyrinth of Capital Gains Tax Policy (Washington: Brookings Institution).

Burman, L. and W. Randolph, 1994, Measuring permanent responses to capital gains tax changes in panel data, American Economic Review 84, 794-809.

Burman, L., S. Wallace, and D. Weiner, 1997, How capital gains taxes distort homeowners decisions, Proceedings of the 89th Annual Conference on Taxation, National Tax Assocation, Columbus, OH, 382-390.

Butters, J., L. Thompson, and L. Bollinger, 1953, Effects of Taxation: Investment by Individuals (Cambridge, MA, Graduate School of Business Administration, Harvard University).

Campbell, J. and K. Froot, 1995, Securities transaction taxes: What about international experiences and migrating markets, in Catalyst Institute, Securities Transaction Taxes: False Hopes and Unintended Consequences (Chicago, Catalyst Institute).

Chalmers, J., 1998, Default risk cannot explain the municipal puzzle: Evidence from municipal bonds that are secured by U.S. Treasury obligations, Review of Financial Studies 11 (Summer), 281-308.

Chaplinsky, S. and H. Seyhun, 1990, Dividends and taxes: Evidence on tax-reduction strategies, Journal of Business 63, 239-260.

Chay, J., D. Choi, and J. Pontiff, 2000, Market valuation of tax-timing options: Evidence from capital gains distributions, mimeo, University of Washington Department of Finance.

Constantinides, G., 1984, Optimal stock trading with personal taxes: Implications for prices and the abnormal January returns, Journal of Financial Economics 13, 65-89.

Constantinides, G. and M. Scholes, 1980, Optimal liquidation of assets in the presence of personal taxes: Implications for asset pricing, Journal of Finance 35, 439-449.

Cooper, G., 1979, A Voluntary Tax? New Perspectives on Sophisticated Estate Tax Avoidance (Washington, The Brookings Institution).

Dammon, R. and R. Green, 1987, Tax arbitrage and the existence of equilibrium prices for financial assets, Journal of Finance 42, 1143-1166.

Dammon, R. and C. Spatt, 1996, The optimal trading and pricing of securities with asymmetric capital gains taxes and transactions costs, Review of Financial Studies 9, 921-952.

Dammon, R., C. Spatt, and H. Zhang, 2000, Optimal asset location and allocation with taxable and tax-deferred investing, mimeo, Carnegie Mellon University – Graduate School of Industrial Administration.

Dammon, R., C. Spatt, and H. Zhang, 2001, Optimal consumption and investment with capital gains taxes, Review of Financial Studies (forthcoming).

Dhaliwal, D., M. Erickson, and R. Trezevant, 1999, A test of the theory of dividend clienteles, National Tax Journal 52, 179-194.

Dick, A. and A. Edlin, 1997, The implicit taxes from college financial aid, Journal of Public Economics 65, 295-322.

Dickson, J., 2000, Pension taxation and tax code risk, in W. Gale, J. Shoven, and M. Warshawsky, eds., Public Policies and Private Pensions. Washington: Brookings Institution, forthcoming.

Dickson, J. and J. Shoven, 1994, A stock index mutual fund without net capital gain realizations, NBER Working Paper 4717, Cambridge, MA.

Dickson, J. and J. Shoven, 1995, Taxation and funds: An investor perspective, in J. Poterba, ed., Tax Policy and the Economy, volume 9 (Cambridge, MA, MIT Press).

Dickson, J., J. Shoven, and C. Sialm, 2000, Tax externalities of equity mutual funds, National Tax Journal 53 (September, Part 2), 607-628.

Domar, E. and R. Musgrave, 1944, Proportional income taxation and risk-taking, Quarterly Journal of Economics 58, 388-422.

Dyl, E., 1977, Capital gains taxation and the year-end stock market behavior, Journal of Finance 165-175.

Eades, K., P. Hess and E. Kim, 1984, On interpreting security returns during the ex-dividend period, Journal of Financial Economics 13, 3-34.

Eades, K., P. Hess and E. Kim, 1994, Time series variation in dividend pricing, Journal of Finance 49, 1617-1638.

Eaton, J. and H. Rosen, 1980, Taxation, human capital, and uncertainty, American Economic Review 70, 705-715.

