Portfolio Allocation in a General Equilibrium Model and the "Dynamic" Scoring of Tax Reform

Craig E. Johnson
Office of Tax Analysis
U.S. Department of the Treasury
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1. Introduction

With the formation of the President's Advisory Panel on Federal Tax Reform early this year, the President signaled that fundamental tax reform of the federal income tax system would be a leading domestic priority during his second term. The prospect of tax reform has and will continue to incite debates in policy and political circles. One of the debates will center on the revenue cost of the Administration's proposal. The primary responsibility for providing the Administration's revenue score for a tax reform proposal falls to the Office of Tax Analysis (OTA) within the Department of the Treasury. OTA normally incorporates relevant behavioral elasticities from the economics literature when developing the revenue estimate for a particular proposal.

However, fundamental tax reform may have significant effects on the after tax rates of return to different assets with subsequent reshuffling of portfolios across households that would generate new before tax rates of return. Tax reform may lead to a new allocation of capital across production sectors, with the returns taxed at different rates. Businesses may also alter the use of debt versus equity financing and corporations may change their payout policy. While these types of effects do not normally need to be included in OTA revenue estimates, the Office does maintain a general equilibrium model that provides estimates for these types of changes that can help inform the revenue estimates when appropriate.

The general equilibrium Portfolio Allocation (PA) model[1] focuses on tax distortions in household portfolio decisions and the ensuing effects on the allocation of physical capital across production sectors. Taxes distort both real and financial decisions and real and financial variables are determined simultaneously. Businesses and the government sector issue securities to meet their demand for capital. Meanwhile, households and pension funds acquire securities in a manner consistent with their risk-return preferences. The model uses a mean-variance approach where the demand for an asset is positively related to the after-tax rate of return and negatively related to the after-tax variance. The resulting portfolio choices affect market rates of return, which then affect the cost of capital to sectors issuing securities. Total factor supplies are fixed and the model is closed to international capital flows.

In addition, the model explicitly accounts for two distortions related to the taxation of capital gains upon realization. First, capital gains realizations are based on a semi-log function of the gains tax rate that allows for direct calculation of the excess burden due to the lock-in effect on realizations. Second, the corporate dividend payout ratio is negatively related to the difference between the average marginal tax rates on dividends and capital gains.

The debt/equity ratio for noncorporate businesses is fixed, while corporations choose the debt-equity ratio to maximize the value of the corporate capital stock. This involves a tradeoff between the net tax benefits of debt finance and leverage costs that are assumed to increase with the share of debt. Taxation of businesses is described by two variables, the statutory marginal tax rate, and an inclusion factor that represents the present value effect of all business tax preferences for that sector.

[1] A more detailed description of previous versions of the model can be found in Galper, Lucke and Toder (1988), Hendershott and Won (1992) and Hendershott, Toder and Won (1991).

The PA model has many features that lends itself to simulating the effects of tax reforms.[2] Many of the portfolio shifts expected to occur would be directly modeled, such as movement of capital between noncorporate businesses, owner-occupied housing and the corporate sector, as well as the shift between debt and equity. The model calculates new equilibrium rates of return for each sector, the corporate debt/capital ratio and the dividend payout rate. Yet the most attractive feature of the model for the purposes of evaluating tax reform lies in the detailed household sector, with numerous household cells with various income and wealth levels. These households hold a diversified portfolio of assets that depend on the after-tax rate of return and portfolio shifts can be analyzed by income class.

Despite these strengths, the model also has some weaknesses. The model is closed to international capital flows, which would likely have large effects on equilibrium rates of return. The model also abstracts from intertemporal distortions. The model includes statutory individual income tax rates and brackets, but the alternative minimum tax (AMT) is ignored. Furthermore, while the model finds the optimal debt/equity ratio for assets held in retirement accounts (pensions and IRAs), the amount of assets held in such accounts is exogenously determined.

In addition, for the purpose of revenue estimation, the employment of Cobb-Douglas production functions implies that income shares from each production sector remains constant. While household and firm behavioral responses can lead to income being shifted so that it faces a lower tax rate at the household level, corporate tax revenues will remain relatively constant. Also, this limits that amount of shifting that could occur for individual tax revenues.

The primary reform examined in this paper essentially reverses the tax rate reductions on ordinary income, dividends, and capital gains enacted as a result of the Economic Growth Tax Relief Reconciliation Act of 2001 (EGTRRA) and the Jobs and Growth Tax Relief Reconciliation Act of 2003 (JGTRRA). Reversing the signs of the economic effects will provide estimates of the economic effects of the individual rate reductions passed in 2001 and 2003. For ease in making comparisons between "dynamic" and static revenue estimates, ordinary, dividends and capital gains tax rates are increased starting from an equilibrium consistent with JGTRRA tax law. The word dynamic is listed in quotation marks in the title of the paper because recent use of the term has focused on feedback effects generated by changing aggregate supplies of labor and capital. The results in this paper are not dynamic according to that usage of the term.

When examining only individual income tax revenues, the static revenue estimate is reduced by 10 percent when all of these rates are increased under the base case parameters. Most of the behavioral response stems from decreasing dividend payout when dividend taxes are increased and households reducing realization of gains when capital gains tax rates are increased. Including estimates of the change in corporate tax revenues due to the movement of capital out of the corporate sector and an increase in the debt-capital ratio decreases the static estimate by another 3 percentage points.

[2] For prior examples of the model's evaluation of tax reforms see Galper, Lucke and Toder (1988), Hendershott and Won (1992), Hendershott, Toder and Won (1991), Johnson and Mackie (2004), and U.S. Department of the Treasury (1992).

This paper is organized as follows. The next section presents the model structure and describes the equations that govern the behavioral responses in the model. The third section discusses the calibration process and the setting of parameter values. The fourth section presents results from two reforms, the first being an increase in the top marginal ordinary tax rate to 40 percent and the second being the almost reversal of EGTRRA and JGTRRA. The final section concludes and suggests steps for improvements to the model.

2. Model Description

Output and Demand for Capital Services

There are six production sectors in the model: corporate and noncorporate businesses (the noncorporate sector is divided into rental housing and other noncorporate), state and local governments and two household production sectors, owner-occupied housing and consumer durables. The production functions for corporate, noncorporate and state and local goods and services are Cobb-Douglas functions of labor and the flow of capital services. The production coefficients for labor and capital are equal across the three sectors. Rental services of the remaining sectors—rental housing, owner-occupied housing and consumer durables—require no direct labor input and derive solely from capital services. Capital services used in the production functions are produced from permanent capital and replacement production that is required to offset the annual depreciation in each sector's capital. All replacement production for capital is assumed to be done in the corporate sector. Final output for each sector is represented as a function of total direct and indirect labor and capital inputs:

$$X_i = L^{A_{Li}} K_i^{A_{Kii}} K_1^{A_{1i}}, \qquad i = 1...6, \tag{1}$$

where A_{Li} = labor's share in output of sector i, A_{Kii} = the share of own capital used in sector i, A_{K1i} = the share of corporate capital in the output of sectors 2-6, and $A_{Li} + A_{Kii} + A_{K1i} = 1$ for all i.

The demand equations for capital for each production sector are generated by differentiating these production functions and setting the resulting marginal revenue products equal to the cost of capital,

$$K_i = \frac{K_{i0}}{r_i - \pi}, \qquad i = 1 \ldots 6, \tag{2}$$

where r_i equals the pretax rate of return to capital in sector i, and π equals the rate of inflation. Hence, the demand for capital services in each sector is inversely related to its real cost of capital.

The constant term in the demand equation for corporate capital is equal to:

$$K_{10} = \sum_{i=1}^{6} A_{K1i} P_i X_i, \tag{3}$$

where A_{K1i} equals corporate capital's share in the output of sector I, X_i equals the output of sector I, and P_i equals the price of output in sector i.

The constant terms in the demand equations for capital in the other five sectors are equal to:

$$K_{i0} = A_{Kii} P_i X_i, \quad i = 2 \ldots 6. \tag{4}$$

The pretax rates of return on financial assets supplied to households determine the net cost of capital in each sector. These pretax returns differ across assets due to differential taxation at the household level and the corporate income tax and because assets have different risk characteristics that affect the attractiveness to households.

Corporations supply taxable bonds, tax-exempt bonds (private-activity bonds) and corporate equity to households. Following current tax law, interest payments to bond holders are deductible in computing corporate income. Also, only a_1 per dollar of corporate economic income is included in the tax base, this inclusion factor represents the cumulative effect of corporate tax preferences, such as accelerated depreciation. Finally, corporations face a bankruptcy premium that increases the costs of debt finance as the debt-equity ratio increases. This premium is represented mathematically as:

$$Z = \frac{z f_1^{\,2}}{1 - f_1}, \tag{5}$$

where Z equals leverage cost per unit of capital, f_1 equals the corporate debt to capital ratio, and z = a constant. The value of z is set during the initial calibration to replicate the observed debt-capital ratio of the corporate sector. This is described in more detail below.

The nominal pretax return on corporate capital is expressed as the weighted average of payments to owners (including retained earnings) and creditors, plus net property taxes and leverage costs, gross of corporate taxes:

$$r_1 = \left[\frac{1}{1 - t_c a_1}\right]\left[f_1(e i_e + (1-e) i_f)(1 - t_c) + (1 - f_1) i_c + (1 - t_c) p\gamma + \frac{z f_1^{\,2}}{1 - f_1} \right], \tag{6}$$

where t_c equals the corporate tax rate, e equals the share of corporate debt financed by tax-exempt bonds, i_e equals the tax-exempt interest rate, i_f equals the pretax interest rate on taxable bonds, i_c equals the pretax rate of return on corporate equity, p equals the property tax rate and γ equals the share of capital subject to the property tax.

