Deficits, Interest Rates, and the User Cost of Capital:

A Reconsideration of the Effects of Tax Policy on Investment

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ABSTRACT

Under traditional formulations, lower capital income tax rates reduce the user cost of capital and stimulate investment. The traditional approach, however, implictly or explicitly considers a revenue-neutral reduction in capital income taxation. We extend the traditional approach by considering a reduction in taxes that generates an increase in the budget deficit; the expanded budget deficit raises interest rates and the opportunity cost of investment. This provides a mechanism through which tax cuts can raise the cost of capital. Representative calculations show that, even with relatively modest interest rate effects, the net effect of making the Administration's recent tax cuts permanent or a 10-percent reduction in individual income tax rates would be to raise the user cost of capital. Thus, sustained tax cuts can raise the cost of capital and reduce investment.

I. Introduction

One of the principal goals of tax reform efforts is to improve the long-run performance of the economy. A frequently observed manifestation of this goal is the provision of tax incentives for firms to invest in equipment and structures. Traditionally, the effects of tax policy on firms' demand for investment are summarized in estimates of the "user cost of capital." The user cost of a capital investment is the minimum return a firm needs to cover depreciation, taxes, and the opportunity costs of the funds used to finance the project (Jorgenson 1963, Hall and Jorgenson 1967, Auerbach 1983b). Lower user costs typically translate into higher investment levels.

All previous analyses find that lower tax rates generally reduce the user cost. These studies, however, have either explicitly or implicitly considered revenue-neutral tax changes and assumed a fixed opportunity cost of funds. In other words, the analyses assume that changes in tax policy do not affect the required after-all-taxes return that investors demand.

This paper extends the traditional user cost framework to allow tax policy to affect investors' required after-all-taxes return. Specifically, tax changes that raise or reduce federal revenues typically also change federal borrowing, which influences the interest rate on government debt. When the after-tax interest rate on government bonds changes, the after-all-taxes return investors demand on other investments should change, too.

We assess the empirical importance of this effect by analyzing two tax policy options: the Administration's recent tax cuts (made permanent) and a 10-percent across-the-board reduction in individual income tax rates. We show that when the analysis includes relatively modest effects of deficits on interest rates, the net effect of the tax cuts in question is to *raise* the user cost of capital under almost all of the scenarios considered. These results suggest that incorporating the effects of tax cuts on deficits and the resulting impact on interest rates is a firstorder consideration in evaluating the effects of tax policy on investment. In particular, sustained tax cuts can actually raise the cost of capital, once deficit and interest rate effects are taken into account.

The rest of the paper is organized as follows. Section II describes the standard user cost model and extends the framework to allow tax policy to affect the interest rate on government debt. Section III describes the policy scenarios we simulate. Section IV develops the parameter values. Section V presents the main results. Section VI concludes.

II. A Model of the User Cost of Capital

A. Standard Model

As noted above, the user cost of capital is the minimum rate of return a corporation needs on an investment to break even—that is, to cover the costs of the asset's depreciation, to pay the associated taxes on the investment, and to compensate investors for the funds they provide. The standard formula for the user cost of capital for a firm making a \$1 investment is

$$c = \left(\frac{r - \pi + \delta}{1 - u}\right)(1 - uz), \tag{1}$$

where c = the user cost of capital, r = the nominal after-corporate-tax discount rate that the firm must earn to attract investors, π = the rate of inflation, δ = the rate of economic depreciation, u = the statutory corporate tax rate, and z = the present value of depreciation deductions on a \$1 investment. In (1), $r-\pi$ is the opportunity cost of the investment, δ represents depreciation, and the term (1-uz)/(1-u) summarizes the impact of corporate taxes.[1]

[1] The formulation of (1) is based on many simplifying assumptions, including: expectations of future policy and asset prices are static; there are no adjustment costs to investment; the asset is never resold; the economic depreciation of the capital good occurs at an exponential rate; and there is a constant marginal cost of new capital goods, which makes the price of capital goods exogenous to the firm. The formula also incorporates approximations, such as approximating the real interest rate, $(1+r)/(1+\pi)-1$, by $r-\pi$. The classic studies of user costs and investment are Jorgenson (1963) and Hall and Jorgenson (1967), which develop equation (1). More recent studies, using (1) or variants of it, include Auerbach (1983a, 1989), Auerbach and Hassett (1992, 2003), Carroll,

The key variable for our purposes is r, the nominal after-*corporate*-tax return that the firm must earn to attract investors. All individual-level taxes and other issues affecting the opportunity cost of investment, such as the interest rate on government bonds, enter equation (1) through r. The required nominal after-corporate-tax return will be a function of the allocation of financing of new investment projects:

(2) $$r = x_E r_E + x_D r_D,$$

where x_E = the share of new investment financed by equity, x_D = the share of new investment financed by debt ($= 1 - x_E$), r_E = investors' required nominal after-corporate-tax return on equity-financed investments, and r_D = investors' required nominal after-corporate-tax return on debt-financed investments.

Let investors' required *real* return on corporate equity after corporate *and individual* income taxes, s_E, be given by:

(3) $$s_E = (1 - t_E)r_E - \pi,$$

where t_E = the effective tax rate on nominal equity income in the individual income tax. The equation for t_E is given by:

(4) $t_E = pm + (1 - p)w$, in the "old view," and

$t_E = w$, in the "new view."

where p = the dividend payout rate (= dividends / (dividends and retained earnings))[2], m = the effective marginal tax rate on dividends in the individual income tax, and w = the effective

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Hassett, and Mackie (2003), Chirinko (1993), Chirinko, Fazzari, and Meyer (1999), Clark (1979, 1993), Cummins, Hassett and Hubbard (1994), Desai and Goolsbee (2004), Goolsbee (1998), and Poterba and Summers (1983, 1985). Equation (1) and its variants represent an uneasy compromise between alternative theories of firm capital structure, dividend policy, and corporate and individual portfolio choices and arbitrage options. The equation also omits a variety of tax and non-tax factors that may be relevant for investment choices. For excellent discussions of these and related issues, see Auerbach (1983b), Gravelle (1994), Hassett and Hubbard (1997), King and Fullerton (1984), Mackie (2002), Sinn (1990a, 1990b), and Sorenson (1995).