Eichner, M., and T. Sinai, 2000, Capital gains tax realizations and tax rates: New evidence from time series, National Tax Journal 53 (September, part 2), 663-682.

Elton, E. and M. Gruber, 1970, Marginal stockholders' tax rates and the clientele effect, Review of Economics and Statistics 52, 68-74.

Elton, E. and M. Gruber, 1978, Taxes and portfolio composition, Journal of Financial Economics 6, 399-

410.

Feenberg, D., 1981, Does the investment interest limitation explain the existence of dividends?, Journal of Financial Economics 9, 265-269.

Feenberg, D. and E. Coutts, 1993, An introduction to the TAXSIM model, Journal of Policy Analysis and Management 12, 189-194.

Feenberg, D. and J. Poterba, 1991, Which households own municipal bonds? Evidence from tax returns, National Tax Journal 44 (December), 93-103.

Feldstein, M., 1976, Personal taxation and portfolio composition: An econometric analysis, Econometrica 44, 631-649.

Feldstein, M., 1978, The welfare cost of capital income taxation, Journal of Political Economy 86, S29-52.

Feldstein, M., 1995, College scholarship rules and private saving, American Economic Review 85, 552-566.

Feldstein, M., J. Slemrod, and S. Yitzhaki, 1980, The effects of taxation on the selling and switching of common stock, Quarterly Journal of Economics 94, 777-791.

Fortune, P., 1988, Municipal bond yields: Whose tax rates matter?, National Tax Journal 41, 219-233.

Frank, M. and R. Jagannathan, 1998, Why do stock prices drop by less than the value of the dividend? Evidence from a country without taxes, Journal of Financial Economics 47, 161-188.

Gale, W. and J. Slemrod, 2001, Rethinking estate and gift taxes: Overview, in W. Gale and J. Slemrod, eds., Rethinking Estate and Gift Taxation. Washington: Brookings Institution.

Gale, W. and M. Perovek, 2001, Does the estate tax affect saving?, in W. Gale and J. Slemrod, eds., Rethinking Estate and Gift Taxation. Washington: Brookings Institution.

Gentry, W. and J. Milano, 1994, Taxation and the demand for variable annuities, mimeo, Columbia University Graduate School of Business.

Ghee, W., and W. Reichenstein, 1996, The after-tax returns from different saving vehicles, Financial Analysts Journal (July/August), 62-72.

Gordon, R., 1985, Taxation of corporate capital income: Tax revenues versus tax distortions, Quarterly Journal of Economics 100, 1-27.

Gordon, R. and D. Bradford, 1980, Taxation and the stock market value of capital gains and dividends: Theory and empirical results, Journal of Public Economics 14, 109-136.

Gravelle, J., 1994, The economic effects of taxing capital income (Cambridge, MA, MIT Press).

Green, R., 1993, A simple model of the taxable and tax-exempt yield curves, Review of Financial Studies 6, 233-264.

Green, R. and B. Odegaard, 1997, Are there tax effects in the relative pricing of U.S. government bonds?, Journal of Finance 52, 609-633.

Green, R. and K. Rydqvist, 1999, Ex-day behavior with dividend preference and limitations to short-term arbitrage: The case of Swedish lottery bonds, Journal of Financial Economics 53, 145-187.

Grinblatt, M. and M. Keloharju, 2000, Tax-loss trading and wash sales, mimeo, Anderson School of Management, UCLA.

Grinblatt, M. and T. Moskowitz, 2000, The cross section of expected returns and its relation to past returns: New evidence, mimeo, UCLA Department of Finance.

Gruber, M., 1996, Another puzzle: The growth in actively managed mutual funds, Journal of Finance 51, 783-810.

Guiso, L., M. Haliassos, and T. Jappelli, 2001, Household Portfolios, Cambridge, MIT Press.

Gustman, A. and T. Steinmeier, 1992, The stampede toward defined contribution pension plans: Fact or fiction?, Industrial Relations 31, 361-369.

Haliassos, M. and C. C. Bertaut, 1995, Why do so few hold stocks, Economic Journal 105, 1110-1129.