The noncorporate and rental housing sectors do not face an entity level tax, thus the pretax return on noncorporate and rental housing capital is equal to the return on shares of noncorporate and rental housing capital received by households. These returns, denoted as i_n and i_{rh}, respectively, reflect a premium that compensates individual investors for the greater riskiness of these types of capital relative to taxable bonds. Hence, the cost of capital for these sectors is simply

$$r_2 = i_n\,, \tag{7}$$

and

$$r_3 = i_{rh} \tag{8}$$

State and local government capital is financed by tax-exempt bonds paying a return of i_e to lenders. The cost of capital is

$$r_4 = i_e \tag{9}$$

Households supply capital in the owner-occupied housing and consumer durables sectors to themselves. Consumer durable capital is risk-less and the cost of capital for each household is equal to the opportunity cost of capital, the after-tax rate of return on risk free bonds for that household. This depends on the itemization status and marginal tax rate of the household. The cost of capital for consumer durables for household j facing marginal tax rate t^j can be expressed as:

$$r_5^j = i_f\,(1 - b^j t^j)\,, \tag{10}$$

where b^j equals one for itemizers and non-itemizers who are net lenders and zero for non-itemizers who are net borrowers.

For owner-occupiers, the cost of capital is more complicated as the return to housing is risky and the required return also needs to cover property taxes. For household j facing marginal tax rate t^j the owner-occupied housing cost of capital is:

$$r_6^j = i_h^j = \left(i_f + p\right)\left(1 - b^j t^j\right) + \rho_h^j\,, \tag{11}$$

where ρ^j_h is the risk premium associated with investment in owner-occupied housing for household j.

Financial Asset Supplies

The total supply of the five financial assets to the household sector can be derived directly from capital stocks in the productive sectors and the supply of federal government bonds:

$$F = f_1(1-e)K_1 + G + TTE \tag{12}$$

$$C = (1 - f_1)K_1 \tag{13}$$

$$NN = K_2 \tag{14}$$

$$RH = K_3 \tag{15}$$

$$E = K_4 + f_1 eK_1 - TTE \tag{16}$$

where *F* equals net taxable bonds supplied to households, *G* equals Federal debt, *C* equals corporate equity supplied to households, *NN* equals noncorporate equity supplied to households, *RH* equals rental housing equity supplied to households, *E* equals tax-exempt bonds supplied to households, and *TTE* equals the amount of tax-exempt bonds held by financial intermediaries. The model normally assumes that households hold these securities directly, although in reality much of these securities are held by financial intermediaries and households then hold claims at these institutions, such as savings accounts at banks. An exception is made regarding tax-exempt bonds, as a certain portion is assumed to be held at commercial banks and property and casualty insurance companies. Institutions that hold the tax-exempt bonds are assumed to finance these holdings by issuing taxable (and deductible) debt to households. The difference between the taxable interest rate received by the households as the ultimate lender and the tax-exempt rate paid by the borrowers can be regarded as a subsidy to state and local borrowing that is conveyed indirectly by means of reducing the taxes paid by financial institutions that hold tax-exempt bonds.

2.3 Household Utility Maximization and Asset Demands

Households allocate their wealth among equity in corporate, noncorporate and rental housing businesses, taxable and tax-exempt bonds, owner-occupied housing and durable goods. Initially, taxable bonds are the only risk-free financial asset. Households are divided into numerous representative cells (294) based on labor income, capital income, tax filing status, and homeownership. Each household cell holds a exogenous portion of its wealth in a nontaxable pension account that contains an endogenous mix of taxable bonds and corporate equities. Households face statutory tax schedules with income from all sources other than capital fixed, and with most deductions and exemptions fixed except for the amount of itemized deductions. The amount of income and variance from each asset that is included in taxable income is represented by asset and household specific inclusion factors.

Households maximize an exponential utility function specified as

$$U^j = m_0(1 - \mathrm{e}^{-m_1^j V^j}), \tag{17}$$

where m_0 is a constant, m_1 is household *j*'s risk aversion parameter and *V* is a Cobb-Douglas function of outputs consumed.

The household specific risk aversion parameter (m_1) is assumed constant for each household, thus *U* is a monotonically increasing function of *V*. Maximizing *U* then requires maximizing *V* subject to the household's budget constraint. That is,

$$\max V = \prod_{i=1}^{6} X_i^{v_i}, \ \sum_{i=1}^{6} v_i = 1 \tag{18}$$

subject to

$$Y = \sum_{i=1}^{6} P_i X_i \,, \tag{19}$$

where Y is the household's real after-tax income, P_i is the price of output i, X_i is the quantity of output i consumed, and v_i are constant consumption share parameters. Because households either rent or own their own housing, each household spends its income on five goods and services.

Maximizing (18) subject to (19) leads to the standard Cobb-Douglas demand equations

$$X_i = \frac{v_i Y}{P_i} \,. \tag{20}$$

Substituting equation (20) into (18), we obtain an indirect utility function in terms of prices and after-tax income in the form:

$$V = m_2 Y \,, \tag{21}$$

where

$$m_2 = \prod_{i=1}^{6} \left(\frac{v_i}{P_i} \right)^{v_i} \tag{22}$$

is the marginal utility of income. Substituting (21) into (17) leads to

$$U = m_0 \left(1 - e^{-m_1 m_2 Y} \right) \tag{23}$$

If Y is normally distributed with mean E(Y) and variance σ^2_Y, then expected utility can be described as

$$\mathrm{E}(U) = m_0 \left[1 - e^{-m_1 m_2 \left(E(Y) - \frac{m_1 m_2 \sigma_Y^2}{2} \right)} \right]. \tag{24}$$

As expected utility is a monotonically increasing function of the following equation (25), it can be shown that maximizing E(U) is equivalent to maximizing

$$m_2 \left(\mathrm{E}(Y) - \frac{m_1 m_2 \sigma_Y^2}{2} \right). \tag{25}$$

In other words, expected utility is positively related to the expected value of income and negatively related to the product of the variance of income, the households risk aversion parameter and the marginal utility of income. Hence the household's maximization problem can be restated as:

$$\max \mathrm{E}(U^j) = m_2^j \left(\mathrm{E}(Y^j) - \frac{m_1^j m_2^j \sigma_Y^{2\,j}}{2} \right) \tag{26}$$

subject to

$$W^j - CD^j = F^j + C^j + NN^j + RH^j + E^j + OH^j, \tag{27}$$

$$CD^j, C^j, NN^j, RH^j, E^j, OH^j \geq 0, \tag{28}$$

where W is each household's wealth, CD equals consumer durables and OH equals owner-occupied housing. Equation (28) indicates that the only asset that households can hold a negative amount of is taxable bonds; that is they can issue debt.

The households expected after-tax income (other than imputed income from the service flow from owner-occupied housing and consumer durables) is equal to:

$$\begin{aligned} &\mathrm{E}((Y^j) = L^j(1-t^j) + Y_{\mathrm{inf}}^j + i_f(1-b^j t^j)F^j + \mathrm{E}(i_e)E^j + \\ &\mathrm{E}(i_c)(1-a_c^j t^j)C^j + [\mathrm{E}(i_n)(1-a_n^j t^j) - p\gamma(1-t^j)]NN^j + \\ &[\mathrm{E}(i_{rh})(1-a_{rh}^j t^j) - p\gamma(1-t^j)]RH^j + PEN^j(i_f(1-penc) + \mathrm{E}(i_c)\,penc) \end{aligned} \tag{29}$$

where L^j equals labor income of household j; Y^j_{inf} equals inframarginal income of household j attributable to the average tax being below the marginal tax rate; a_c^j, a_n^j, and a_{rh}^j are the percentage of the return to corporate equities, noncorporate equity and rental housing equity, respectively, included in taxable income; PEN^j is the pension and IRA holdings of household j; and $penc$ is the share of pensions and IRAs held in corporate equity.

The after-tax variance for corporate equity, noncorporate equity, rental housing equity, tax-exempt bonds, and owner-occupied housing, respectively can be written as

$$VARC^j = h_c^j \sigma_c^2 \left[C^j(1-a_c^{*j} t^j) + PEN^j\, penc + Ct_c^{\mathrm{var}} GS^j \right]^2, \tag{30.1}$$

$$VARN^j = h_n^j \sigma_n^2 \left[N^j(1-a_n^{*j} t^j) + Nt_n^{\mathrm{var}} GS^j \right]^2, \tag{30.2}$$

$$VARRH^j = h_{rh}^j \sigma_{rh}^2 \left[RH^j(1-a_{rh}^{*j} t^j) + RHt_{rh}^{\mathrm{var}} GS^j \right]^2, \tag{30.3}$$

$$VARE^j = h_e^j \sigma_e^2 \left[E^j(1-a_e^{*j} t^j) + Et_e^{\mathrm{var}} GS^j \right]^2, \tag{30.4}$$

$$VAROH^j = h_{oh}^j \sigma_{oh}^2 OH^j, \tag{30.5}$$

where t_c^{var}, t_n^{var}, t_{rh}^{var}, and t_e^{var}, equal the weighted average tax rates on the variance of corporate equity, noncorporate equity, rental housing equity and tax-exempt bonds, respectively. The t_c^{var} term includes the effect of the corporate tax rate and the t_e^{var} term accounts for capital gains taxation of tax-exempt bonds. The h terms are asset and household specific risk-aversion parameters, or hassle factors. The a_c^{*j}, a_n^{*j}, a_{rh}^{*j}, and a_e^{*j}, terms represent the share of variance from corporate equity, noncorporate equity, rental housing equity and tax-exempt bonds, respectively, that is included in taxable income.

The uncertainty in returns to taxable risky assets implies that the government revenue stream is also uncertain. In order to keep the level of public expenditure unchanged, the variance in Federal government revenue is transferred back to households. In other words, any variance in federal revenue must result in an equal amount of aggregate variance in the net after-tax and after-transfer income of households. The model handles this by creating a new variable with a mean of zero and total variance equal to the variance of the government revenue stream. The last term in equations (30.1-30.4) represent each household's share of variance of the government revenue stream attributable to that asset, where GS^j equals the household's share of total labor income.

