The Bush Tax Cut and National Saving

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Abstract

Following through on pledges made during his election campaign, President Bush proposed and Congress passed a substantial tax cut in 2001, the Economic Growth and Tax Relief Reconciliation Act (EGTRRA). Much has been written about the size of the tax cut, its impact on the federal budget, its distributional consequences, and its short-run macroeconomic impact. There has been less focus on EGTRRA's incentive effects; one of the most important potential behavioral effects is on saving.

To analyze the behavioral effects of the Bush tax cut on saving and other macroeconomic variables, I use the Auerbach-Kotlikoff (1987) model in conjunction with the NBER's TAXSIM model. An interesting by-product of this analysis is the "dynamic scoring" of the tax cut – the estimated feedback effects of behavior on revenue. By comparing the revenue losses generated by the model with those that would occur without any behavioral response, one can estimate how much of the static revenue loss would be recouped by expanded economic activity. The simulations suggest that dynamic scoring has a significant impact on estimated revenue losses, but that the tax cut's impact on national saving is still negative in the long run.

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INTRODUCTION

Following through on pledges made during his election campaign, President Bush proposed and Congress passed for his signature a substantial tax cut in 2001, forever linked to the unwieldy acronym EGTRRA (the Economic Growth and Tax Relief Reconciliation Act). Much has been written about the size of the tax cut, its impact on the federal budget, and its distributional consequences. There has also been considerable debate over the politics and economics of the tax cut's "unfinished business." These include, in particular, the growing problem of the Alternative Minimum Tax (AMT), which was exacerbated by EGTRRA's reduction in ordinary income tax burdens, and the tax cut's "sunset" after 2010. The tax cut's passage has also prompted a debate about its short-run macroeconomic consequences, with respect to both its timing and whether its "back-loaded" structure undercut its ability to spur economic activity during the recent economic downturn.

Throughout this debate, there has been less focus on EGTRRA's incentive effects. This lack of attention might be surprising, given that the lion's share of the projected revenue losses come from reductions in statutory marginal tax rates and through other provisions (such as the phasing out of the estate tax) that would be expected to influence behavioral incentives. The focus on other issues may relate to the complexity of the legislation, the various phase-ins and phase-outs, and the difficulty of modeling the simultaneous effects of such a large number of provisions. Yet, an important underlying motivation for many in pursuing this tax cut was the notion that lower taxes can spur private activity and thereby make the economy more productive. It seems, then, that efforts to evaluate the tax cut's incentive effects are important, if challenging. One of the most important potential behavioral effects is on saving, which affects future productivity and living standards through capital deepening.

This paper focuses on the net national saving rate as a summary measure of the nation's rate of capital accumulation. The net national saving rate is the share of net output that is consumed by neither government nor households. Unlike measures of saving based on the behavior of the private sector or households alone, the net national saving rate accounts for government saving and therefore is a comprehensive measure of the share of output put aside by the economy as a whole for capital accumulation. This inclusion of government saving is especially important in analyzing policies, such as tax cuts, under which resources are being shifted from government to the private sector, because private and personal saving rates may rise even as national saving falls.

To analyze the behavioral effects of the Bush tax cut, I use the Auerbach-Kotlikoff (1987, hereafter *AK*) model, a dynamic general equilibrium simulation model that incorporates the behavior of firms, government and forward-looking households. The *AK* model has been used extensively over the years to evaluate fundamental tax reforms, such as replacing the federal income tax with a consumption tax, but it is also capable of measuring the effects of more incremental changes in the tax system like those adopted in 2001.

The remainder of the paper is organized as follows. The next section describes the major provisions of EGTRRA that will be evaluated, indicating their impact on marginal tax rates and their potential effects on behavior. The following section describes the *AK* model and how the model is used to study the effects of the tax cut. The remainder of the paper presents simulation results of the effects of the tax cut on saving and output under a variety of assumptions. The simulations suggest that the Bush tax cut may increase saving in the short run, depending on assumptions, and that it is likely to increase output in the short run, due to its additional salutary effects on labor supply. In the longer run, though, saving and output are likely to fall, once the

revenue losses generated by the tax cut are confronted through necessary policy changes. Only if the revenue losses are entirely offset by reductions in government consumption spending can this long-run outcome be avoided. Thus, whatever its benefits, the tax cut does not offer the promise of enhancing saving and expanding output in the long run.