Hamilton, J., 1987, Optimal wage and income taxation with wage uncertainty, International Economic Review 28, 373-388.

Hassett, K. and G. Metcalf, 1999, Investment with uncertain tax policy: Does random tax policy discourage investment?, Economic Journal 109, 372-393.

Heckman, J., 1976, A life-cycle model of earnings, learning, and consumption, Journal of Political Economy 84, S11-44.

Heckman, J., L. Lochner, and C. Taber, 1998, Tax policy and human capital formation, American Economic Review 88 (May), 293-297.

Henriques, D. and F. Norris, 1996, Wealthy, helped by Wall Street, find new ways to escape tax on profits, New York Times (December 1), 1.

Hochguertel, S., R. Alesie, and A. van Soest, 1997, Saving accounts versus stocks and bonds in household portfolio allocation, Scandinavian Journal of Economics 99, 81-97.

Holtz-Eakin, D., and D. Marples, 2000, Distortion costs of taxing wealth accumulation: Income versus estate taxes, mimeo, Syracuse University.

Holtz-Eakin, D., D. Joulfaian, and H. Rosen, 1994a, Sticking it out: Entrepreneurial survival and liquidity

constraints, Journal of Political Economy 102, 53-75.

Holtz-Eakin, D., D. Joulfaian, and H. Rosen, 1994b, Entrepreneurial decisions and liquidity constraints, RAND Journal of Economics 23, 334-347.

Huang, J., 2001, Taxable or tax-deferred account? Portfolio decisions with multiple investment goals, mimeo, MIT Sloan School of Management.

Hubbard, R., 1985, Personal taxation, pension wealth, and portfolio composition, Review of Economics and Statistics 67, 53-60.

Hubbard, R., 1995, Securities transaction taxes: Can they raise revenue?, in Catalyst Institute, Securities Transaction Taxes: False Hopes and Unintended Consequences (Chicago, Catalyst Institute).

Huddart, S., 1998, Tax planning and the exercise of employee stock options, Contemporary Accounting Research 15 (Summer), 203-16.

Huddart, S. and M. Lang, 1996, Employee stock option exercises: An empirical analysis, Journal of Accounting and Economics 21, 5-43.

Huddart, S. and V. Narayanan, 2000, An empirical examination of tax factors and mutual fund stock sales, mimeo, Penn State University.

Ibbotson Associates, 1996, Stocks, Bills, Bonds, and Inflation (Chicago, Ibbotson Associates).

Investment Company Institute, 1999, Equity Ownership in America (Washington: Investment Company Institute and Securities Industry Association).

Ioannides, Y., 1989, Housing, other real estate, and wealth portfolios, Regional Science and Urban Economics 19, 261-280.

Jacobs, N., 1996, Tax-efficient investing: Reduce tax drag, improve asset growth, Trusts and Estates (June), 25-33.

Jeffrey, R. and R. Arnott, 1993, Is your alpha big enough to cover its taxes?, Journal of Portfolio Management (Spring), 15-25.

Joulfaian, D., 1991, Charitable bequests and estate taxes, National Tax Journal 44, 169-180.

Judd, K., 1998, Taxes, uncertainty, and human capital, American Economic Review 88 (May), 289-292.

Kalay, A., 1982, The ex-dividend day behavior of stock prices: A re-examination of the clientele effect, Journal of Finance 37, 1059-1070.

Kaplow, L., 1993, Human capital and the income tax, NBER Working Paper 4299, Cambridge, MA.

Kaplow, L., 1994, Taxation and risk-taking: A general equilibrium perspective, National Tax Journal 47, 789-798.

Kaplow, L., 2001, A framework for assessing estate and gift taxation, in W. Gale and J. Slemrod, eds., Rethinking Estate and Gift Taxation (Washington: Brookings Institution, forthcoming).

Karpoff, J. and R. Walkling, 1988, Short-term trading around ex-dividend days: Additional evidence, Journal of Financial Economics 21, 291-298.

Karpoff, J. and R. Walkling, 1990, Dividend capture in NASDAQ stocks, Journal of Financial Economics 28, 39-66.

Kennickell, A., M. Starr-McCluer, and B. Surette, 2000, Changes in U.S. family finances at the end of the 1990s: Results from the 1998 Survey of Consumer Finances, Federal Reserve Bulletin 86 (January), 1-29.