Total variance of after-tax income of household j, adjusted for j's asset-specific risk preferences is simply the sum of equations 30.1 through 30.5:

$$\sigma_Y^{2j} = VARC^j + VARN^j + VARRH^j + VARE^j + VAROH^j. \tag{31}$$

Demand equations for each asset can then be derived by substituting equations 29 and 31 into equation 26, differentiating with respect to household j's shares of the risky assets and setting the results equal to zero, subject to the constraints in equations 27 and 28. The asset demand equations for corporate equity, noncorporate equity, rental housing equity, tax-exempt bonds and owner-occupied housing are given below (dropping the expectations notation):

$$C^j = \frac{(1-a_c^j t^j) i_c - (1-b^j t^j) i_f - m_1^j m_2^j h_c^j (1-a_c^{*j} t^j) Ct_c^{\text{var}} GS^j \sigma_c^2}{m_1^j m_2^j h_c^j (1-a_c^{*j} t^j)^2 \sigma_c^2}, \tag{32.1}$$

$$N^j = \frac{(1-a_n^j t^j) i_n - p\gamma(1-t^j) - (1-b^j t^j) i_f - m_1^j m_2^j h_n^j (1-a_n^{*j} t^j) Nt_n^{\text{var}} GS^j \sigma_n^2}{m_1^j m_2^j h_n^j (1-a_n^{*j} t^j)^2 \sigma_n^2}, \tag{32.2}$$

$$RH^j = \frac{(1-a_{rh}^j t^j) i_{rh} - p\gamma(1-t^j) - (1-b^j t^j) i_f - m_1^j m_2^j h_{rh}^j (1-a_{rh}^{*j} t^j) RHt_{rh}^{\text{var}} GS^j \sigma_{rh}^2}{m_1^j m_2^j h_{rh}^j (1-a_{rh}^{*j} t^j)^2 \sigma_{rh}^2}, \tag{32.3}$$

$$E^j = \frac{(1-a_e^j t^j) i_e - (1-b^j t^j) i_f - m_1^j m_2^j h_e^j (1-a_e^{*j} t^j) Et_e^{\text{var}} GS^j \sigma_e^2}{m_1^j m_2^j h_e^j (1-a_e^{*j} t^j)^2 \sigma_e^2}, \tag{32.4}$$

$$OH^j = \frac{i_h^j - (1 - b^j t^j)(i_f + p)}{m_1^j m_2^j h_h^j \sigma_h^2}. \tag{32.5}$$

Examination of these equations reveals that the demand for each risky asset is positively related to the difference between the assets expected after-tax return and the after-tax return to taxable bonds and is inversely related to the after-tax variance. The final term in the numerator for the first four assets represents the covariance of the return on the asset with the return on government transfer.

Capital Gains Taxes and Setting Inclusion Factors

The model explicitly accounts for two sources of efficiency loss that stems from taxing capital gains at realization instead of upon accrual. First, taxpayers are encouraged to delay realizations in order to reduce the real burden of the capital gains tax. This "lock-in" effect can lead to investors holding sub-optimal portfolios as taxes influence the decision of when to sell. Second, investors have an incentive to invest too much in assets that produce lower taxed capital income, rather than ordinary income, and to undergo transactions costs to transform ordinary income into capital income. One prominent example of this type of conversion is the substitution of corporate retained earnings for dividend payments. Several studies have found the dividend tax penalty, measured as the difference between the weighted average dividend and capital gains tax rates, to be a significant determinant of dividend payout rates.[3]

It is assumed that the demand for realizing gains as a percentage of accruals declines with the capital gains tax rate. The specific functional form characterizing the demand for realizing gains is written

$$rr_k^j = \exp\left(k_{0_k} - \frac{g^j}{g_k'}\right), \tag{33}$$

where *rr* is the realization rate of gains as a percentage of accruals for household *j* regarding asset *k*, k_0 is an asset-specific constant ($k_0 < 0$), *g* is the marginal tax rate on realized gains for household *j*, and *g´* is the revenue maximizing tax rate on capital gains for asset *k*.

Tax revenue per dollar of accrued gain is simply *grr*. The total tax burden per dollar of accrual (*grr**) is the area under the *rr* demand curve between 0 and *g*, which includes the explicit tax revenue plus the implicit tax due to the distorting effect of the gains tax on realizations. This is expressed as

$$grr^* = grr\left[\exp\left(\frac{g}{g'}\right) - 1\right]\left(\frac{g}{g'}\right). \tag{34}$$

[3] For a recent example, see Poterba (2004).

For simplicity only one dividend payout equation is specified for all corporations.

$$\text{PAYOUT}_c = \exp(c_0 + c_1 \text{DIVCOST}), \tag{35}$$

where PAYOUT is the ratio of corporate nominal earnings that are paid as dividends, c_0 and c_1 are constants and DIVCOST = DIVMTR – AVGGRR*, where DIVMTR is the average marginal tax rate on dividends and AVGGRR* is the average marginal tax rate on retained earnings including implicit taxes. These average tax rates include the portion of shares held by pension funds, where the marginal tax rate is assumed to be zero.

The utility loss that comes from a sub-optimal dividend payout ratio is represented as the area under the payout curve between 0 and DIVCOST, which is written as:

$$\text{UL} = -\frac{\exp(c_0)}{c_1}[1 - \exp(c_1 \text{DIVCOST})] - \text{DIVCOST} * \text{PAYOUT}_c . \tag{36}$$

The inclusion rate for corporate equity in the demand equation (32.1) includes the implicit taxes described above:

$$a_c t = (\text{PAYOUT}_c)t + (1 - \text{PAYOUT}_c)grr * + \text{UL} . \tag{37}$$

The inclusion rate for tax revenues ignores implicit taxes.

$$a_c t = (\text{PAYOUT}_c)t + (1 - \text{PAYOUT}_c)grr . \tag{37.1}$$

The inclusion rates for noncorporate and rental housing businesses are similar, except that all recorded noninflationary earnings are paid out. However, the payout rate generally falls below one because inflationary gains are deferred and the recording of some real earnings is deferred due to favorable tax provisions such as accelerated depreciation. The payout rate for noncorporate and rental housing businesses is

$$\text{PAYOUT}_n = \frac{i_n - \pi - (d_n^t - d_n)}{i_n}, \tag{38.1}$$

$$\text{PAYOUT}_{rh} = \frac{i_{rh} - \pi - (d_{rh}^t - d_{rh})}{i_{rh}}, \tag{38.2}$$

where $d^t - d$ is the difference between the geometric-equivalent tax depreciation rate (at replacement cost) and the economic depreciation rate.

The inclusion factors for the demand for noncorporate and rental housing businesses can be expressed as:

$$a_n t = (\text{PAYOUT}_{\text{n}})t + (1 - \text{PAYOUT}_{\text{n}})\,grr^{*}. \tag{39}$$

$$a_{rh} t = (\text{PAYOUT}_{\text{rh}})t + (1 - \text{PAYOUT}_{\text{rh}})\,grr^{*}. \tag{40}$$

Again, the inclusion rates for tax revenue have the same form, but *grr* replaces *grr**.

3. Calibration of the Model

The following briefly describes the steps taken to calibrate the base case for the PA model.

Division of taxpayers into household cells

The first task was to divide taxpayers into cells, based on labor and capital income rankings derived from tax return data reported in the Statistics of Income (SOI) 1998 final individual file. Dependent filers were dropped from the sample. Labor income was determined from the following equation using data from lines 7, 12 and 18, respectively, of the 1998 1040, and lines 28a and 28b of Schedule E;

$$\text{labinc} = \text{wages} + 0.53*\text{schc} + 0.56*\text{schf} + 0.53\text{actpart} \tag{41}$$

Capital income was equal to

$$\begin{aligned}\text{capinc} = {} & \text{inttax} + \text{inttaxex} + \text{div} + 0.47*\text{schc} + \text{stcapgain} + 0.11*\text{ltcapgain} + \alpha*\text{othgain} + \\ & \beta*\text{taxira} + \beta*\text{taxpen} + \text{scheoth} + 0.47\text{actpart} + 0.44*\text{schf},\end{aligned} \tag{42}$$

which comes from lines 8a, 8b, 9, 12, 13 (lines 7 and 16 on Schedule D), 14, 15b, 16b, 17 (Schedule E line 28a and b) and 18, respectively, of the 1040. The ratios used to split Schedule C, E and F income are based on how the Panel Study of Income Dynamics survey split business earnings to capital and labor, which reflects reported hours of labor. However, even that split is mostly arbitrary. Partnership income that is deemed to include a labor component (actpart) is split using the Schedule C ratio. All other Schedule E income, including passive partnership income, is assumed to be entirely capital income.

One challenge is determining how much of the amounts listed under capital gains and other gains should be considered as annual capital income. Internal Revenue Service (2002) provides data on holding periods for capital asset transactions. The weighted average holding period for long-term transactions was calculated to be just under 9 years. Consequently, the average annual return on reported long-term capital gains is set at 1/9 = 0.11. An estimate for other gains was not known and the estimate for the annual percentage of long-term capital gains was used (α = 0.11). However, nothing is done to impute accrual of gains to those households that have gains but did not realize any in the current year.

Similar issues arise for the treatment of pension and IRA distributions. The annual return to wealth held in tax-deferred accounts is not determinable from the taxable or non-taxable distribution. Also, there are many taxpayers with tax-deferred wealth, but do not have a distribution in 1998. There appears to be two main options: (1) ignore IRA and pension

distributions in the calculation of capital income (β =0); or (2) set β equal to a reasonable estimate of relationship between pension distribution and current account earnings. For example, assuming that the account balance is drawn down to zero over 20 years in equal annual payments and the real rate of return is equal to 6 percent, then on average, account earnings are approximately 42 percent of pension distributions. This estimate varies with the rate or return and the years of retirement. As a rough guess, β is set equal to 0.25 to lessen the difference between taxpayers that have tax-deferred wealth but do not have distributions and those that have distributions.