An interesting by-product of this analysis is the "dynamic scoring" of the tax cut – the estimated feedback effects of behavior on revenue. By comparing the revenue losses generated by the model with those that would occur without any behavioral response, one can estimate how much of the static revenue loss would be recouped by expanded economic activity. Although the *AK* model is well suited for such calculations, it has not been used for this purpose in the past. The results below suggest that static revenue estimates generally overstate the net revenue loss from tax cuts like EGTRRA, even for simulations in which the tax cuts are projected to reduce national saving and output. That is, the results regarding saving and output summarized above take place *in spite of* the recoupment of revenue predicted by the model.

EGTRRA: PROVISIONS AND EFFECTS

While EGTRRA contained many provisions, the most important from the perspective of revenue cost were those reducing marginal income tax rates. These included the creation of the new 10 percent bracket in 2001 below the 15 percent bracket and the phase in of lower marginal tax rates in higher brackets. The legislation would further reduce effective marginal tax rates through the phased repeal of the itemized deduction and personal exemption phase-outs. Under the heading of "marriage penalty relief," the legislation broadens the 15 percent bracket and reforms the Earned Income Tax Credit for married couples, both provisions that reduce marginal tax rates for some taxpayers.

These rate reductions were accompanied by an increase in the child tax credit and (for couples) the standard deduction, provisions that could, indirectly, reduce marginal tax rates slightly by sheltering more income from tax. There was also a temporary provision (through 2004) to increase the AMT exemption level, aimed at reducing the number of additional taxpayers subject to the AMT because of the other provisions.

When EGTRRA became law, the Joint Committee on Taxation (JCT 2001) estimated that the provisions listed above accounted for 82 percent of its revenue loss in 2010, the last full year of the tax cut prior to its legislated sunset, and 87 percent over the period 2001-2010.[1] This paper considers the macroeconomic effects of these provisions, as a group.

The most significant element omitted from this list of provisions is the phased repeal of the estate tax, which accounts for about half of the remaining revenue loss between 2001 and 2010. There are two reasons for this omission. First, there is considerable uncertainty about how to model the effects of the estate tax on behavior (see, e.g., the collection of papers in Gale, Hines and Slemrod, 2001). While bequests appear sensitive to estate tax rates, the motivations for bequest saving and the manner in which taxes influence estate planning are not clear. Thus, there would be enormous uncertainty attached to any particular modeling assumptions. Second, the results based on any given behavioral specification will also be very sensitive to one's assumption about the permanence of estate tax repeal. Under the law as passed, estate tax repeal lasts for just one year, 2010, after which the pre-2001 rules apply. If this law remains in force, estate tax repeal is likely to have very insignificant effects on saving. On the other hand, if estate tax repeal is extended for a significant period of time, then its impact could be more important,

depending then on the particular behavioral assumptions one chose.[2] Thus, the analysis of this paper and its conclusions apply to the Bush tax cut, *excluding* changes in the estate tax.

Impact of EGTRRA on Marginal Tax Rates

Table 1 presents estimates of the effects of EGTRRA on average marginal tax rates (weighted by the respective type of income) faced by labor income, interest and dividend income, and long-term capital gains for each year during the period 2001-2010.[3] All calculations are based on a 1996 sample of tax returns, with later years simulated using the assumption of smooth growth in prices (3 percent per year), population (1.2 percent per year) and real per capita income (1 percent per year). The table's first three columns project tax rates that would have prevailed had EGTRRA not been enacted. Even with no change in law, average marginal tax rates would have risen through "real" bracket creep, the migration of taxpayers into higher brackets due to real income growth.

With EGTRRA in effect, marginal rates are lower, progressively more so until 2006, when most of the main provisions are phased in. Two patterns regarding capital income taxes are worth noting. First, the reductions in average marginal tax rates on interest and dividend income are higher than those on wage and salary income because interest and dividend income are more concentrated in higher brackets that eventually enjoy a larger percentage-point drop in

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[1] The JCT estimates for these provisions total $152.8 billion in 2010, compared to an overall revenue loss of $187.0 billion. For the period 2001-2010, the comparable figures are $1,054.7 billion and $1,219.0 billion, respectively. The percentages for other individual years are similar, except for 2001 (when the percentage is lower) and 2002 (when it is higher). These exceptions are attributable to a large shift in corporate estimated taxes from 2001 to 2002 adopted solely to push more revenue into the relevant budget window.