Khorana, A. and H. Servaes, 1999, The determinants of mutual fund starts, Review of Financial Studies 12, 1043-1073.

Kiefer, D., 1990, Lock-in effect within a simple model of corporate stock trading, National Tax Journal 43, 75-94.

Kim, T., 1997, College financial aid and family saving, Ph.D. dissertation, MIT Department of Economics, Cambridge, MA.

King, M. and J. Leape, 1998, Wealth and portfolio composition: Theory and evidence, Journal of Public Economics.

King, R. and S. Rebelo, 1990, Public policy and economic growth: Developing neoclassical implications, Journal of Political Economy 98, S126-S150.

Klein, P., 1999, The capital gain lock-in effect and equilibrium returns, Journal of Public Economics 71 (March), 355-378.

Kochin, L. and R. Parks, 1988, Was the tax-exempt bond market inefficient or were future expected tax rates negative?, Journal of Finance 53, 913-931.

Koski, J., 1996, A microstructure analysis of ex-dividend stock price behavior before and after the 1984 and 1986 Tax Reform Acts, Journal of Business 69, 313-338.

Koski, J. and J. Scruggs, 1998, Who trades around the ex-dividend day? Evidence from NYSE audit file data, Financial Management 27 (Autumn), 58-72.

Kovenock, D. and M. Rothschild, 1987, Notes on the effect of capital gains taxation on non-Austrian assets, in A. Razin and E. Sadka, eds., Economic Policy in Theory and Practice (New York, St. Martin's Press), 309-339.

Kraft, A. and I. Weiss, 1998, Tax planning by mutual funds: Evidence from changes in the capital gains tax rate, mimeo, University of Chicago Graduate School of Business.

Kruse, D., 1995, Pension substitution in the 1980s: Why the shift toward defined contribution?, Industrial Relations 34, 218-241.

Lakonishok, J. and T. Vermaelen, 1983, Tax reform and ex-dividend behavior, Journal of Finance 38, 1157-1179.

Landsman, W. and D. Shackelford, 1995, The lock in effect of capital gains taxes: Evidence from the RJR Nabisco leveraged buyout, National Tax Journal 58, 245-260.

Lang, M. and D. Shackelford, 2000, Capitalization of capital gains taxes: Evidence from stock price reactions to the 1997 rate reduction, Journal of Public Economics 76, 69-85.

Leape, J., 1987, Taxes and transaction costs in asset market equilibrium, Journal of Public Economics 33, 1-20.

Leland, H., 2000, Optimal portfolio management with transactions costs and capital gains taxes, mimeo, Haas School of Business, University of California-Berkeley.

Lewellen, W., K. Stanley, R. Lease, and G. Schlarbaum, 1978, Some direct evidence on the dividend clientele phenomenon, Journal of Finance 33, 163-195.

Litzenberger, R. and K. Ramaswamy, 1979, The effect of personal taxes and dividends on capital asset prices: Theory and empirical evidence, Journal of Financial Economics 7, 163-195.

Litzenberger, R. and K. Ramaswamy, 1980, Dividends, short-selling restrictions, tax-induced investor clienteles, and market equilibrium, Journal of Finance 35, 469-482.

Long, J., 1977, Efficient portfolio choice with differential taxation of dividends and capital gains, Journal of Financial Economics 5, 25-53.

Long, J., 1978, The market valuation of cash dividends: A case to consider, Journal of Financial Economics 6, 235-264.

Lord, W. and P. Rangazas, 1998, Capital accumulation and taxation in a general equilibrium model with risky human capital, Journal of Macroeconomics 20, 509-531.

Lybeck, J., 1991, On political risk - The turnover tax on the Swedish money and bond markets, or how to kill a market without really trying, in S. J. Khoury, ed., Recent Developments in International Banking and Finance (Amsterdam, North Holland-Elsevier Science Publishers).

Mackie-Mason, J., 1990, Some nonlinear tax effects on asset values and investment decisions under uncertainty, Journal of Public Economics 42, 301-328.

Maki, D., 1996, Portfolio shuffling and tax reform, National Tax Journal 49, 317-330.