Taxpayers were then divided into labor and capital income groups using the absolute value (by source) of capital income. There are 49 household cells resulting from capital and labor income pairs. The cell division is unequal according to percentile ranking to include more cells of higher income and wealthier taxpayers and less of taxpayers with little wealth or income. For example the lowest capital income group includes the bottom half of households, while the top capital income group includes only the higher 1 percent of households. At times the choice of percentile cutoffs reflected a desire to prevent any cell from becoming too sparse.

Each cell was assigned the average labor income, transfer income, income adjustments and asset holdings for that cell. For calculating tax rates in the simulation program, each cell was further divided into the portion of taxpayers that file under the single, married filing jointly and head of household filing statuses.

To calculate tax liability in the program, transfer income, which equals

$$\text{traninc} = \text{refund} + \text{alimony} + \text{taxpen} + \text{taxira} + \text{unecomp} + \text{otherinc} + \text{taxssb}, \tag{43}$$

(lines 10, 11, 15b, 16b, 19, 20b and 21) is added to labor income. With the exception of the taxable portion of social security benefits, this total is fixed in the program, to which the taxable portion of capital income that flows from the portfolio holdings for each cell is added.

Assigning portfolio shares

The portion of each assets held by each cell were assigned using tax return data supplemented by information from the 1998 Survey of Consumer Finances (SCF). The choice was made to use tax return data when possible due to the smaller sample size in the SCF (147,738 vs 3903 unweighted observations), and the uncertainty surrounding both the reported income and wealth totals in the SCF.

However, tax return data does not provide enough information to assign owner occupied housing, consumer durables, or pension and IRA holdings. The household units in the SCF were divided into labor and capital income groups using a procedure similar to the one outlined above for the SOI, with modifications as described below.

There appeared to be substantial underreporting of income by source for some households in the SCF. For example, capital income would be zero, but large stocks of interest income bearing financial assets, such as bonds and CD's were also reported. For those households who reported

zero capital income, rates of return were imputed to certain financial assets to calculate a new level of capital income. This reduced the portion of households who reported zero capital income from 50 percent to 20 percent, compared to 30 percent for the SOI file. It is also likely that there are households which report positive capital income, but underreport that income. No correction was made in those circumstances.

Households that reported zero labor income and capital income, but positive total income, were assigned labor income equal to total income minus capital income (imputed) minus other income. In addition, to enhance the conformability of the two data sets, all households that did not report filling out a tax return were dropped from the sample. Households in the SCF were then divided into cells based on capital and labor income.

The following table describes how the portion of each asset held by a household cell was calculated.

Asset	**Household cell share of aggregate asset total in proportion to:**
Taxable Bonds	Taxable interest income reported in SOI file.
Tax-exempt Bonds	Tax-exempt interest income reported in SOI file.
Corporate Equity	Dividends reported in SOI file.
Non-corporate Equity	Absolute value of sum of income reported on Schedule C, Schedule F and lines 31 and 39 of Schedule E.
Rental Housing	Income reported on line 3 of Schedule E.
Housing	Average housing value reported in the SCF.
Consumer Durables	Average vehicle value reported in the SCF.
IRAs	Average value of IRAs reported in the SCF.
Pensions	Average value of defined contribution and defined benefit plans reported in the SCF (note: DB plan data is underrepresented).
Liabilities	
Mortgage Debt	Average value of mortgage debt reported in the SCF.

There are several potential problems with this approach: (1) using income flows assumes that rates of return are constant across income groups; (2) dividends reported on the tax form include interest earned through mutual funds; (3) there may be clientele effects in corporate stock ownership with high dividend paying stocks disproportionately owned by lower rate taxpayers; (4) there may be important composition differences between the cells formed using tax return data and the SCF. Most of these problems are not likely to be large when evaluating the aggregate economic effects of tax reform, but they may be more important when looking at the effects on particular income groups. To test this importance, new portfolio shares will be found using only SCF data to see if different initial asset holdings have a significant effect on the economic results, but this has not been done yet.

Aggregate capital stock and asset values

The value of capital in each sector and corresponding assets were derived for 2001 from the *Flow of Funds Accounts of the United States* (FOF) released by the Federal Reserve and the Fixed Assets Tables (FAT) produced by Bureau of Economic Analysis. Physical assets were

valued at replacement cost. Both the FOF and the FAT include S-corporations in the corporate sector, but for the sake of this model capital owned by S-Corporations is included in the non-corporate sector as these firms receive pass-through tax treatment similar to partnerships or sole proprietorships.

The market value of financial securities held by the household sector was greater than the replacement cost of physical capital in the corporate sector as reported in the FOF. For the model, the value of corporate debt plus equity was set equal to the value of physical capital in the corporate sector. Other asset values, such as government bonds were scaled down by the same factor. The capital stock in the state and local sector was set equal to the scaled down value of municipal securities outstanding.

The division of pension accounts into debt and equity result from calculations using the FOF. For these calculations, miscellaneous assets held in pension accounts were disregarded. The total for pension accounts includes FOF totals for certain life insurance reserves, private defined benefit plans, private defined contribution plans, and state and local pension funds. IRAs are assumed to hold the same ratio of debt and equity as private pension plans. For the purpose of the model, IRAs and private pension funds are combined, that is the amount of assets held in IRAs and pension is held fixed, but a separate objective function determines the optimal mix of debt and equity held in such accounts assuming a marginal tax rate of zero.

Parameter values

Table 1 lists initial parameter values for both exogenous and endogenous variables. Variances and initial rates of returns for each asset type were set to hit historical averages as calculated by Ibbotson (2000). The real rate of return on corporate bonds was set to 4 percent and the rates of return to other assets were calculated by adding a risk premium. Lacking a reliable empirical estimate for the return to rental housing, the initial values was set to generate a reasonable return to owner-occupied housing in the initial equilibrium.

The corporate taxable inclusion rate is set to 0.71, which reflects the acceleration of depreciation deductions compared to economic depreciation. This implies an effective corporate tax rate of 25 percent. Initial individual tax rates and brackets follow 2000 tax law, with marginal rates of 15, 28, 31, 36 and 39.6. The initial capital gains rates are set at 10 and 20 percent.

The nominal dividend payout rate was calculated to hit the average payout rate for C-corporations from 1996-2000. This payout rate separates distributions from S-corporations from reported data in the NIPA account using tax return data.

When evaluating changes to dividend taxation, the issue of whether firms follow the new or traditional (old) view of dividend taxation significantly influences the expected outcomes. The old view predicts that taxes on dividend payouts matter and affect the corporate cost of capital and the payment of dividends. On the other hand, the new view predicts that investment is financed with retained earnings and that dividends are paid as a residual. This implies that the dividend tax rate does not influence the dividend payout ratio or corporate investment decisions. There has been considerable debate in the empirical literature regarding which theory holds in

practice.[4] A recent paper by Auerbach and Hasset (2003) suggests that the market is segmented into different groups of firms, with one group behaving in a manner consistent with the new view, where retained earnings are the likely source of marginal investment funds. Another group of firms, where new share issues are more prevalent, behave in a manner more consistent with the old view. Following Carroll, Hassett and Mackie (2003), I assume in the base case that 50 percent of the firms are old view and 50 percent are new view. Results are also presented assuming that all firms follow the old view.

The dividend payout response parameter, c_1 in equation 35 is set to -4.0 in the base case. This implies an elasticity of dividend payouts with respect to the weighted average of the after tax return to dividends divided by the after tax return to capital gains of 3.1. For the moderate response case, c_1 equal -2.0 which implies a dividend payout elasticity of 1.4. These values are consistent with the long-run dividend payout elasticity estimated by Poterba (2004). Initial work on the effect of JGTRRA's reduction in dividend tax rates on dividend payouts by Chetty and Saez (2004) also finds a statistically significant response.

Given the empirical controversy surrounding the value of the long run capital gains realization elasticity, results are also provided with high and moderate parameter values.[5] The realization elasticity for corporate stocks is set higher than that for assets held in the rental housing and noncorporate sectors. For the high response case, the revenue maximizing gains rate for stocks is set at 20 percent and for other assets 30 percent. This implies a realization elasticity of 0.75 for corporate stocks and 0.5 for other assets for high income households under JGTRRA tax law. In the moderate response case, the realization elasticities are set to 0.43 and 0.28, respectively.

Solving the Model

The initial solution essentially consists of solving for utility and production function parameters to hit the given targets. This involves setting risk aversion parameters for each household consistent with their given portfolio shares and tax bracket. Moving to a new tax structure will change the after-tax returns on assets and households will desire a new portfolio mix. The model then solves for new rates of return that will clear each market. This process is complicated by the use of statutory tax schedules that are not continuous, which leaves the possibility of corner solutions. However, the model does abstract from complicated phase-outs such as PEP and Pease for exemptions and itemized deductions and from the AMT.

The first corner solution involves the decision whether to itemize deductions. For households with negative taxable bonds, whether the after-tax or pre-tax rate of return is used for other asset demand calculations depends on the itemization status. Each household cell has a fixed amount of itemized deductions other than interest. For many cells, the amount of other itemized deductions is greater than the standard deduction and the cell is always an itemizer. For other cells, itemization status depends on the amount of interest deductions, which depends on issuance of taxable bonds to finance home ownership. It is possible for the after-tax return on taxable bonds under the itemization status to lead to wealth holdings that would imply fewer interest deductions than needed to be an itemizer. Similarly, for that same cell using the pre-tax

[4] See Zodrow (1991) and Auerbach (2002) for reviews of the literature.
[5] See Poterba (2002) and Zodrow (1993) for reviews of the literature.

rate of return on taxable bonds could imply wealth holdings that would lead to itemization. The solution algorithm handles this problem by calculating the after-tax rate of return on taxable bonds that would make the cell just indifferent to itemization.