[2] As discussed below, the impact of all provisions depends to some extent on the assumed permanence of the tax cut. But the nature of the estate tax, with its very long planning horizon and large one-time tax assessment, makes this issue much more important.

[3] The estimates in Table 1 of reductions in marginal tax rates on wages and interest and dividend income are somewhat higher than those estimated by Treasury and CBO, summarized in Gale and Potter (2002), Table 6. To the extent that the figures used here overstate the marginal rate reductions, they are also likely to overstate the tax cut's salutary effects.

marginal tax rates. Second, the average marginal tax rate on long-term capital gains is actually slightly *higher* under EGTRRA. The primary reason for this involves the AMT.

As discussed above, EGTRRA pushes more taxpayers onto the AMT. At first, one might think that this would have no impact on the tax rate faced by capital gains, for the 20 percent maximum capital gains tax rate applies under both the ordinary income tax and the AMT. But the AMT contains a provision that phases out the initial exemption amount. This provision works much like the personal exemption and itemized deduction phase-outs under the ordinary income tax, but it has a much more powerful effect on marginal tax rates, because the AMT exemption is large and the rate of phase-out is high.

In 2001, joint filers on the AMT with incomes between $150,000 and $346,000 lost 25 cents of exemptions for each added dollar of income (including capital gains). This had the effect of raising the marginal tax rate on income within this broad range by one-fourth of the statutory AMT marginal tax rate, which was 28 percent for most affected taxpayers. Hence, a dollar of capital gain income was subject to a marginal tax rate of 27 percent (20 + .25 x 28), not 20 percent. With more taxpayers pushed onto the AMT, capital gains are potentially subject to much higher marginal tax rates. It is doubtful that President Bush intended to increase capital gains taxes, but this is one result of his plan.

SIMULATING THE IMPACT OF EGTRRA ON BEHAVIOR

Simulating the effects of EGTRRA with the *AK* model requires a variety of adjustments to the data in Table 1 and some additional calculations and assumptions.

First, I adjust revenues in the model to track the revenue losses projected by the Joint Committee on Taxation, using contemporaneous projections of fiscal-year output by the Congressional Budget Office (2001) to estimate annual revenue losses as a share of output. I

treat the JCT's projections as being "static" revenue estimates[4] and calibrate the model so that its static revenue losses as a share of output match these revenue estimates, which are shown in the last column of Table 1.[5] Note that these revenue losses will not correspond to those in the model's full simulations, because of dynamic revenue feedback effects.

Second, I take the year 2001 tax system, pre-EGTRRA, as the baseline, and consider the impact on this baseline of the tax rate changes given in the third panel of Table 1. Thus, I ignore the underlying drift in marginal tax rates that would have occurred without EGTRRA, and apply the changes in marginal tax rates to the 2001 baseline.

Third, to reduce the complexity of the simulations, I assume that there are a small number of tax regimes under EGTRRA, even though phase-outs and phase-ins make the provisions in effect in each year somewhat distinct from those in adjoining years. Based on the numbers in Table 1, it involves minimal approximation error to assume that there are four tax regimes under EGTRRA, for the years 2001, 2002-3, 2004-5, and 2006-10, and to use for each regime averages of the tax rates and revenue losses in the years of the regime. The marginal tax rates for these regimes are given in the first three columns of Table 2. The last column of Table 2 lists the target ratio of revenue to NNP, based on the revenue losses in Table 1 and an assumed initial ratio of 15.0 percent. This ratio equals the share of federal revenues, excluding payroll taxes, which are treated separately in the model. The baseline value is set at 15.0 percent, slightly higher than the actual 2001 value, to take account of the impact of the tax cut.

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[4] The JCT's revenue estimates are not fully static, because they incorporate behavioral changes at the micro level. For example, they allow for taxpayer responses to changes in capital gains tax rates, but not the macro feedback effects of changes in aggregate output. See Auerbach (1996a) for further discussion. It would be preferable to use truly static revenue estimates for this calibration exercise, but these are not publicly available. The paper's estimates of dynamic feedback effects would not be significantly affected, however, because they depend on the difference between the assumed static revenue loss and the revenue loss projected by the model.