[2] We abstract from share repurchases.

marginal tax rate on accrued capital gains in the individual income tax.[3]

Similarly, let investors' required real return on corporate debt after corporate and personal income taxes (s_D) be given by

(5) $$s_D = (1 - t_D)r_D - \pi,$$

where t_D = the effective marginal tax rate on nominal interest income from corporate bonds in the individual income tax.

Solving (3) and (5) for r_E and r_D and substituting the result into (2) yields

(6) $$r = x_E\left(\frac{s_E + \pi}{1 - t_E}\right) + x_D\left(\frac{s_D + \pi}{1 - t_D}\right).$$

Equation (6) implies that r depends on investors' opportunity costs (i.e., the real required after-all-tax returns on debt and equity), the effective marginal individual income tax rates on income from corporate debt and equity, the financing shares, and the rate of inflation.

Traditionally, formulations in the user cost literature specify r as in equation (6) (see Mackie 2002, or Carroll, Hassett, and Mackie 2003, for example) or as a constant (see Hall and Jorgenson 1967, or Cummins, Hassett, and Hubbard 1994, for example). In the first case, s_E and s_D are held constant over tax policy changes; in the latter case, the entire expression in (6) is fixed. In either case, changes in the interest rate on government debt are assumed not to affect the user cost. We modify this assumption below.

B. Extensions

Let investors' required real return on government bonds after personal income taxes be

(7) $$s_G = (1 - t_G)i_G - \pi,$$

where i_G = the nominal interest rate on government bonds, and t_G = the effective marginal tax

[3] The new view and old view differ with respect to the marginal sources of finance of new investment projects and other issues. See Auerbach (1983b) for an overview, Auerbach and Hassett (2003, 2005) for recent analysis and literature review, and Sinn (1990a, 1990b) for additional perspectives and an attempt to integrate the two views.

rate on nominal interest income from government bonds in the individual income tax.

The precise nature of the links between the returns to government bonds, corporate bonds, and corporate equity depends on a host of factors that influence financial markets. In lieu of developing a structural model that explicitly addresses these factors, we explore three possible benchmarks, which span a considerable range of options. The simplest specification would equate real after-tax returns across assets:

(8.1) $s_E = s_G$, and

(9.1) $s_D = s_G$.

Substituting these equations into (7) and the results into (6) yields

$$r = \left[\frac{x_E(1-t_G)}{(1-t_E)} + \frac{x_D(1-t_G)}{(1-t_D)} \right] i_G . \tag{10.1}$$

This specification links the assets' returns, but omits any role for risk or the equity premium in determining relative rates of return. A simple way to include these factors is to have real after-tax returns vary across assets by a fixed amount:

(8.2) $s_E = s_G + \alpha_E$, and

(9.2) $s_D = s_G + \alpha_D$,

where α_E is a measure of the equity premium, α_D is a risk spread reflecting the difference in the required return on corporate bonds relative to government bonds, and both α terms are constant. These equations imply that

$$r = \left[\frac{x_E(1-t_G)}{(1-t_E)} + \frac{x_D(1-t_G)}{(1-t_D)} \right] i_G + \left[\frac{\alpha_E}{(1-t_E)} \right] x_E + \left[\frac{\alpha_D}{(1-t_D)} \right] x_D . \tag{10.2}$$

This specification incorporates a role for risk and the equity premium, but holds the difference in returns constant on an after-tax basis for all tax rates. One implication is that if the tax rate on equity rose, the before-tax risk premium on equity must also rise. In some situations, however, this implication may be inappropriate. As a simple (perhaps extreme) example, consider a tax on the excess return on an investment. If such a tax rose, investor's willingness to hold the asset would not change, so the required before-tax return and the before-tax risk premium should not change. But since overall taxes on the investment rose, the difference in after-tax returns between equity and government bonds would fall. The situation would be somewhat more complex when the entire return is taxed, but the basic idea is the same: under plausible circumstances, the difference between the required after-tax return on equity and government bonds could fall as tax rates on equity rise. Similar considerations apply to corporate bonds. One way to allow for such effects is to specify that

(8.3) $s_E = s_G + \alpha_E(1\text{-}t_E)$, and

(9.3) $s_D = s_G + \alpha_D(1\text{-}t_D)$,

which in turn implies that

(10.3) $$r = \left[\frac{x_E(1-t_G)}{(1-t_E)} + \frac{x_D(1-t_G)}{(1-t_D)}\right] i_G + \alpha_E x_E + \alpha_D x_D \, .$$

Equations (10.1), (10.2) and 10.3) generate the standard results that reducing the effective personal income tax rate on equity or corporate debt reduces investors' required after-all-tax return ($dr/dt_E > 0$, $dr/dt_D > 0$), holding other factors constant. In addition, in each of the equations, increases in the government borrowing rate raise r:

(11) $$\frac{dr}{di_G} = \frac{x_E(1-t_G)}{1-t_E} + \frac{x_D(1-t_G)}{1-t_D} > 0 \, .$$

This occurs because the higher interest rate raises the after-tax return on government bonds, which in equilibrium raises the effective hurdle rate for corporate investment projects. Thus, to the extent that tax cuts create budget deficits, and budget deficits raise government bond rates, the value of r will rise, as will the user cost. The increase in r due to an increase in i_G need not be one-for-one, however, because of the differing tax treatment of equity, debt, and government interest. Typically, the marginal effect of changes in i_G on r will be between 0 and 1 in absolute value because the effective personal income tax rate on equity is usually thought to be lower than the effective personal income tax rate on corporate or government debt (see the next section for further discussion).

We make one additional assumption that will have an important effect in the simulation analysis below, namely that changes in the tax rate on interest income from government bonds (financed by tax changes outside the model, so that the deficit is unaffected) do not affect the equilibrium cost of capital for firms. Formally, this requires that

(12) $ds_G/dt_G = 0,$

which in turn requires that $di_G/dtG = i_G/(1-t_G)$.

Intuitively, this assumption is based on a scenario in which lower tax rates on interest income from government bonds raise investors' demand for bonds, which drives the bond price up and the interest rate down. Equation (12) implies that this process continues until the after-tax return to government bonds, given in (7), is the same as it was before the cut in t_G. Equation (12) is the most favorable assumption that could be made in this context for allowing tax cuts to reduce the cost of capital. If a cut in t_G led to no change in i_G or to a decline in i_G that was smaller in absolute value than shown in (12), inspection of (10.1), (10.2), and (10.3) shows that r would rise, as would the user cost of capital.