The second corner solution occurs when a cell is right at the border of a change in marginal tax rates. The wealth holdings and corresponding capital tax income given after-tax rate of return using the upper tax rate implies taxable income in the lower tax bracket. But wealth holdings and capital tax income at the lower marginal tax rate implies taxable income in the upper tax bracket. The model deals with this by finding the marginal tax rate which would keep the cell at the bracket change income amount. This becomes the marginal tax rate for the household, rather than the statutory rate, for behavioral purposes. In this model where time is not explicitly modeled, a household in this situation can be thought of as a taxpayer that moves back and forth between two marginal tax brackets over time.

4. Model Results

JGTRRA as Reference Tax Law

As described above, the model uses portfolio shares for 2001 and individual tax rates and brackets consistent with 2000 tax law when calibrating household and pension asset demand functions. The model then solves for a new equilibrium assuming that individual tax rates and brackets are equal to those in 2005 as set forth by JGTRRA. Note that this is a long-run equilibrium and that even if the shifts in capital allocation predicted by the model were accurate, it would likely be a few more years before all the shifting would be completed. Individual ordinary tax rates are set to 10, 15, 25, 28, 33 and 35 percent and dividends and capital gains are taxed at rates of 5 (for taxpayers in the 10 and 15 percent ordinary brackets) and 15 percent. The standard deduction and the 10 and 15 percent rate brackets for joint returns are twice that for single returns, which reflects the marriage penalty correction. The model does not account the temporary bonus depreciation enacted by the Job Creation and Worker Assistance Act of 2002 or the manufacturing deduction and other changes enacted by the American Jobs Creation Act of 2004.

The shares of nominal income, individual income taxes, individual tax returns and wealth by nominal income class are reported in Table 2. Nominal income equals earnings from labor and financial assets (whether realized or not) and includes transfers included on the tax return. The imputed returns to housing and consumer durables are not included. The nominal income class for each cell is determined in the initial equilibrium. This table indicates that income, individual income taxes and wealth are greatly skewed toward the top of the income distribution. For example, households with nominal income greater than $500,000 (in 2001 dollars) account for only 1.1 percent of individual tax returns, but account for 14.5 percent of nominal income, 25.3 percent of individual income taxes and hold over a quarter of the nation's wealth.

Table 3 lists the share of each asset according to nominal income class. Caution should be used when interpreting the taxable bond shares. Taxable bonds are the only assets that households can hold negative amounts (mortgage debt) and only net amounts are reported by each cell. The positive taxable bond column only includes taxpayer cells that hold, on net, a positive amount of

taxable bonds. The negative taxable bond column only includes taxpayer cells that hold, on net, a negative amount of taxable bonds. The holdings of positive taxable bonds, corporate equity, tax-exempt bonds and non-corporate equity are skewed toward the upper income groups. Holdings of negative taxable bonds, owner-occupied housing, consumer durables, and pensions are skewed towards the lower and middle income groups. Rental housing equity is fairly evenly distributed with a slight skew towards upper middle income groups.

The rates of return for different assets and the allocation of physical capital across production sectors under JGTRRA are listed in Tables 4 and 10, respectively.

Increasing the Top Rate from 35 to 40 Percent

The first reform experiment that I examine is an increase in the top marginal tax rate on ordinary income from 35 to 40 percent. This will increase the taxation of taxable bonds, rental housing equity and non-corporate equity for those in the highest tax bracket, but it will not increase the taxation of corporate equity as tax rates on dividends and capital gains are held at 15 percent.[6] Tables 4 and 5 summarize the economic effects of this tax change. As would be expected physical capital moves out of the non-corporate sector and into the corporate sector.[7] Households shift into tax-exempt bonds and corporate equity and out of taxable bonds. As this drives up the return to taxable bonds and decreases the return to corporate equity, pensions shift out of equity and into bonds. Perhaps unexpectedly, taxpayers shift out of household capital (owner-occupied housing and consumer durables).

An examination of asset changes by income classes listed in Table 6 provides further insight into the nature of the portfolio shifting. The increase in the top marginal rate reduces the after-tax return to taxable bonds, which leads these taxpayers to shift out of taxable bonds as the demand for all other assets increases. The total affect on the demand for rental housing and non-corporate business is theoretically ambiguous for the highest income class. The lower opportunity cost and the reduction in after-tax variance increase demand, while the higher taxation of the return would reduce demand. In equilibrium, the highest income brackets actually increase their holdings of rental housing and non-corporate equity, even though the tax on the return to these assets has increased.

In addition, the demand for these assets will depend on before-tax rates of return, which adjust to bring markets back into equilibrium. As the highest income class shifts out of taxable bonds, this drives up the before-tax rate of return on these bonds. This increases the opportunity cost of funds to other income groups and leads other income groups to lower their demand for all other assets. An exception to this pattern is households with nominal income between $75,000 and $100,000. These households increase holdings of all risky assets except tax-exempt bonds. This is likely due to a switch in itemization status. If a cell switches from becoming a non-itemizer that holds negative bonds to an itemizer, then the risk-free return switches from the before-tax rate to the after-tax rate. This would lead to an increase in the demand for other assets.

[6] The simulations for this paper assume that all corporate dividends qualify for the lower dividend tax rate.
[7] The percentage changes reported in Table 5 are as a percent of total physical capital or total wealth. The changes reported in Table 6 are as a percent of the asset held by that income class. Other tables in the paper follow a similar format.

What are the revenue implications of this asset shifting? Table 7 compares the static revenue estimate with the "dynamic" revenue estimate.[8] The static estimate keeps assets and rates of return at JGTRRA levels and calculates the gain in tax revenue associated with raising the top marginal rate. The dynamic estimate recalculates the change in revenue after portfolios are allowed to shift. Only the top two income classes have any households in the top marginal rate bracket as indicated by the static revenue loss of 0.6 percent for the next to highest income group and a loss of 6.1 percent for the highest group. All of the income groups face a dynamic revenue change, although for most groups the change is negligible. The dynamic estimates as a percentage of the static estimates are 60 and 87 percent for the next to highest and highest income group, respectively. For total individual revenues, the dynamic estimate is 91 percent of the static. This reflects that other income groups, on net, pay more taxes after portfolio adjustments as a result of shifting out of other assets and into taxable bonds.[9]

Increasing Ordinary, Dividends and Capital Gains Tax Rates

The next set of experiments will examine the economic and revenue effects of mostly undoing the reduction in marginal rates accomplished through the passage of EGTRRA and JGTRRA. To better clarify the effects of each type of tax rate change, results will be presented separately for the increase in ordinary, dividends and capital gains tax rates.

First, the 10, 15, 25, 28, 33, 35 percent individual tax brackets now become 15, 15, 28, 31, 36, 39.6 percent, respectively. However, the standard deduction and bracket sizes for joint returns are not changed, as this would make it more difficult to compare static and dynamic revenue changes.

A summary of the economic effects of increasing ordinary tax rates compared to JGTRRA are found in tables 8 through 11. The directions of the aggregate changes are quite similar to the changes due to increasing just the top marginal rate. Again capital moves out of the household and non-corporate sectors and into the corporate and state and local sectors. Also, households shift from taxable bonds into corporate equities and tax-exempt debt, while pensions shift out of equities into debt. The magnitudes, not surprisingly, are generally larger when more of the rates are increased, but the pattern of change across income groups is different.

For taxpayers that face the after-tax rate of return on taxable bonds, itemizers and those with net positive taxable bond holdings, the increase in the before-tax rate of return of 18 basis points is more than offset by the increase in marginal tax rates so that the after-tax rate of return to the risk-less asset falls. This leads to an increase in demand for other assets and a switching out of taxable bonds. This pattern characterizes most households with more than $75,000 in nominal income as indicated by Table 12.1. For households in the 15 percent bracket under JGTRRA that remain in the 15 bracket and for households who are not itemizers but have negative taxable

[8] As described above, this estimate does not allow for aggregate factor supplies to change and hence the use of the term "dynamic" is a bit of a misnomer with regard to how the term has been used lately.

[9] The revenue implications of other types of shifting could also be examined, such as the movement of capital out of non-corporate sectors and into the corporate sector or the decline in the corporate debt-capital ratio on corporate receipts. The methodology for estimating the revenue effects of these shifts will be discussed in the next section.

bonds, the before and after tax rate of return to taxable bonds increases, hence these households shift away from other assets and towards taxable bonds.

At the aggregate level, the primary net shift is from taxable bonds into corporate equity and to a lesser extent, tax-exempt bonds. The increase in the rate of return to bonds leads corporations to lower the debt-capital ratio by 0.6 percentage points. There is very little change in the dividend payout rate.

Somewhat surprisingly, Table 13 indicates that the dynamic revenue estimates are nearly equal to the static estimates, 98 percent on aggregate. There are several reasons why the behavioral responses lead to little change in revenue. First, since all rates but the 15 percent rate are increased, much of the revenue gain is inframarginal. Second, changes in the rates of return work to offset much of the portfolio shifting. For example, an increase in the interest rate on taxable bonds shifts taxable income from lower income groups (net borrowers) to upper income groups (net lenders). Third, compared to the previous experiment where only the top rate was raised, the gain for the highest income group to move into a lower tax bracket are reduced as the rate on that bracket has been increased from 33 to 36 percent. Fourth, the increase in the before tax return on taxable bonds increases the income from federal bonds which are held fixed.[10]

Another issue to explain is why for some middle income groups, those with incomes between $50,000 and $100,000, the dynamic estimate is actually higher than the static estimate. It is possible that this is partly explained by a switch in itemization status. A cell that became an itemizer would be faced with a lower opportunity cost and would increase holding of other assets including taxable assets. This higher gross income would be partially offset by use of more interest deductions, but the value of these would be reduced to the extent the standard deduction exceeded the value of potential itemized deductions under JGTRRA tax law.