[5] Because output in the model is net of depreciation, the output measure used to calculate revenue shares is net national product (NNP), estimated by adjusting CBO's 2001-2010 GDP projections by the 2000 NNP-GDP ratio.

Fourth, it is necessary to adjust taxes on labor income to account for the fact that taxes on some compensation are deferred. One must also adjust capital income taxes, to reflect both additional taxes at the corporate level and the fact that substantial shares of capital income are received in tax-sheltered forms. These adjustments are complex, and so the details of how they are carried out are relegated to the Appendix. The methodology closely follows that developed in Auerbach (1996b) but is based on more recent data. Table 3 provides the tax rates that result from these calculations. The first column lists the average tax rate on wages, set as a residual to hit the target revenue level given in Table 2. The second column lists the marginal tax rate on wage income that, when combined with the consumption tax rate in the next column, yields a full effective marginal tax rate on wages equal to the corresponding value in Table 2. The third column lists the consumption tax rate, which is used (as discussed in the Appendix) to account for the deferred taxes on sheltered compensation. The fourth column lists the capital income tax rate, derived according to the methodology that is described in the Appendix.

Parameterizing the AK Model

The paper uses the *AK* model to simulate the macroeconomic effects of tax changes. This is a dynamic model that, at each date, has 55 overlapping generations of individuals who save and supply labor to maximize a nested CES lifetime utility function.[6] There is a single production sector and a government sector with two functions, one a pay-as-you-go social insurance system and the other encompassing all remaining federal government activities. This general government sector imposes taxes on consumption, capital income, and labor income. The labor income tax is specified as a quadratic function of income, thus allowing the marginal

and average income tax rates to differ. By adjusting the two parameters of the labor income tax function, one can hit both a revenue target and a desired average marginal tax rate.

All of the simulations presented below preserve a number of the original assumptions in Auerbach and Kotlikoff (1987) and in Auerbach (1996b). These assumptions include a population growth rate of 1.5 percent per year, a Cobb-Douglas production function, a relative weight of 1.5 for leisure in each period's utility sub-function of leisure and consumption, and a perceived offset of .25 of payroll taxes in terms of perceived future benefits. Unless otherwise reported, all simulations also follow the original assumptions regarding the pure rate of time preference (1.5 percent per year), the intertemporal elasticity of substitution (0.25), and the intratemporal elasticity of substitution between leisure and goods (0.8). Reflecting the need to consider realistic short-run responses to tax cuts, I incorporate investment adjustment costs, following the parameterization used for such simulations in Auerbach (1996b).[7] Except where noted, simulations assume a closed economy.

The initial steady state is calibrated so that the payroll tax rate is 15.3 percent, the sum at present of employer and employee contribution rates. The initial level of the national debt equals 40 percent of NNP, roughly its value at the end of 2000. As discussed above, the average tax rate on labor income is adjusted to ensure that the revenue from the non-social-insurance government sector is 15 percent of output, the latter corresponding in the model to NNP.

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[6] The version used here ignores the bequest motive, except where noted. Recent simulations by Altig et al. (2001) using an extension of the *AK* model suggest that incorporating the bequest motive does not have a major impact on the estimated effects of major tax reforms on output and capital accumulation. (The reforms considered did not involve the estate tax.)

[7] In the model the quadratic adjustment cost parameter is set so that an increase of 1 percentage point in the investment-capital ratio increases the cost of investment goods by 10 percent. As discussed in Auerbach (1996b), this is a reasonable estimate, based on the literature. It also corresponds to the base case used by Altig et al. (2001).

Modeling Tax Cuts

As discussed above, EGTRRA includes a phase in of provisions through 2010, followed by a sunset in 2011. This sunset is duly incorporated by the JCT in its revenue estimates, as required, but it is not necessarily consistent with expectations. To simulate the effects of EGTRRA, expectations must be taken into account. In the forward-looking behavior of the agents in the *AK* model, decisions about labor supply and saving during the legislated period of the tax cut depend on what agents believe about the tax cut in the years after 2010. Thus, a complete simulation must specify the full path of fiscal policy, not just its path through 2010. Given our uncertainty about what actually will happen, I provide simulations corresponding to a number of alternative assumptions about post-2010 fiscal policy.