To summarize, the standard model shows the user cost to be a function of investors' required nominal return after corporate taxes (r), inflation, economic depreciation, the statutory corporate tax rate, and depreciation rules. The value of r, in turn, is either held constant or is allowed to depend on the structure of financing; dividend payout ratios; effective marginal personal income tax rates on dividends, capital gains and corporate interest payments; and investors' required after-all-tax returns to debt and equity, where the required returns are assumed constant with respect to tax policy. We extend this model by allowing investors' required after-all-tax return on corporate debt and equity to depend on the after-tax return they can obtain on government bonds. As a result, our model shows that changes in tax revenues that change government borrowing can affect the user cost by affecting the interest rate on government bonds.

C. Effective Tax Rate

As noted above, the user cost is the real, pre-tax, gross-of-depreciation return that is needed for a firm to cover depreciation, taxes, and investors' opportunity costs. The effective tax rate on an investment is defined as the share of the net-of-depreciation return that is taxed.[4] Thus, defining c as the user cost, δ as the depreciation rate, and $r^*-\pi$ as the opportunity cost of the investor funds, the effective tax rate (ETR) is given by

$$ETR = \frac{(c-\delta)-(r^*-\pi)}{(c-\delta)}. \tag{13}$$

where $r^* = i_G^* + x_E\alpha_E + x_D\alpha_D$, and represents the opportunity cost of funds in a world where all marginal income tax rates are zero and revenues are collected via lump sum taxes. The equation for r* is derived by setting all of the marginal income tax rates in (10) equal to zero. Recall from (12) that s_G is held constant with respect to t_G. Thus, in the simulations, i_G^* is set so that s_G, given i_G^* and tG=0, is the same as it is in the baseline scenario.[5]

[4] Alternatively and equivalently, the effective tax rate is the statutory tax rate that, if applied to economic income from the investment project, would yield the same investment incentive as the various features of the tax code modeled in equations (1) and (10). See Auerbach (1983b) or Mackie (2002) for further elaboration.

[5] To be concrete, in the baseline developed below, i_G =.06 and t_G = .262, so that $(1-t_G)i_G$ = .04428. Hence, with t_G set to zero in the ETR calculation, we set i_G^* = .04428.

III. Policy Scenarios

To provide some perspective on the potential importance of the theoretical analysis above, we estimate how two sets of tax policy changes would alter the user cost of capital for corporate investments in equipment and structures. In each case, we parameterize equation (1), using (10.1), (10.2) or (10.3) as the specification of r, under a variety of assumptions. Because we are specifically interested in the medium- and long-term effects of tax policy on growth, we examine the implied effects of the tax policy changes on the user cost of capital as of 2014 (the end of the Congressional Budget Office's 10-year budget window at the time the initial version of this paper was drafted). For each policy scenario, the baseline is pre-2001 tax law, applied to the year 2014.

We also include estimates of how tax policy changes the ETR (as defined in (13)) on corporate investments. For the first policy change described below, our ETR estimates can be compared to results from the Department of Treasury (2004, 2005). The Treasury ETR calculations do not allow the government borrowing rate to change due to changes in the deficit, and for the purposes of comparability, we similarly do not allow the government borrowing rate to change in calculating the ETR.

A. Making the Administration's Tax Cuts Permanent

The central scenario we analyze is an extension of almost all features of the Bush Administration's 2001 tax cuts (many of which were extended or accelerated in 2003 and 2004), along with the dividend and capital gains tax cuts enacted in 2003. Specifically, the Economic Growth and Tax Relief Reconciliation Act of 2001 (EGTRRA, or "the 2001 tax cut") reduced the top four income tax rates, carved a 10 percent bracket out of the existing 15 percent bracket, increased the AMT exemption, repealed PEP and PEASE (the phaseout of personal exemptions and limitations on itemized deductions), reduced and eventually repealed the estate tax, expanded the child credit, reduced marriage penalties, expanded tax preferences for saving and education, and raised the AMT exemption. All of these provisions were temporary, however, expiring by the end of 2010. The Jobs and Growth Tax Relief Reconciliation Act of 2003 (JGTRRA or "the 2003 tax cut") accelerated the phase-in of some of these provisions and reduced the taxation of capital gains and dividends. The Working Families Tax Relief Act of 2004 (WFTRA, or "the 2004 tax cut") extended the accelerated, phased-in levels of many provisions through 2010.[6] Like the 2001 tax cut, the 2003 and 2004 acts provided temporary tax reductions only.[7]

In its Fiscal Year 2006 budget, introduced in February 2005, the Administration proposes making almost all of these provisions permanent (Office of Management and Budget 2005). In our "permanent tax cuts" scenario, we consider the effects of the tax cuts above, plus the enactment of the Administration's proposal to extend the tax cuts. In addition, we extend the AMT exemption at its current nominal level and make permanent the use of nonrefundable personal credits against the AMT for education, elderly, and dependent care.

B. 10 percent across-the-board individual income tax rate reduction.

In the second policy scenario, rather than examine the tax cuts that were enacted or have been proposed, we examine the effects of an across-the-board 10 percent reduction in statutory individual income tax rates – including capital gains tax rates and AMT tax rates – beginning in 2001. The estate tax, payroll tax, and corporate tax remain as in pre-2001 law.

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[6] In 2004, Congress enacted and the President signed another tax bill as well (the American Jobs Creation Act), which we ignore here.

[7] See Gale and Orszag (2004b) and Joint Committee on Taxation (2001, 2003, and 2004). Note that we do not extend the bonus depreciation provisions that were enacted in 2002, expanded in 2003, and expired at the end of 2004.

IV. Parameter Values

For each of the policy scenarios, we set the statutory corporate tax rate (u) at 35 percent, the rate of inflation (π) at 3 percent, and the dividend payout ratio (p) at 50 percent. Following Gravelle (1994), we set the present value of depreciation deductions per dollar of investment (given by z) equal to .83 for equipment and .54 for structures, and the annual rate of economic depreciation (δ) at .15 for equipment and .03 for structures.[8]

We allow for either 100 percent equity financing (x_E = 1.00) or a combination of 65 percent equity financing and 35 percent debt financing. We examine scenarios with no equity and risk premia (10.1), with constant equity and risk premia (10.2, with α_E =.03, α_D = .01) and with equity and risk premia adjusted for tax rates (10.3). We estimate results under the "old view" and the "new view" (with the distinction affecting the formula for t_E as discussed above). The other key parameters are the individual income tax rates on capital income and the interest rate on government borrowing, discussed below.