Next, the preferential rates on dividends are removed so that dividends are taxed at ordinary rates. Again the economic effects of this change are summarized in Tables 8 through 11. Not surprisingly, Table 9 shows a relatively large decline out of corporate stock (1.19 percent of total wealth) and a large shift out of physical capital out of the corporate sector (0.61 percent of total physical capital). The decline in corporate stock held by households is larger than the decline in physical capital in the corporate sector because pensions increase stock holdings and corporations shift towards debt financing, as indicated by the debt-capital ratio increasing by 1.1 percentage points. Most of the decline in corporate capital is offset by increases in household capital, especially consumer durables. Also, the nominal dividend payout rate falls by 5.5 percentage points.

As indicated by Table 12.2, the pattern of portfolio shifting across income groups is fairly consistent. Most households shift out of corporate equity and into other assets. The primary

[10] The revenue estimates presented in this paper abstract from the spending impact of changes in interest payments on federal debt. This is done for a couple of reasons, (1) the model does not include an estimate of change in the stock of federal debt; and (2) the model only includes federal debt held by households and ignores debt held by the Federal Reserve, state and local governments and foreigners.

exception is households with incomes between $75,000 and $100,000, who decrease holdings in rental housing, non-corporate businesses, owner-occupied housing and consumer durables.[11]

Table 13 shows that on average, the dynamic revenue estimate is 78 percent of the static estimate. This amount tends to increase over the income distribution, with the percentage increasing from 67 percent for the next to lowest income group to 81 percent for the highest income group.[12] The lower dynamic estimate primarily stems from corporations responding to the higher dividend tax rate by decreasing dividend payouts so that a higher portion of the corporate payout would be taxed at lower capital gains rates.

To determine the portion of revenue change attributable to the dividend payout elasticity, the same experiment was conducted with the dividend payout elasticity essentially set equal to zero.[13] The dynamic estimate in this case now becomes 94 percent, suggesting that approximately 73 percent of the decline in revenues in the dynamic case was attributable to the dividend payout rate. The remaining decline is due to portfolio shifting as households move out of corporate equity and into other assets.

Furthermore, if all firms are assumed to be old view firms and the high response parameters are kept, Table 15 shows that this increases the behavioral response so that only 64 percent of the static revenue estimate is realized. If the all firms are old view, but the dividend payout response parameter is lowered from -4.0 to -2.0, then the dynamic estimate is 77 percent of the static estimate, which nearly equals the new view base case.

The final experiment is to increase capital gains tax rates from 5 to 10 percent for those in the 15 percent ordinary tax bracket and from 15 to 20 percent for those in higher tax brackets. The higher taxation of corporate and non-corporate capital leads to a shift of physical capital out of these sectors, primarily into owner-occupied housing and to a lesser extent into consumer durables and the state and local sector. Households also shift out of holding corporate equities and into taxable and tax-exempt bonds. As seen in Table 12.3, the pattern of shifting is mostly consistent across the income classes.

Under the base case high response parameters, the dynamic estimate is only 32.6 percent of the static estimate. The range across the income groups, excluding the bottom group, is between 25 and 57 percent.

The two main parameters that govern the dynamic response to an increase in capital gains tax rates in the model is the gains realization elasticity and the dividend payout elasticity. If increasing the capital gains tax rates leads households to reduce their realization of gains, then only a portion of the static estimate will be realized in the dynamic case. For elasticities greater than one, the sign of the revenue change can even be different in the dynamic case. However, as the effective tax rate on gains increases, this will lead corporations to increase dividend payouts.

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[11] As mentioned above, this sort of behavior may be explained by a switch in itemization status.

[12] Most of the discussion in this paper ignores the bottom income group because they hold little wealth and pay little in income taxes. The percentage changes are often substantially different from other income groups due to the large number of taxpayers with a marginal tax rate of zero.

[13] Setting the parameter equal to zero would result in a division by zero.

The impact of the dividend payout elasticity in muting the revenue impact of the capital gains response can be seen by examining the summary results of the sensitivity analysis presented in Table 15. Using the same high response parameters for the dividend payout rate and the capital gains realization elasticity, but then assuming that all corporations are old view firms, rather than half new view, raises the dynamic revenue ratio to 40 percent, as firms are more willing to increase dividend payouts.

If the revenue maximizing gains tax rate for corporate stock is set to 0.35 and the revenue maximizing rate for non-corporate and rental housing businesses is set to 0.55, while the dividend payout parameter is cut in half, then the dynamic estimate of increasing the capital gains tax rate in this moderate response case is 56 percent of the static estimate.

Evaluating the Total Response

Now that each part of the reform has been looked at in isolation, we can examine the total effect. The last section of Table 13 indicates that the static individual revenue estimate from increasing ordinary marginal rates, taxing dividends at ordinary rates and raising the capital gains rates to 10 and 15 percent should be reduced by about 10 percent, after accounting for the behavioral responses included in this model. The total behavioral responses tend to increase with income, but excluding the bottom group the range is fairly narrow, between 3 and 12 percent. The higher total responses from upper income groups stems from the relative importance that capital income has for those groups so that the dividend and capital gains responses carry relatively more weight than the ordinary rate changes.

Table 15 provides summary information of the revenue implications of changing the behavioral response parameters for dividends and capital gains. Assuming that all corporations follow the old view of dividend behavior implies the total static estimate should be reduced by 14 percent. Maintaining the old view assumption and reducing the capital gains realization and dividend payout elasticities lowers this estimate to 9 percent. As discussed above, these parameters have rather large effects on dividends and capital gains estimates, but the overall effect is muted given the relatively large amount of revenue attributable to the increase in ordinary tax rates. The estimates for the behavioral response to the increase in ordinary tax rates are essentially unchanged under the different behavioral parameter assumptions.

The discussion so far has ignored a potentially important component to measuring the total revenue impact of these tax changes, the effect on corporate revenues. There are several important ways that corporate tax revenues could be affected due to the reforms discussed in this paper, although the corporate tax structure is being held constant. First, corporations could alter their debt-capital ratio. Second, businesses could alter their organizational form between C-corporations and entities that receive pass-through tax treatment such as S-corporations, partnerships and sole proprietorships. Third, physical capital could move out of the corporate sector into non-taxed sectors such as owner-occupied housing. Fourth, labor compensation could switch between wages and other forms of compensation, such as stock options.[14] Only the first issue directly impacts corporate tax revenues in the model and the latter issue is beyond the

[14] For further discussion of these issues see Gordon and Slemrod (2000).

scope of the model. For the second and third issues, the model certainly produces estimates of changes in the allocation of capital between the corporate, non-corporate and household sectors; however, the assumption of Cobb-Douglas production functions implies that no income is being shifted as the rate of return adjusts to maintain constant income shares.

This implies that additional assumptions and off-model calculations need to be made in order to provide an estimate of the effect of shifting capital in or out of the corporate sector. A sample calculation for the total change from JGTRRA tax law to the increased ordinary, dividends and capital gains tax rates for the corporate sector follows. First, the model calculates that corporate tax payments decline by 0.5 percent due to the increased use of interest deductions. This reflects the greater use of debt to finance corporate capital, but also the decline in the corporate capital stock.

Second, the corporate capital stock declines by 2.16 percent, mostly due to the increase in dividend taxation. The non-corporate capital stock also declines, which implies that this capital is absorbed by the untaxed owner-occupied housing, consumer durables and state and local sectors. Adjustments to the capital stock are likely to occur rather slowly through time and it is assumed that only 60 percent of the adjustment occurs by the end of the budget window. Valuing the decline in corporate capital at the midpoint of the nominal return to corporate capital between the two tax regimes, 14.82 percent, implies a decline in corporate income of 1.3 percent.

These two changes together imply that corporate revenues would decline by 1.8 percent. Subtracting this from the previous estimate of the dynamic revenue change lowers the dynamic estimate as a percentage of the static from 90.4 to 87.2 percent. If the assumption is made that all of the shift out of corporate capital is made within the budget window, then the percentage would become 85.6. This illustrates the potential importance of including corporate revenue effects. Similar calculations could be made for the effect on individual tax revenues due to the movement of physical capital out of the corporate and non-corporate business sectors

5. Conclusion

This paper illustrates that portfolio responses to tax changes are potentially large enough to matter when scoring the revenue impact of certain tax proposals. The model described in this paper may be used to help inform the revenue estimates produced by OTA for a fundamental tax reform proposal. To help overcome some of the limitations described above, the model may be improved to provide better estimates. A list of potential improvements include: (1) allowing the amount of assets held in pension accounts to be endogenous; (2) making bonds issued by corporations and non-corporate businesses a risky asset, and leaving Treasury and mortgage bonds as the residual risk-less asset; (3) modifying the production sector so that a different function form (CES) could be used so that income shares do not remain constant; and (4) introducing a foreign sector cell that trades in certain assets (bonds and corporate equity).