Maringer, R., 1995, Taxes, capital gains realizations, and revenues: A critical review and some new results, National Tax Journal 48, 447-462.

McDonald, R., 1983, Government debt and private leverage, Journal of Public Economics 22, 303-325.

McGratten, E. and E. Prescott, 2000, Is the stock market overvalued?, NBER Working Paper 8077, Cambridge, MA.

Meehan, J., D. Yoo, and G. Fong, 1995, Taxable asset allocation with varying market risk premiums, Journal of Portfolio Management (Fall), 79-87.

Michaely, R., 1991, Ex-dividend day stock price behavior: The case of the 1986 Tax Reform Act, Journal of Finance 46, 845-860.

Michaely, R. and J.-L. Vila, 1995, Trading volume with private valuations: Evidence from the ex-dividend day, Review of Financial Studies

Miller, M., 1977, Debt and taxes, Journal of Finance 32, 261-275.

Miller, M. and M. Scholes, 1978, Dividends and taxes, Journal of Financial Economics 6, 333-364.

Miller, M. and M. Scholes, 1982, Dividends and taxes: Some empirical evidence, Journal of Political Economy 90, 1118-1141.

Mintz, J. and M. Smart, 2001, Tax-exempt investors and corporate capital structure, Journal of Public Economics (forthcoming).

Mitchell, O., J. Poterba, M. Warshawsky, and J. Brown, 1999, New evidence on the money's worth of individual annuities, American Economic Review 89 (December), 1299-1318.

Mitrusi, A. and J. Poterba, 2001, The changing importance of income and payroll taxes on U.S. families, in J. Poterba, ed., Tax Policy and the Economy, Volume 15 (Cambridge: MIT Press).

Morgan, G. and S. Thomas, 1998, Taxes, dividend yields, and returns in the U.K. equity market, Journal of Banking and Finance 22, 405-423.

Naranjo, A., M. Nimalendran, and M. Ryngaert, 1998, Stock returns, dividend yields, and taxes, Journal of Finance 53, 2029-2057.

Odean, T., 1998, Are investors reluctant to realize their losses?, Journal of Finance 53, 1775-1798.

Organization for Economic Cooperation and Development, 1994, Taxation and Household Saving (Paris).

Petit, R., 1977, Taxes, transactions costs, and the clientele effect of dividends, Journal of Financial Economics 5, 419-436.

Peterson, R., R. Peterson and J. Ang, 1985, Direct evidence on the marginal rate of taxation on dividend income, Journal of Financial Economics 14, 267-282

Poterba, J., 1986a, The market value of cash dividends: The Citizens Utilities case reconsidered, Journal

of Financial Economics 15, 395-405.

Poterba, J., 1986b, Explaining the yield spread between taxable and tax-exempt bonds: The role of expected tax policy, in H. Rosen, ed., Studies in State and Local Public Finance (Chicago, University of Chicago Press).

Poterba, J., 1987, How burdensome are capital gains taxes?, Journal of Public Economics 33, 153-172.

Poterba, J., 1989, Capital gains tax policy toward entreprenuership, National Tax Journal 42, 375-390.

Poterba, J., 2000a, Stock market wealth and consumption, Journal of Economic Perspectives 14 (Spring), 99-118.

Poterba, J., 2000b, The estate tax and after-tax investor returns, in J. Slemrod, ed., Does Atlas Shrug? (New York: Russell Sage Foundation), 329-349.

Poterba, J., 2001a, Taxation and portfolio structure: Issues and implications, in L. Guiso, M. Haliassos, and T. Jappelli, eds., Household Portfolios (Cambridge: MIT Press, forthcoming).

Poterba, J., 2001b, Incentive effects of estate and gift taxes in the United States, Journal of Public Economics 79, 237-264.

Poterba, J. and A. Samwick, 1999, Taxation and household portfolio composition: Evidence from the 1980s and 1990s, NBER Working Paper 7392.

Poterba, J., J. Shoven, and C. Sialm, 2001, Asset location for retirement savers, In W. Gale and J. Shoven, eds., Public Policies and Private Pensions (Washington: Brookings Institution, forthcoming).