A. Individual Income Tax Rates on Capital Income

We estimate the effective marginal income tax rates on income from dividends, capital gains, and interest income (assuming that the tax rate on interest income from government bonds is the same as the tax rate on interest income from corporate bonds) using the Tax Policy Center microsimulation model.[9] Tax rates for 2014 under the pre-2001 tax law baseline and under each of the policy scenarios are shown in Table 1.

To determine the marginal tax rates on income from dividends (interest, capital gains) for

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[8] Technically, z should be a function of r (see Hall and Jorgenson 1967 and Gravelle 1994 for careful discussions of this issue). That is, increases in r should raise the rate at which future depreciation deductions are discounted and hence reduce z. This in turn would raise the user cost, above and beyond the increase caused by raising r but holding z constant. We do not include this effect, but adding it to the analysis would work in the direction of accentuating the results we obtain. Some suggestive calculations indicate that the added effect is not very large.

[9] http://www.taxpolicycenter.org/taxmodel.

taxable investors,[10] we increase dividends (interest, capital gains) by $1,000 for each record in the TPC model, calculate the increase in income tax liability in dollars, and divide by $1,000. This generates a marginal tax rate for each record. These record-specific values are weighted by shares of the type of income and sampling weights to generate an estimate of the overall weighted average effective marginal tax rate by type of income. For capital gains, we then divide the estimated marginal tax rate in half to account for the fact that gains are taxed on realization rather than accrual, which allows investors to reduce the effective tax rate by deferring the realization and/or the timing the realization of gains to offset the realization of losses. The marginal tax rate levels and changes shown in Table 1 are consistent with those in Kiefer et al (2002), using the Treasury tax model for taxable investors.

A large share of capital income, however, accrues to investors who do not pay federal income taxes, including non-profits, pension funds, state and local governments, and some foreigners. To allow for this, we calculate the effective marginal tax rate for *all* investors by dividing the marginal tax rates for taxable investors in half (see Mackie 2002, Gale and Potter 2002 and Gordon, Kalambokidis, and Slemrod 2003 for further discussion). These tax rates and changes are consistent with those in Dennis et al (2004) using the CBO tax model for all investors.

B. Federal Borrowing Rate

We assume that under pre-EGTRRA law, the nominal federal government borrowing rate (i_G) would have been 6 percent in 2014. With the assumptions above, this generates a real, after-tax rate of return on Treasury debt of just under 1.5 percent.

As noted above, the borrowing rate can be affected by two aspects of tax changes. First,

[10] Taxable investors are those who are statutorily subject to the tax, even if they have no actual tax liability.

the lower tax rate on interest income from government bonds will tend to reduce the interest rate. For example, the tax rate on government bonds falls from .262 under pre-EGTRRA law to .238 if the Administration's tax cuts are made permanent, and satisfaction of equation (12) then requires that i_G fall to 5.81 percent before considering any effects of deficits on interest rates. Likewise, the tax rate on interest income falls to .235 under 10-percent across-the-board tax cuts, which requires i_G to fall to 5.78 percent before consideration of deficit effects.

The second effect is the influence of higher federal deficits. To estimate these effects, we need to resolve two issues: the effects of the tax policies in question on federal deficits and debt, and the effects of federal deficits and debt on government interest rates.

To address the first issue, Table 2 reports the estimated effects of the different policy scenarios on the 2014 primary deficit, the 2014 unified deficit, and the 2014 debt/GDP ratio.[11] Appendix Table 1 lists the revenue effects and the budget effects (including the added interest costs from higher federal debt payments but not from higher interest rates) under each scenario for each year from 2001 to 2014.

To address the second issue, the extent to which such changes in fiscal policy translate into changes in government borrowing rates, we appeal to a recent review of the literature we conducted in Gale and Orszag (2004a). At the risk of greatly oversimplifying, the overall literature on fiscal policy and interest rates is mixed, but studies that examine the effects of *anticipated* deficits tend to find positive effects on interest rates that are economically and statistically significant. Research by Laubach (2003), Engen and Hubbard (2004), and Gale and Orszag (2004a) uses a common data set and finds that, when only one fiscal variable is included

[11] The revenue estimates for extended tax cuts come from CBO (2005); the revenue figures for the 10 percent tax cut come from the TPC microsimulation model; the interest calculations are based on the CBO interest matrix for January 2005. The estimates assume no offsetting change in other government spending or revenue. For an analysis of the "starve the beast" hypothesis under which the tax cuts would ostensibly put pressure on policy-makers to reduce spending, see Gale and Orszag (2004c).

in the equation, anticipated, sustained increases in primary deficits raise either long-term or forward interest rates by 32-46 basis points; similar increases in unified deficits raise interest rates by 18-39 basis points, and anticipated increases in the debt-to-GDP ratio of 1 percentage point raise long-term rates by between 2.8 and 5.6 basis points.[12] A recent estimate by the President Bush's Council of Economic Advisers (CEA) is consistent with these results, suggesting that a persistent $100 billion annual increase in the deficit would raise long-term interest rates by about 30 basis points, which implies that a persistent increase in the unified deficit of 1 percent of GDP would raise interest rates by 43 basis points (Wall Street Journal 2003).[13]

To err on the conservative end of these ranges, we assume that an anticipated, sustained 10-year, 1-percent-of-GDP increase in the unified deficit would raise interest rates by 30 basis points and that a 1-percent-of-GDP increase in public debt would raise interest rates by 3 basis points. These estimates are consistent with Engen and Hubbard (2004) but lower than the estimates reported by the Bush Administration CEA in March 2003 and by several researchers noted above. We also assume that an anticipated, sustained 1 percent of GDP in the primary deficit would raise interest rates by 40 basis points.

As shown in Table 2, these assumptions imply that, by 2014, government interest rates would rise by between 71 and 90 points if the Administration's tax cuts were made permanent, and by between 41 and 51 basis points if tax rates were cut by 10 percent. In our simulations, to be conservative, we employ the lower bound estimate in each case: 71 basis points for the

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[12] Similar or stronger results are obtained in Gale and Orszag (2004) in equations that control for both anticipated debt and deficits, in Elmendorf (1993) and Canzoneri, Cumby and Diba (2002) using anticipated measures of anticipated fiscal policy, in Dai and Philippon (2004) using VAR methods, and in Ardagna, Caselli, and Lane (2004) using data from a panel of 16 advanced industrial countries.