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Table 1. Initial Parameter Values

Description	Value
Exogenous Variables	
Debt/capital ratio for rental housing sector	0.255
Debt/capital ratio for non-corporate sector	0.255
Share of corporate debt financed by tax-exempt bonds	0.048
Corporate taxable income inclusion rate	0.71
Property tax rate	0.016
Share of business capital subject to the property tax	0.6
Variance of corporate equity	0.05
Variance of tax-exempt bonds	0.015
Variance of rental housing equity	0.03
Variance of noncorporate equity	0.12
Variance of housing	0.02
Inflation	0.025
Initial Values for Endogenous Variables	
Debt/capital ratio for corporation sector	0.26
Share of pension assets held in corporate equities	0.566
Taxable bonds rate of return	0.065
Corporate equity rate of return	0.122
Tax-exempt bonds rate of return	0.057
Rental housing rate of return	0.105
Non-corporate rate of return	0.165
Dividend payout rate	0.44
Base Case High Response	
Capital gains revenue maximizing rate, corporate equity (g')	0.2
Capital gains revenue maximizing rate, non-corporate	0.3
Dividend payout responsiveness parameter (c_1)	-4.0
Moderate Response	
Capital gains revenue maximizing rate, corporate equity (g')	0.35
Capital gains revenue maximizing rate, non-corporate	0.55
Dividend payout responsiveness parameter (c_1)	-2.0

Table 2. Income, Tax and Wealth Shares by Nominal Income Class under JGTRRA Tax Law

	Absolute Shares				Cumulative Shares			
Nominal Income Class ($1,000's)	Nominal Income	Individual Income Taxes	Individual Tax Returns	Wealth	Nominal Income	Individual Income Taxes	Individual Tax Returns	Wealth
< 10	1.6%	0.0%	11.7%	0.6%	1.6%	0.0%	11.7%	0.6%
10-30	10.1%	4.2%	28.7%	4.5%	11.7%	4.3%	40.5%	5.1%
30-40	2.3%	0.9%	4.4%	1.8%	13.9%	5.2%	44.9%	6.9%
40-50	10.0%	6.7%	15.0%	6.4%	24.0%	11.9%	59.9%	13.3%
50-75	16.6%	14.0%	16.6%	9.7%	40.5%	25.9%	76.4%	23.0%
75-100	11.4%	9.3%	8.9%	16.7%	51.9%	35.2%	85.4%	39.7%
100-200	26.6%	29.9%	12.0%	27.7%	78.5%	65.1%	97.3%	67.4%
200-500	7.0%	9.6%	1.6%	7.4%	85.5%	74.7%	98.9%	74.8%
> 500	14.5%	25.3%	1.1%	25.2%	100.0%	100.0%	100.0%	100.0%

Table 3. Shares of Aggregate Assets by Income Class under JGTRRA Tax Law

Nominal Income Class ($1,000's)	Wealth	Positive Taxable Bonds	Negative Taxable Bonds	Corporate equity	Tax-exempt bonds	Rental Housing	Non-corporate	Owner-Occupied Housing	Consumer Durables	Pensions
< 10	0.6%	0.1%	5.2%	0.0%	-	0.0%	0.0%	2.8%	4.5%	0.6%
10-30	4.5%	0.7%	23.0%	1.2%	0.0%	2.2%	2.4%	13.8%	19.2%	6.5%
30-40	1.8%	0.4%	4.3%	0.7%	0.2%	1.8%	3.7%	3.4%	3.6%	2.4%
40-50	6.4%	3.1%	14.4%	3.1%	0.7%	3.9%	1.8%	13.0%	13.3%	8.0%
50-75	9.7%	2.2%	25.3%	4.3%	3.4%	9.2%	7.6%	19.4%	20.1%	15.9%
75-100	16.7%	23.0%	4.5%	14.2%	8.4%	15.0%	8.8%	12.2%	10.9%	14.4%
100-200	27.7%	27.6%	20.5%	28.7%	26.0%	31.7%	19.1%	24.1%	19.5%	33.7%
200-500	7.4%	4.0%	2.6%	8.2%	3.5%	11.4%	12.6%	5.7%	3.5%	8.9%
> 500	25.2%	38.8%	0.3%	39.4%	57.7%	24.8%	44.0%	5.7%	5.4%	9.7%

Table 4. Rates of Return Under JGTRRA Tax Law and with an Increase in the Top Ordinary Tax Rate to 40 Percent

	JGTRRA	Increase Top Ordinary Tax Rate to 0.4
Taxable Bonds	6.26	6.30
Corporate Equity	11.93	11.89
Tax-exempt Bonds	5.72	5.68
Rental Housing	10.42	10.42
Noncorporate	16.37	16.39
Corporate	14.69	14.67

Table 5. Summary of Economic Effects Due to Increasing Top Ordinary Tax Rate to 40 Percent Compared to JGTRRA Tax Law

	Increase Top Ordinary Rate to 0.4
A. Change in the Allocation of Physical Capital	
(As a percent of total physical capital)	
Corporate Business	0.04%
Total Noncorporate Capital	-0.02%
State and Local Government	0.04%
Total Household Capital	-0.06%
B. Change in the Allocation of the Household Sector's Portfolio	
(As a percent of total wealth)	
Corporate Stock	0.19%
Taxable Debt	-0.15%
Tax-exempt Debt	0.04%
Total Noncorporate Capital	-0.02%
Total Household Capital	-0.05%
Pensions	
Corporate Stock	-0.11%
Debt	0.11%
C. Change in Corporate Financial Policy	
(in percentage points)	
Leverage Ratio	-0.1
Nominal Dividend Payout Ratio	0.0

Table 6. Percentage Change in Asset Holdings by Income Class, Increase Top Ordinary Tax Rate to 40 Percent from JGTRRA

Nominal Income Class ($1,000's)	Positive Taxable bonds	Corporate equity	Tax-exempt bonds	Rental Housing	Non-corporate	Owner-Occupied Housing	Consumer Durables
< 10	9.1%	-11.2%	0.0%	-18.1%	-31.8%	-0.5%	-1.2%
10-30	3.9%	-0.8%	-41.2%	-3.5%	-3.7%	-0.5%	-0.9%
30-40	3.2%	-2.0%	-28.7%	-1.8%	-0.5%	-0.5%	-1.2%
40-50	2.8%	-0.9%	-34.4%	-2.4%	-4.5%	-0.5%	-1.1%
50-75	2.7%	-2.2%	-24.4%	-2.2%	-2.1%	-0.4%	-0.6%
75-100	1.0%	1.3%	-12.5%	2.2%	1.4%	0.4%	1.3%
100-200	1.4%	-0.4%	-7.3%	-1.3%	-1.2%	-0.3%	-2.0%
200-500	1.7%	2.0%	-3.7%	-0.8%	-0.5%	0.1%	2.6%
> 500	-4.5%	4.2%	9.9%	2.3%	0.8%	1.1%	15.8%
Total	**-0.9%**	**1.8%**	**1.5%**	**0.0%**	**-0.2%**	**-0.2%**	**0.2%**

Table 7. Static Versus Dynamic Changes in Revenue from Increasing the Top Ordinary Tax Rate to 40 Percent Compared to JGTRRA Tax Law

Nominal Income Class ($1,000's)	Static	Dynamic	Dynamic as Percentage of Static
< 10	-	0.4%	n.a.
10-30	-	-0.1%	n.a.
30-40	-	0.0%	n.a.
40-50	-	0.0%	n.a.
50-75	-	0.0%	n.a.
75-100	-	0.3%	n.a.
100-200	-	0.2%	n.a.
200-500	0.6%	0.4%	60.1%
> 500	6.1%	5.3%	87.2%
Total	**1.6%**	**1.5%**	**91.2%**

Table 8. Rates of Return Under JGTRRA Tax Law and with an Increase in Ordinary, Dividends and Capital Gains Tax Rates

	JGTRRA	Increase Ordinary Tax Rates	Increase Ordinary and Dividend Tax Rates	Increase All Individual Tax Rates
Taxable Bonds	6.26	6.44	6.37	6.32
Corporate Equity	11.93	11.83	12.13	12.22
Tax-exempt Bonds	5.72	5.68	5.64	5.62
Rental Housing	10.42	10.45	10.43	10.43
Noncorporate	16.37	16.44	16.42	16.43
Corporate	14.69	14.65	14.90	14.95

Table 9. Summary of Economic Effects Due to Increasing Ordinary, Dividend and Capital Gains Tax Rates Compared to JGTRRA Tax Law

	Increase Ordinary Tax Rates	Increase Dividend Tax Rates	Increase Capital Gains Tax Rates	Total Change
A. Change in the Allocation of Physical Capital				
(As a percent of total physical capital)				
Corporate Business	0.08%	-0.61%	-0.14%	-0.67%
Total Noncorporate Capital	-0.10%	0.05%	-0.02%	-0.07%
State and Local Government	0.04%	0.04%	0.02%	0.11%
Total Household Capital	-0.02%	0.52%	0.13%	0.63%
B. Change in the Allocation of the Household Sector's Portfolio				
(As a percent of total wealth)				
Corporate Stock	0.63%	-1.19%	-0.36%	-0.92%
Taxable Debt	-0.55%	0.59%	0.24%	0.28%
Tax-exempt Debt	0.03%	0.05%	0.02%	0.11%
Total Noncorporate Capital	-0.09%	0.05%	-0.02%	-0.07%
Total Household Capital	-0.02%	0.51%	0.12%	0.61%
Pensions				
Corporate Stock	-0.38%	0.41%	0.13%	0.16%
Debt	0.38%	-0.41%	-0.13%	-0.16%
C. Change in Corporate Financial Policy				
(in percentage points)				
Leverage Ratio	-0.6	1.1	0.5	1.0
Nominal Dividend Payout Ratio	-0.1	-5.5	0.8	-4.8

Table 10. Allocation of Physical Capital Across Production Sectors as a Percentage of Total Physical Capital

	JGTRRA	Increase Ordinary Tax Rates	Increase Ordinary and Dividend Tax Rates	Increase All Individual Tax Rates
Corporate	31.18%	31.26%	30.65%	30.51%
Rental Housing	8.01%	7.97%	8.00%	7.99%
Non-corporate	11.20%	11.13%	11.15%	11.14%
State & Local	3.63%	3.67%	3.72%	3.74%
Consumer durables	10.66%	10.62%	10.97%	10.99%
Owner-occupied housing	35.32%	35.34%	35.51%	35.61%