Poterba, J. and L. Summers, 1984, New evidence that taxes affect the valuation of dividends, Journal of Finance 39, 1397-1415.

Poterba, J. and L. Summers, 1985, The economic effects of dividend taxation, in E. Altmann and M. Subrahmanyam, eds, Recent Advances in Corporate Finance. Homewood, IL: Dow-Jones Irwin, 227-284.

Poterba, J., S. Venti, and D. Wise, 2000, Saver behavior and 401(k) wealth, American Economic Review 90 (May), 297-302.

Poterba, J., and S. Weisbenner, 2001a, Taxing estates or unrealized capital gains at death, in W. Gale, J. Hines, and J. Slemrod, eds., Rethinking Estate and Gift Taxation (Washington: Brookings Institution, forthcoming).

Poterba, J. and S. Weisbenner, 2001b, Capital gains tax rules, tax loss trading, and turn of the year returns. Journal of Finance 56, 353-368.

Poterba, J. and D. Wise, 1998, Individual financial decisions in retirement saving plans and the provision of resources for retirement, in M. Feldstein, ed., Privatizing Social Security (Chicago: University

of Chicago Press).

Prisman, E., G. Roberts, and Y. Tian, 1996, Optimal bond trading and the tax-timing option in Canada, Journal of Banking and Finance 20, 1351-1363.

Protopapadakis, A., 1983, Some indirect evidence on effective capital gains tax rates, Journal of Business 56, 127-138.

Rebelo, S., 1991, Long run policy analysis and long-run growth, Journal of Political Economy 99, 500-521.

Reese, W., 1998, Capital gains taxation and stock market activity: Evidence from IPOs, Journal of Finance 53, 1799-1820.

Ross, S., 1985, Debt and taxes and uncertainty, Journal of Finance 40, 637-657.

Samwick, A. and J. Skinner, 1998, How will defined contribution pension plans affect retirement income? NBER Working Paper 6645.

Samwick, A., 2000, Portfolio responses to taxation: Evidence from the end of the rainbow, in J. Slemrod, ed., Does Atlas Shrug? (New York: Russell Sage Foundation), 289-323.

Sandmo, A., 1977, Portfolio theory, asset demand, and taxation: Comparative statics with many assets, Review of Economic Studies 44, 369-379.

Sandmo, A., 1985, The effects of taxation on savings and risk-taking, in A. Auerbach and M. Feldstein, eds., Handbook of Public Economics, Volume 1 (Amsterdam: North Holland), 265-309.

Scholes, M., M. Wolfson, M. Erickson, E. Maydew, and T. Shevlin, 2002, Taxes and Business Strategy: A Planning Approach, Second Edition, Prentice Hall: Upper Saddle River, NJ.

Schmalbeck, D., 2001, Avoiding federal wealth transfer taxes, in W. Gale and J. Slemrod, eds., Rethinking Estate and Gift Taxation (Washington: Brookings Institution, forthcoming).

Scholz, J., 1992, A direct examination of the dividend clientele hypothesis, Journal of Public Economics 49, 261-285.

Scholz, J., 1994, Tax progressivity and household portfolios: Descriptive evidence from the Surveys of Consumer Finances, in J. Slemrod, ed., Tax Progressivity & Income Inequality (New York, Cambridge University Press), 219-274.

Schuetze, H., 2000, Taxes, economic conditions, and recent trends in male self-employment: A Canada-U.S. comparison, Labour Economics 7, 507-544.

Schwert, G. and P. Seguin, 1995, Securities transaction taxes: An overview of costs, benefits, and unresolved questions, in Catalyst Institute, Securities Transaction Taxes: False Hopes and Unintended Consequences (Chicago, Catalyst Institute).

Seida, J., and W. Wempe, 2000, Do capital gain tax rate increases affect individual investors' trading decisions?, Journal of Accounting and Economics 30, 33-57.

Seyhun, H. and D. Skinner, 1994, How do taxes affect investors' stock market realizations? Evidence from tax-return panel data, Journal of Business 67, 231-262.

Shackelford, D., 2000a, The tax environment facing the wealthy, in J. Slemrod, ed., Does Atlas Shrug? (New York: Russell Sage Foundation), 114-138.