[13] At the time this estimate was provided, projected GDP for the next 10 years, 2004-13 was $144 billion (CBO 2003).

Administration's tax cuts made permanent and 41 basis points for the 10-percent tax reduction. Thus, when the effects of deficits are included in the analysis below, the government borrowing rate is 6.52 percent (5.81+0.71) for the Administration's tax cuts made permanent and 6.19 percent (5.78+0.41) under the 10-percent across-the-board tax cuts. When deficits are ignored, the rates are 5.81 percent and 5.78 percent, respectively.

V. Results

Table 3 reports the effects of making the Admnistration's tax cuts permanent. The estimates that do not allow for the effects of tax cuts on deficits and the resulting effect on interest rates could in some situations be considered short-term effects. The estimates that incorporate macroeconomic effects of fiscal policy should be considered the impact on the user cost as of 2014.

In the cases that do not allow deficits to affect interest rates, results are consistent with traditional formulations of the user cost of capital. First, the user cost falls more in the old view than in the new view: Under the new view, the large tax cut on dividend income in 2003 does not affect the user cost, and the percentage reduction in t_E is therefore larger under the old view (Table 1). Second, under the old view, the user cost falls more when the investment is financed 100 percent with equity because the percentage reductions in the tax rate on dividends and capital gains exceed the percentage tax cut on interest income (Table 1). Third, the effect on the user cost is smaller in absolute value when the marginal investor is assumed to be an average of taxable and non-taxable investors, because a significant share of all investors are non-taxable.

In addition, the reductions in the user cost are larger when equity and risk adjustments are assumed to be constant than when they are related to the tax rate. This occurs because the reduction in t_E and t_D under the tax cuts affects the last two terms in (10.2) but not in (10.3).

The main result from Table 3, however, is that once the macroeconomic effects of fiscal policy on interest rates are included, the tax cuts almost uniformly *raise* the user cost of capital. In 22 of the 24 cases examined, the net effect of the change – including both the direct effects of reductions in marginal tax rates and the indirect effects stemming from the tax cuts' effects on deficits and the resulting impact on interest rates – is to raise the user cost.

The one significant exception is the case with the uniformly most optimistic set of assumptions (given the structure of the recent tax cuts): the old view, with 100 percent equity financing, taxable investors, and constant equity and risk adjustments included. Even in this case, although the user cost does not rise, the absolute value of the reduction in the user cost (and hence the impact on investment) shrinks by two-thirds for both equipment (from 4.2 percent without interest rate effects to 1.4 percent with interest rate adjustments) and for structures (from 9.8 percent without interest rate effects to 3.2 percent with interest adjustments).[14] The one minor exception occurs under the same set of assumptions, except that financing is 65 percent equity. In this case, the user cost falls by 0.1 percent for equipment and 0.3 percent for structures. It is notable that all of the estimates that incorporate deficit effects and either exclude equity or risk premia adjustments or allow such adjustments to be endogenously affected by the tax rate find positive effects on the user costs once the macroeconomic effects of fiscal policy are included. Likewise, all of the estimates that incorporate deficit effects and use the new view show a positive effect on the user cost.

Table 3 also shows different results for structures and equipment. When interest rate effects are ignored, the percentage reductions in the user cost of capital are larger for structures than equipment. When interest rate effects are included, the percentage increases in the user cost

[14] If effects of deficits are as described by the Bush Administration (in the text above), the user cost would rise for both equipment and structures, even under this scenario.

are larger for structures than equipment. This occurs as a purely mechanical result: because the depreciation rate for structures is smaller, a given arithmetic change in r represents a larger percentage change (in absolute value) in the user cost for structures than for equipment.

Finally, we note the results for the effective tax rate in the last two columns. As mentioned earlier, these ETR calculations do not allow for adjustments in interest rates due to deficits. These results show that reductions in the ETR as traditionally calculated are consistent with increases in the user cost once interest rate effects are included in the latter calculations. In addition, the estimates can be compared to Treasury Department estimates. The Bush Administration tax policies enacted through 2004 (not including bonus depreciation, which we exclude as well) reduced the ETR on corporate investment by 15 to 17 percent according to the Department of Treasury (2004, 2005). The first several rows of Table 3 show that it is clearly possible to generate estimates of the same magnitude using the assumptions we employ.

The tax changes enacted since 2001 create a significant amount of revenue loss from items that do not affect marginal tax rates on investment income very much if at all (for example, the expanded child credit and the 10 percent bracket). Thus, we also examine an alternative policy that reduces all marginal tax rates by 10 percent since 2001. As Dennis et al (2004) point out, such a policy is likely to have a higher bang-for-the-buck for economic growth, since all of the tax revenue reductions are directly related to improvement of marginal incentives.

Table 4 reports results for this scenario. In all 24 cases, the net effect of the tax cut on the user cost of capital is positive when interest rate effects are considered.[15]

VI. Conclusions

Tax policy can affect the economy in general and private investment in particular through

[15] The pattern of results across the specification of old view versus new view, and financing assumptions differs somewhat from Table 3 because the changes in the taxation of dividends, capital gains and interest income in this policy scenario differ from the changes in the first policy scenario.

direct and indirect channels. The direct channels include the standard income and substitution effects that alter households' and firms' budget constraints, holding prices constant. The indirect effects include the impact of tax cuts on deficits, and the resulting effect of higher government borrowing on national saving and interest rates (see Dennis et al 2004, Gale and Potter 2002).

Traditional analyses assume that tax policy can not affect the opportunity cost of funds. This paper shows, however, that tax policy can influence investors' after-all-tax return on investments by raising the interest rate on government bonds. Moreover, applying user cost formulas incorporating these effects to selected tax policy options implies that these considerations are important empirically and can even reverse standard conclusions about tax cuts and investment.

In the particular example of making the Administration's tax cuts permanent, the *direct* effect of the tax cuts is to reduce the user cost of capital in many cases, but the *overall* effect, including the impact on the government interest rate, is to raise the user cost. This casts doubt on the notion that the tax cuts per se will be good for long-term growth. It is worth emphasizing, too, that the interest rate effects considered were modest or conservative relative to recent estimates and were consistent with the estimates of both the Bush Administration and former Administration officials. In addition, our estimates of the change in the effective tax rate (which hold the interest rate constant) were consistent with Administration estimates.