Table 11. Change in the Allocation of Physical Capital Across Production Sectors as a Percentage of Total Physical Capital Due to Increasing Ordinary, Dividend and Capital Gains Tax Rates

	Increase Ordinary Tax Rates	Increase Dividend Tax Rates	Increase Capital Gains Tax Rates	Total Change
Corporate	0.08%	-0.61%	-0.14%	-0.67%
Rental Housing	-0.03%	0.03%	-0.01%	-0.01%
Non-corporate	-0.06%	0.02%	-0.01%	-0.05%
State & Local	0.04%	0.04%	0.02%	0.11%
Consumer durables	-0.04%	0.35%	0.03%	0.33%
Owner-occupied housing	0.02%	0.17%	0.11%	0.30%

Table 12.1 Percentage Change in Asset Holdings by Income Class, Increase Ordinary Tax Rates from JGTRRA

Nominal Income Class ($1,000's)	Positive Taxable bonds	Corporate equity	Tax-exempt bonds	Rental Housing	Non-corporate	Owner-Occupied Housing	Consumer Durables
< 10	-90.2%	17.1%	0.0%	-47.4%	-54.9%	-1.8%	3.6%
10-30	-12.7%	3.2%	-8.6%	-11.8%	-6.5%	-1.8%	-1.5%
30-40	0.3%	-1.6%	-56.8%	-6.4%	-1.6%	-1.8%	-3.5%
40-50	0.0%	6.4%	-23.1%	-6.2%	-8.3%	-0.2%	-2.4%
50-75	13.0%	0.2%	-52.6%	-6.2%	-3.9%	-0.9%	-7.2%
75-100	1.1%	8.1%	-23.7%	7.3%	5.4%	2.3%	6.4%
100-200	-2.4%	7.4%	2.5%	-1.4%	-1.9%	1.0%	1.0%
200-500	-3.8%	7.9%	2.5%	-0.8%	-0.7%	0.7%	4.9%
> 500	-3.7%	4.4%	7.9%	0.8%	0.2%	0.9%	10.8%
Total	**-1.9%**	**5.9%**	**1.2%**	**-0.4%**	**-0.6%**	**0.0%**	**-0.4%**

Table 12.2 Percentage Change in Asset Holdings by Income Class, Increase Dividend Tax Rates from JGTRRA plus Higher Ordinary Tax Rates

Nominal Income Class ($1,000's)	Positive Taxable bonds	Corporate equity	Tax-exempt bonds	Rental Housing	Non-corporate	Owner-Occupied Housing	Consumer Durables
< 10	1026.7%	25.8%	0.0%	11.2%	5.4%	0.8%	-6.2%
10-30	-1.9%	-10.2%	12.6%	1.3%	0.3%	0.8%	1.7%
30-40	0.6%	-10.0%	15.9%	1.5%	0.6%	0.8%	1.9%
40-50	-0.5%	-11.9%	9.6%	1.3%	0.4%	0.8%	1.9%
50-75	-1.4%	-18.6%	11.5%	1.4%	0.5%	0.7%	2.4%
75-100	0.4%	-10.6%	3.9%	-4.0%	-3.8%	-0.8%	-1.4%
100-200	1.7%	-11.6%	1.2%	1.1%	0.5%	0.5%	11.6%
200-500	2.8%	-13.7%	3.5%	1.4%	0.7%	0.6%	3.9%
> 500	2.3%	-8.1%	1.5%	1.2%	0.6%	0.4%	3.8%
Total	**1.6%**	**-10.5%**	**1.9%**	**0.4%**	**0.2%**	**0.5%**	**3.3%**

Table 12.3 Percentage Change in Asset Holdings by Income Class, Increase Capital Gain Tax Rates from JGTRRA plus Higher Ordinary and Dividend Tax Rates

Nominal Income Class ($1,000's)	Positive Taxable bonds	Corporate equity	Tax-exempt bonds	Rental Housing	Non-corporate	Owner-Occupied Housing	Consumer Durables
< 10	-50.9%	-13.7%	0.0%	-18.3%	-20.3%	0.4%	5.0%
10-30	-0.9%	-5.6%	8.2%	-0.5%	-0.5%	0.4%	1.0%
30-40	0.3%	-5.3%	10.2%	-0.1%	0.0%	0.4%	1.0%
40-50	-0.7%	-4.1%	6.6%	-0.6%	-1.2%	0.4%	1.1%
50-75	-1.7%	-7.5%	7.9%	-0.7%	-0.6%	0.4%	1.6%
75-100	0.0%	-3.0%	3.5%	-0.1%	-0.1%	0.3%	1.2%
100-200	0.6%	-4.9%	0.7%	-0.1%	-0.2%	0.1%	-4.5%
200-500	1.3%	-4.9%	0.9%	0.0%	0.0%	0.2%	1.6%
> 500	0.5%	-2.1%	0.4%	0.1%	0.0%	0.1%	1.7%
Total	**0.3%**	**-3.6%**	**0.9%**	**-0.1%**	**-0.1%**	**0.3%**	**0.2%**

Table 12.4 Percentage Change in Asset Holdings by Income Class, Increase All Individual Tax Rates from JGTRRA

Nominal Income Class ($1,000's)	Positive Taxable bonds	Corporate equity	Tax-exempt bonds	Rental Housing	Non-corporate	Owner-Occupied Housing	Consumer Durables
< 10	-45.7%	27.2%	0.0%	-52.2%	-62.2%	-0.6%	2.1%
10-30	-15.2%	-12.6%	11.3%	-11.2%	-6.7%	-0.6%	1.2%
30-40	1.1%	-16.1%	-44.9%	-5.0%	-0.9%	-0.6%	-0.7%
40-50	-1.1%	-10.1%	-10.1%	-5.6%	-9.1%	1.0%	0.6%
50-75	9.6%	-24.5%	-43.1%	-5.6%	-4.0%	0.2%	-3.5%
75-100	1.5%	-6.2%	-17.9%	2.9%	1.3%	1.8%	6.2%
100-200	-0.1%	-9.7%	4.5%	-0.5%	-1.6%	1.6%	7.6%
200-500	0.2%	-11.5%	7.0%	0.7%	0.0%	1.5%	10.7%
> 500	-1.0%	-6.0%	10.0%	2.1%	0.9%	1.4%	17.0%
Total	**0.0%**	**-8.6%**	**4.0%**	**-0.2%**	**-0.5%**	**0.8%**	**3.1%**

Table 13. Static Versus Dynamic Changes in Revenue from Increasing Ordinary, Dividend and Capital Gains Tax Rates Compared to JGTRRA Tax Law

	Increase Ordinary Rates			Increase Dividend Rates			Increase Capital Gains Rates		
Nominal Income Class ($1,000's)	**Static**	**Dynamic**	**Dynamic as Percentage of Static**	**Static**	**Dynamic**	**Dynamic as Percentage of Static**	**Static**	**Dynamic**	**Dynamic as Percentage of Static**
< 10	49.0%	26.4%	53.9%	1.8%	20.7%	1124.8%	1.0%	-8.4%	-832.2%
10-30	23.8%	23.3%	98.0%	0.4%	0.3%	65.7%	0.3%	0.1%	34.1%
30-40	21.7%	21.6%	99.6%	1.2%	0.9%	71.9%	1.6%	0.9%	57.3%
40-50	14.7%	14.1%	96.3%	1.0%	0.7%	70.6%	0.5%	0.2%	39.5%
50-75	11.6%	11.7%	100.5%	0.7%	0.5%	74.3%	0.4%	0.2%	39.9%
75-100	9.9%	10.4%	105.0%	3.5%	2.5%	71.5%	1.5%	0.5%	31.0%
100-200	9.6%	9.2%	96.0%	2.6%	2.0%	74.2%	0.8%	0.3%	45.2%
200-500	9.9%	9.4%	95.6%	3.5%	2.7%	78.3%	0.9%	0.2%	26.0%
> 500	10.3%	10.3%	99.4%	7.6%	6.2%	81.1%	1.2%	0.3%	25.0%
Total	**11.2%**	**11.0%**	**98.3%**	**3.5%**	**2.8%**	**78.3%**	**0.9%**	**0.3%**	**32.6%**

Table 13. Continued

	Increase All Rates		
Nominal Income Class ($1,000's)	**Static**	**Dynamic**	**Dynamic as Percentage of Static**
< 10	52.2%	39.9%	76.4%
10-30	24.6%	23.8%	96.5%
30-40	25.1%	23.8%	94.5%
40-50	16.3%	15.2%	93.1%
50-75	12.9%	12.5%	96.7%
75-100	16.1%	14.4%	89.4%
100-200	13.4%	11.8%	88.1%
200-500	14.3%	12.6%	88.5%
> 500	19.7%	17.5%	88.6%
Total	**16.0%**	**14.5%**	**90.4%**

Table 14. Average Marginal Ordinary Income Tax Rates by Income Class

Nominal Income Class ($1,000's)	JGTRRA	Increase Top Marginal Rate	Increase Ordinary Rates
< 10	5.1	5.1	7.7
10-30	9.8	9.8	11.6
30-40	10.4	10.4	12.1
40-50	15.8	15.8	17.7
50-75	17.8	17.8	18.6
75-100	19.4	19.4	20.7
100-200	26.0	26.0	29.0
200-500	29.7	30.2	32.9
> 500	34.7	37.7	38.4
Total	**24.8**	**25.6**	**27.3**

Table 15. Summary of Dynamic Revenue as a Percent of Static Revenue Compared to JGTRRA Tax Law, Sensitivity Analysis

	Increase Ordinary Tax Rates	Increase Dividend Tax Rates	Increase Capital Gains Tax Rates	Total
New View, High Response	98.3%	78.3%	32.6%	90.4%
Old View, High Response	98.5%	63.7%	40.0%	85.8%
Old View, Moderate Response	98.5%	77.3%	55.5%	91.3%