Shackelford, D., 2000b, Stock market reaction to capital gains tax changes: Empirical evidence from the 1997 and 1998 tax acts, in J. Poterba, ed., Tax Policy and the Economy 14. Cambridge: MIT Press, 67-92.

Shackelford, D. and R. Verrecchia, 1999, Intertemporal tax discontinuities, NBER Working Paper 7451.

Shefrin, H. and M. Statman, 1985, The disposition to sell winners too early and ride losers too long: Theory and evidence, Journal of Finance 40, 777-790.

Shoven, J., 1999, The location and allocation of assets in pension and conventional savings accounts, NBER Working Paper 7007, Cambridge, MA.

Shoven, J. and C. Sialm, 1998, Long run asset allocation for retirement saving, Journal of Private Portfolio Management 1 (2), 13-26.

Shoven, J. and C. Sialm, 1999, Asset location in tax-deferred and conventional savings accounts, NBER Working Paper 7192, Cambridge, MA.

Shoven, J. and D. Wise, 1998, The taxation of pensions: A shelter can become a trap, in D. Wise, ed., Frontiers in the Economics of Aging (Chicago: University of Chicago Press).

Sialm, C., 2000, Tax rate changes and the equity premium, mimeo, Stanford University Department of Economics.

Siegel, L. and D. Montgomery, 1995, Stocks, bonds, and bills after taxes and inflation, Journal of Portfolio Management (Winter), 17-25.

Sims, T., 1995, Taxation, optimization, and the January seasonal effect (and other essays in taxation and finance),.Ph.D. dissertation, Massachusetts Institute of Technology, Department of Economics.

Slemrod, J., 1982, Stock transactions volume and the 1978 capital gains tax reduction, Public Finance Quarterly 10+, 3-16.

Slemrod, J. and T. Greimel, 1999, Did Steve Forbes scare the municipal bond market?, Journal of Public Economics 74, 81-96.

Summers, L. and V. Summers, 1989, When financial markets work too well: A cautious case for a securities transactions tax, Journal of Financial Services Research 3, 261-286.

Stiglitz, J., 1969, The effects of income, wealth, and capital gains taxation on risk-taking, Quarterly Journal of Economics 83, 262-283.

Stiglitz, J., 1983, Some aspects of the taxation of capital gains, Journal of Public Economics 21, 257-294.

Strickland, D., 1996, Determinants of institutional ownership: Implications for dividend clienteles, mimeo, Ohio State University College of Business.

Talmor, E., 1985, Personal tax considerations in portfolio construction: Tilting the optimal portfolio selection, Quarterly Review of Economics and Business 25, 55-71.

Tepper, I., 1981, Taxation and corporate pension policy, Journal of Finance 36, 1-13.

Tobin, J., 1978, A proposal for international monetary reform, Eastern Economic Journal 4, 153-159.

Trostel, P., 1993, The effect of taxation on human capital, Journal of Political Economy 101, 327-350.

Umlauf, S., 1993, Transaction taxes and the behavior of the Swedish stock market, Journal of Financial Economics 33, 227-240.

U.S. Congressional Budget Office, 1988, How Capital Gains Tax Rates Affect Revenues: The Historical Evidence, Washington: Congressional Budget Office.

U. S. Congressional Budget Office, 1997, Perspectives on the Ownership of Capital Assets and the Realization of Capital Gains, Washington: Congressional Budget Office.

Wolff, E., 1996, Commentary, Tax Law Review 51, 517-522.

Table 1: Individual Marginal Tax Rates on Capital Income in the United States, 1979-99