This work could be extended in several key directions. First, it would be interesting to know the importance of the deficit effect outlined above for other tax policy changes, such as changes in the corporate tax rate or depreciation rules, or earlier tax reform episodes in 1981 or 1993. Second, it would also be of interest to expand the analysis to examine the impact of tax policy on the user cost of capital in other sectors, including small business and housing. (Gale and Potter 2002 provide a preliminary analysis along these lines.) It would also be appropriate to consider the impact of non-deficit means of financing the tax cuts, especially since deficit finance only postpones the ultimate required change in spending or tax rules. Finally, as Abel (1990) and Hall (1994) have clarified, a full model of investment requires analysis of the demand and the supply side. An integration of the effects discussed here, which cover firms' demand for investment, with an analysis of the supply of funds for investment, would be an important extension.

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Table 1
Effects of Tax Policy Options on Effective Marginal Tax Rates, 2014

Investor Group	Form of Income	Marginal Tax Rate: Pre-EGTRRA Law (Baseline)	Marginal Tax Rate: Tax Cuts Extended	Marginal Tax Rate: 10% Reduction in Individual Tax Rates	Percentage Change from Baseline: Tax Cuts Extended	Percentage Change from Baseline: 10% Reduction in Individual Tax Rates
Taxable Investors						
t_D (=t_G)	Interest	0.262	0.238	0.235	-8.9%	-10.0%
m	Dividends	0.287	0.135	0.258	-52.9%	-10.2%
w	Capital Gains	0.095	0.072	0.086	-23.9%	-10.0%
t_E **(under the old view)**[1]	Equity	0.191	0.104	0.172	-45.7%	-10.1%
All Investors						
t_D (=t_G)	Interest	0.131	0.119	0.118	-8.9%	-10.0%
m	Dividends	0.143	0.067	0.129	-52.9%	-10.2%
w	Capital Gains	0.048	0.036	0.043	-23.9%	-10.0%
t_E **(under the old view)**[1]	Equity	0.095	0.052	0.086	-45.7%	-10.1%

Source: Urban-Brookings Tax Policy Center Microsimulation Model and authors' calculations.

(1) Under the old view, t_E = pm + (1-p)w, where p is the divident payout ratio, which is set at 0.50. Under the new view, t_E = w.

Table 2
Effects of Tax Policy Options on Deficits and Debt, 2014

	Tax Cuts Extended	10% Reduction in Individual Tax Rates
Fiscal Measure (In Billions of Dollars)		
Change in Primary Deficit in 2014	360	193
Change in Unified Deficit in 2014	568	314
Change in Public Debt by 2014	4452	2555
As a Percentage of GDP[1]		
Change in Primary Deficit in 2014	1.9%	1.0%
Change in Unified Deficit in 2014	3.0%	1.7%
Change in Public Debt by 2014	23.7%	13.6%
Implied Effect on Government Interest Rates (Basis Points)		
Primary Deficit	76	41
Unified Deficit	90	51
Debt	71	41

Source: CBO (2005, table 1-2) and Urban-Brookings Tax Policy Center Microsimulation Model.

(1) CBO (2005, table 1-2) estimates GDP in 2014 to be $18,826 billion.

Table 3
Effects of Extended Tax Cuts on the User Cost of Capital, 2014

Old View or New View	Equity and Risk Adjustment	Taxable or All Investors	100% or 65% Equity Financing	Percentage Change in User Cost: Ignore Effects of Deficits on Interest Rates: Equipment	Percentage Change in User Cost: Ignore Effects of Deficits on Interest Rates: Structures	Percentage Change in User Cost: Include Effects of Deficits on Interest Rates: Equipment	Percentage Change in User Cost: Include Effects of Deficits on Interest Rates: Structures	Percentage Change in ETR[1]: Equipment	Percentage Change in ETR[1]: Structures
Old	No	Taxable	All Equity	-3.1	-9.8	0.4	1.2	-9.1	-12.6
Old	No	Taxable	65/35	-2.4	-7.4	1.3	4.0	-6.0	-8.0
Old	No	All	All Equity	-2.1	-6.4	1.6	5.1	-4.9	-6.4
Old	No	All	65/35	-1.7	-5.2	2.1	6.4	-3.8	-4.9
Old	Constant post-tax	Taxable	All Equity	-4.2	-9.8	-1.4	-3.2	-16.5	-16.8
Old	Constant post-tax	Taxable	65/35	-3.2	-7.8	-0.1	-0.3	-10.9	-11.5
Old	Constant post-tax	All	All Equity	-2.5	-5.7	0.7	1.5	-9.4	-9.6
Old	Constant post-tax	All	65/35	-2.0	-4.9	1.3	3.2	-6.9	-7.3
Old	Tax-Adjusted	Taxable	All Equity	-2.6	-6.4	0.3	0.8	-13.2	-13.7
Old	Tax-Adjusted	Taxable	65/35	-2.1	-5.2	1.1	2.8	-8.8	-9.4
Old	Tax-Adjusted	All	All Equity	-1.8	-4.2	1.4	3.3	-7.6	-7.8
Old	Tax-Adjusted	All	65/35	-1.5	-3.8	1.8	4.6	-5.7	-6.1
New	No	Taxable	All Equity	-0.7	-2.6	2.7	9.3	-2.9	-4.5
New	No	Taxable	65/35	-0.9	-2.8	2.8	9.1	-2.6	-3.6
New	No	All	All Equity	-0.9	-3.0	2.8	8.8	-2.5	-3.4
New	No	All	65/35	-1.0	-3.1	2.8	8.8	-2.3	-3.1
New	Constant post-tax	Taxable	All Equity	-1.0	-2.5	1.9	4.6	-5.6	-5.8
New	Constant post-tax	Taxable	65/35	-1.1	-2.7	2.1	5.2	-4.5	-3.4
New	Constant post-tax	All	All Equity	-1.0	-2.4	2.2	5.2	-4.4	-4.5
New	Constant post-tax	All	65/35	-1.0	-2.5	2.3	5.8	-3.8	-4.1
New	Tax-Adjusted	Taxable	All Equity	-0.6	-1.6	2.3	5.8	-4.0	-4.3
New	Tax-Adjusted	Taxable	65/35	-0.8	-2.0	2.4	6.3	-3.7	-4.0
New	Tax-Adjusted	All	All Equity	-0.8	-2.0	2.4	5.7	-3.8	-3.9
New	Tax-Adjusted	All	65/35	-0.9	-2.2	2.5	6.2	-3.5	-3.8

Source: Authors' calculations.

(1) Assuming no change in interest rates.

Table 4
Effects of a 10% Reduction in Individual Tax Rates on the User Cost of Capital, 2014

Old View or New View	Equity and Risk Adjustment	Taxable or All Investors	100% or 65% Equity Financing	Percentage Change in User Cost: Ignore Effects of Deficits on Interest Rates		Percentage Change in User Cost: Include Effects of Deficits on Interest Rates		Percentage Change in ETR[1]	
				Equipment	Structures	Equipment	Structures	Equipment	Structures
Old	No	Taxable	All Equity	-0.8	-2.6	1.4	4.3	-2.1	-2.9
Old	No	Taxable	65/35	-1.0	-3.0	1.3	3.9	-2.3	-3.0
Old	No	All	All Equity	-1.1	-3.2	1.2	3.6	-2.4	-3.0
Old	No	All	65/35	-1.1	-3.4	1.1	3.5	-2.4	-3.0
Old	Constant post-tax	Taxable	All Equity	-1.1	-2.5	0.7	1.6	-3.8	-3.8
Old	Constant post-tax	Taxable	65/35	-1.2	-2.8	0.7	1.7	-3.7	-3.9
Old	Constant post-tax	All	All Equity	-1.1	-2.4	0.8	1.9	-3.9	-3.9
Old	Constant post-tax	All	65/35	-1.1	-2.7	0.8	2.1	-3.7	-3.9
Old	Tax-Adjusted	Taxable	All Equity	-0.7	-1.7	1.2	2.8	-3.2	-3.3
Old	Tax-Adjusted	Taxable	65/35	-0.8	-2.1	1.1	2.8	-3.4	-3.6
Old	Tax-Adjusted	All	All Equity	-0.9	-2.1	1.0	2.4	-3.7	-3.8
Old	Tax-Adjusted	All	65/35	-1.0	-2.4	1.0	2.5	-3.7	-3.9
New	No	Taxable	All Equity	-0.4	-1.3	1.7	5.7	-1.4	-2.2
New	No	Taxable	65/35	-0.7	-2.2	1.4	4.7	-2.0	-2.8
New	No	All	All Equity	-0.8	-2.7	1.3	4.2	-2.2	-3.0
New	No	All	65/35	-1.0	-3.1	1.2	3.8	-2.3	-3.0
New	Constant post-tax	Taxable	All Equity	-0.5	-1.2	1.2	3.0	-2.6	-2.7
New	Constant post-tax	Taxable	65/35	-0.8	-2.0	1.1	2.7	-3.2	-3.5
New	Constant post-tax	All	All Equity	-0.8	-1.9	1.0	2.5	-3.5	-3.6
New	Constant post-tax	All	65/35	-0.9	-2.3	1.0	2.5	-3.5	-3.8
New	Tax-Adjusted	Taxable	All Equity	-0.3	-0.8	1.4	3.5	-2.0	-2.1
New	Tax-Adjusted	Taxable	65/35	-0.6	-1.6	1.3	3.3	-2.9	-3.2
New	Tax-Adjusted	All	All Equity	-0.7	-1.7	1.1	2.7	-3.4	-3.5
New	Tax-Adjusted	All	65/35	-0.9	-2.2	1.1	2.7	-3.5	-3.7

Source: Authors' calculations.

(1) Assuming no change in interest rates.

Appendix Table 1

Effects of Tax Policy Options on Revenues and Interest Payments, 2001-2014[1]

	Calendar Year														
	2001	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**Total 2001-2014**
Tax Cuts Extended[2]															
Revenue Loss	-75	-89	-198	-284	-223	-201	-208	-218	-234	-254	-334	-320	-339	-360	-3337
Interest Expense	0	-4	-8	-14	-28	-43	-60	-77	-93	-111	-132	-156	-181	-208	-1115
Budget Cost	-75	-93	-206	-298	-251	-244	-268	-295	-327	-365	-466	-476	-520	-568	-4452
10% Reduction in Individual Tax Rates[2]															
Revenue Loss	-94	-90	-95	-104	-112	-118	-127	-137	-142	-153	-162	-172	-183	-193	-1883
Interest Expense	-1	-5	-9	-12	-18	-27	-36	-46	-56	-67	-78	-91	-105	-120	-671
Budget Cost	-95	-95	-104	-116	-130	-145	-163	-183	-198	-220	-241	-263	-288	-314	-2555

Source: CBO (2005) and Urban-Brookings Tax Policy Center Microsimulation Model and CBO (2005) table 4-10 and supplemental tables.

(1) Entries in billions of dollars.
(2) As described in the text.