Year	Interest	Dividends	Realized Long-Term Gains	Wages	Tax-Exempt Interest
1979	28.8	41.7	16.5	27.6	n.a.
1980	30.5	42.8	16.8	29.1	n.a.
1981	31.1	40.8	17.1	30.2	n.a.
1982	28.2	35.4	15.1	28.4	n.a.
1983	25.7	33.6	15.2	26.6	n.a.
1984	26.6	33.0	15.2	26.2	n.a.
1985	26.6	32.8	15.5	26.4	n.a.
1986	25.8	32.6	16.2	26.6	n.a.
1987	24.2	27.9	25.3	24.2	29.1
1988	22.2	25.1	26.4	22.6	25.7
1989	22.9	25.4	25.9	22.7	26.0
1990	22.8	25.0	25.5	22.5	25.8
1991	22.6	25.5	24.4	22.6	25.9
1992	22.1	25.2	25.2	22.5	25.1
1993	23.6	27.2	26.0	23.3	27.9
1994	24.3	272	26.7	23.6	27.6
1995	25.3	28.2	26.9	23.9	28.9
1996	25.9	28.8	27.9	24.1	29.4
1997	26.5	29.8	24.6	24.5	30.5
1998	26.0	29.4	20.4	25.2	29.6
1999	26.6	29.7	20.5	25.4	29.8

Source: NBER TAXSIM model calculations. Each entry presents a dollar-weighted average marginal tax rate on positive income amounts only, using data from the IRS Individual Tax Model, as analyzed with the NBER TAXSIM Model.

Table 1 headings corrected November 2005 -JP

Table 2: Financial Assets of U.S. Households, 2000

Asset Category	Applicable Tax Rate	Tax Deferral?	Value (Percent) of Holdings, 2000:Q1
Deposits and Money Market Funds	τ_{int}	No	4499.1 (12.6%)
Taxable Bonds	τ_{int}	No	1428.1 (4.0%)
Tax-Exempt Bonds	Untaxed	Not Applicable	535.3 (1.5%)
Corporate Equity	τ_{div}, τ_{cg}	Yes	8266.7 (23.2%)
Mutual Fund Shares	τ_{div}, τ_{cg}	Some	3186.3 (9.0%)
Life Insurance Reserves	$\tau_{ordinary}$	Yes	791.6 (2.2%)
Pension Reserves	$\tau_{ordinary}$	Yes	10395.6 (29.2%)
Personal Trust Investments	$\tau_{ordinary}$	Yes	1135.2 (3.2%)
Equity in Unincorporated Businesses	T_{cg} ??	Yes	4639.6 (13.0%)
Miscellaneous Assets	Varied	Possibly	708.0 (2.0%)
Total Financial Assets			35585.7
Home Mortgages	$\tau_{ordinary}$	No	(4547.6)
Other Debt	$\tau_{ordinary}$	No	(2420.7)
Net Financial Assets			28617.4
Financial Assets Net of Non-Mortgage Debt			33165.0

Source: Author's calculations based on Federal Reserve Board, Flow of Funds Accounts of the United States: Flows and Outstandings, First Quarter 2000 (Release Z.1). Calculations are based on reported information for the household sector, which includes nonprofit institutions. In 1996, the last year for which detailed information on the portfolio holdings of nonprofit institutions are available, "non-nonprofit holdings" represented 5.7 percent of total household holdings of financial assets. Values in parentheses are percentages of total financial assets.

Table 3: Returns on Portfolio Assets, 1926-1996

Asset/Return Concept   Return Standard Deviation

PART A: PRETAX RETURNS

Pretax Nominal Returns:

Asset	Return	Standard Deviation
Large Stocks	12.67%	20.32%
LT Government Bonds	5.45	9.21
Treasury Bills	3.78	3.26

Pretax Real Returns:

Asset	Return	Standard Deviation
Large Stocks	9.45%	20.91%
LT Government Bonds	2.23	10.85
Treasury Bills	0.57	4.36

PART B: AFTER-TAX RETURNS

After-Tax Nominal Returns:

Asset	Return	Standard Deviation
Large Stocks	9.16%	17.15%
LT Government Bonds	3.39	7.03
Treasury Bills	2.15	1.69

After-Tax Real Returns:

Asset	Return	Standard Deviation
Large Stocks	5.94%	17.89%
LT Government Bonds	0.17	9.25
Treasury Bills	-1.07	4.38

Source: Author's calculations using pretax return data, and information on the decomposition of returns into income and capital gains, reported in Ibbotson Associates (1996). Marginal tax rates for the "after tax" calculation correspond to tax rates on a joint filer with a constant $1989 income of $75,000; this marginal tax rate is drawn from Siegel and Montgomery (1995).

Figure 1: Equilibrium in the Miller Model

After-tax Return

Bond
Return

Equity Return

Tax Rate