Appendix Table 2
Effects of Extended Tax Cuts on the User Cost of Capital, 2014

Old View or New View	Equity and Risk Adjustment	Taxable or All Investors	100% or 65% Equity Financing	User Cost of Capital						Effective Tax Rate			
				Baseline		After Tax Cut Extension		After Tax Cut Extension with Interest Rate Effects		Baseline		After Tax Cut Extension	
				Equipment	Structures	Equipment	Structures	Equipment	Structures	Equipment	Structures	Equipment	Structures
Old	No	Taxable	All Equity	0.191	0.068	0.185	0.062	0.191	0.069	0.650	0.627	0.591	0.548
Old	No	Taxable	65/35	0.193	0.071	0.188	0.065	0.195	0.073	0.666	0.648	0.626	0.597
Old	No	All	All Equity	0.194	0.072	0.190	0.067	0.197	0.076	0.675	0.659	0.642	0.618
Old	No	All	65/35	0.195	0.073	0.191	0.069	0.199	0.078	0.681	0.668	0.656	0.635
Old	Constant post-tax	Taxable	All Equity	0.231	0.115	0.221	0.103	0.228	0.111	0.455	0.477	0.380	0.396
Old	Constant post-tax	Taxable	65/35	0.224	0.107	0.217	0.098	0.224	0.106	0.498	0.513	0.443	0.454
Old	Constant post-tax	All	All Equity	0.230	0.113	0.224	0.107	0.232	0.115	0.447	0.469	0.405	0.424
Old	Constant post-tax	All	65/35	0.223	0.105	0.218	0.100	0.226	0.108	0.488	0.502	0.454	0.466
Old	Tax-Adjusted	Taxable	All Equity	0.224	0.106	0.218	0.099	0.224	0.107	0.398	0.415	0.345	0.359
Old	Tax-Adjusted	Taxable	65/35	0.218	0.099	0.213	0.094	0.220	0.102	0.451	0.462	0.411	0.418
Old	Tax-Adjusted	All	All Equity	0.227	0.109	0.223	0.105	0.230	0.113	0.422	0.442	0.390	0.408
Old	Tax-Adjusted	All	65/35	0.220	0.102	0.217	0.098	0.224	0.106	0.467	0.480	0.440	0.450
New	No	Taxable	All Equity	0.184	0.061	0.183	0.060	0.189	0.067	0.585	0.541	0.568	0.516
New	No	Taxable	65/35	0.189	0.066	0.187	0.064	0.194	0.072	0.630	0.602	0.614	0.581
New	No	All	All Equity	0.191	0.068	0.189	0.066	0.196	0.074	0.650	0.627	0.633	0.606
New	No	All	65/35	0.193	0.071	0.191	0.068	0.198	0.077	0.666	0.648	0.650	0.628
New	Constant post-tax	Taxable	All Equity	0.221	0.102	0.218	0.100	0.225	0.107	0.373	0.389	0.352	0.366
New	Constant post-tax	Taxable	65/35	0.217	0.099	0.215	0.096	0.222	0.104	0.446	0.457	0.426	0.442
New	Constant post-tax	All	All Equity	0.225	0.108	0.223	0.105	0.230	0.113	0.411	0.429	0.393	0.410
New	Constant post-tax	All	65/35	0.219	0.101	0.217	0.099	0.225	0.107	0.464	0.476	0.446	0.457
New	Tax-Adjusted	Taxable	All Equity	0.217	0.099	0.216	0.097	0.222	0.104	0.341	0.354	0.327	0.339
New	Tax-Adjusted	Taxable	65/35	0.214	0.095	0.212	0.093	0.219	0.101	0.415	0.423	0.400	0.406
New	Tax-Adjusted	All	All Equity	0.223	0.106	0.222	0.104	0.229	0.112	0.398	0.415	0.382	0.399
New	Tax-Adjusted	All	65/35	0.218	0.099	0.216	0.097	0.223	0.105	0.451	0.462	0.435	0.445

Source: Authors' calculations.

Appendix Table 3
Effects of a 10% Reduction in Individual Tax Rates on the User Cost of Capital, 2014

Old View or New View	Equity and Risk Adjustment	Taxable or All Investors	100% or 65% Equity Financing	User Cost of Capital						Effective Tax Rate			
				Baseline		After Tax Cut Extension		After Tax Cut Extension with Interest Rate Effects		Baseline		After Tax Cut Extension	
				Equipment	Structures	Equipment	Structures	Equipment	Structures	Equipment	Structures	Equipment	Structures
Old	No	Taxable	All Equity	0.191	0.068	0.189	0.067	0.193	0.071	0.650	0.627	0.636	0.609
Old	No	Taxable	65/35	0.193	0.071	0.191	0.069	0.195	0.073	0.666	0.648	0.651	0.629
Old	No	All	All Equity	0.194	0.072	0.192	0.070	0.196	0.075	0.675	0.659	0.659	0.639
Old	No	All	65/35	0.195	0.073	0.193	0.070	0.197	0.075	0.681	0.668	0.665	0.647
Old	Constant post-tax	Taxable	All Equity	0.231	0.115	0.229	0.112	0.233	0.116	0.455	0.477	0.438	0.458
Old	Constant post-tax	Taxable	65/35	0.224	0.107	0.222	0.104	0.226	0.108	0.498	0.513	0.479	0.493
Old	Constant post-tax	All	All Equity	0.230	0.113	0.228	0.111	0.232	0.115	0.447	0.469	0.430	0.450
Old	Constant post-tax	All	65/35	0.223	0.105	0.220	0.102	0.225	0.107	0.488	0.502	0.469	0.483
Old	Tax-Adjusted	Taxable	All Equity	0.224	0.106	0.222	0.104	0.226	0.109	0.398	0.415	0.385	0.402
Old	Tax-Adjusted	Taxable	65/35	0.218	0.099	0.216	0.097	0.220	0.102	0.451	0.462	0.435	0.445
Old	Tax-Adjusted	All	All Equity	0.227	0.109	0.225	0.107	0.229	0.112	0.422	0.442	0.407	0.425
Old	Tax-Adjusted	All	65/35	0.220	0.102	0.218	0.099	0.222	0.104	0.467	0.480	0.450	0.461
New	No	Taxable	All Equity	0.184	0.061	0.184	0.060	0.187	0.065	0.585	0.541	0.577	0.529
New	No	Taxable	65/35	0.189	0.066	0.187	0.064	0.191	0.069	0.630	0.602	0.618	0.585
New	No	All	All Equity	0.191	0.068	0.189	0.066	0.193	0.071	0.650	0.627	0.635	0.608
New	No	All	65/35	0.193	0.071	0.191	0.068	0.195	0.073	0.666	0.648	0.651	0.629
New	Constant post-tax	Taxable	All Equity	0.221	0.102	0.220	0.101	0.223	0.106	0.373	0.389	0.363	0.378
New	Constant post-tax	Taxable	65/35	0.217	0.099	0.216	0.097	0.220	0.101	0.446	0.457	0.432	0.442
New	Constant post-tax	All	All Equity	0.225	0.108	0.223	0.106	0.227	0.110	0.411	0.429	0.396	0.414
New	Constant post-tax	All	65/35	0.219	0.101	0.217	0.099	0.222	0.104	0.464	0.476	0.447	0.458
New	Tax-Adjusted	Taxable	All Equity	0.217	0.099	0.216	0.098	0.220	0.102	0.341	0.354	0.334	0.346
New	Tax-Adjusted	Taxable	65/35	0.214	0.095	0.212	0.093	0.216	0.098	0.415	0.423	0.403	0.410
New	Tax-Adjusted	All	All Equity	0.223	0.106	0.222	0.104	0.226	0.109	0.398	0.415	0.384	0.401
New	Tax-Adjusted	All	65/35	0.218	0.099	0.216	0.097	0.220	0.102	0.451	0.462	0.435	0.445

Source: Authors' calculations.

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