While each of these alternative scenarios may be realistic, *none* correspond to the apparently simple and appealing assumption that the tax cut will be permanent. Without some further adjustment, this assumption would be meaningless, assuming that fiscal policy was on a feasible trajectory to begin with, for it would specify an infeasible fiscal policy path of exploding national debt. It is an even more unreasonable assumption in the current environment, in which a sizable fiscal gap would exist under current policy even had EGTRRA not been implemented (Auerbach, Gale and Orszag 2002).

To separate the analysis below from a more general consideration of how to close the preexisting fiscal gap, all simulations assume (optimistically) that pre-EGTRRA fiscal policy was just sustainable, and that, eventually, the revenue losses introduced by EGTRRA must be offset by fiscal adjustments. In the short run, these adjustments can be deferred by accumulating federal debt, but at some date, which varies by simulation, it is assumed that the per capita level

of debt is stabilized by a tax rate adjustment. The simulations also differ according to *which* tax rate is assumed to adjust at this date of reckoning.

BASIC RESULTS

The *AK* model traces the path of the economy starting from an initial steady state, here taken to be the year 2000, through a period of 150 years, at which time the economy is assumed to have converged to a new steady state. Thus, results for the year 2150 correspond to those for the "long run" after all aggregates in the model have stabilized.

Initially, I consider five simulations, differing by how long EGTRRA is assumed to last and the compensating fiscal instrument that is adjusted after its repeal. These simulations are labeled *w10*, *k10*, *w15*, *k15*, and *k20*. The prefix *w* indicates that the proportional component of the wage tax function is adjusted after the tax cut is repealed; the prefix *k* indicates that the capital income tax serves this residual purpose.[8] The suffixes *10*, *15*, and *20* indicate the number of years the tax cut is assumed to stay in place, from the originally legislated 10 years to a period twice this length. For simulations in which the tax cut lasts longer than currently legislated, I assume that the tax rates from the 2006-2010 regime continue to apply. For all simulations, I assume that debt accumulates while the tax cut is in place, and is stabilized in per capita terms thereafter. Because tax cuts lead to higher debt levels, the eventual stabilization of debt requires an increase in the residual tax component (*w* or *k*) above its pre-tax-cut value.

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[8]A 20-year tax cut simulation using the proportional component of the wage tax as the residual did not converge. The same is true of simulations using the quadratic term in the wage tax function as the residual (which would make subsequent tax increases progressive). Presumably, such simulations would exhibit more negative macroeconomic effects than those increasing labor income tax rates equally for all taxpayers, because of the higher associated marginal tax rates. Simulations using the capital income tax as a residual for periods longer than 20 years produced even larger reductions in capital accumulation than the 20-year tax cut *k20*, both during and after the tax-cut period.

National Saving Rates

Figure 1 presents the path of net national saving rates under the five basic simulations just discussed, over the period 2000-2021 and in the long run (2150). The net national saving rate is defined as the fraction of output (in the model, net output) that is not consumed by households or by the government. The model's net national saving rate initially is 4.3 percent.[9] With the introduction of the tax cut, saving decreases in some simulations and increases in others, depending on the length of the tax cut and the form of the adjustment that occurs thereafter. This range of outcomes, and the possibility that tax cuts can "crowd out" or "crowd in" national savings, is discussed at length in Auerbach and Kotlikoff (1987, chapter 6). There are several factors at work that explain the pattern of results observed in the short run.

First, in the life-cycle model, all tax cuts have wealth effects. Households have more disposable income, and at least some of them will die before the bills come due. This effect generates an increase in consumption and hence a decline in national saving. The longer the tax cut persists, the larger the wealth effect, because the larger the share of the population currently alive that will avoid paying for the tax cut in the future. This explains why short-run saving is lower, the longer the tax cut lasts, for both the *w* and *k* simulations in the figure.

Second, reductions in marginal tax rates on labor income encourage individuals to work more while the tax cut is in force. With this higher income, individuals are in a position to save more, to smooth consumption over time. This factor leads to an increase in saving during the tax cut, and explains why, despite the wealth effect depressing saving, saving rises in the *w* simulations.

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[9] This is about 1 percentage point below the U.S. net national saving rate for the year 2000. Given the model's many abstractions, there is no reason why the two levels should be the same. These simplifications include the omission of the state and local fiscal sector and the assumption that all federal spending is for current consumption.

Finally, though, households take account of the tax increases that are expected *after* the tax cut disappears. If these expected tax increases are on wage income, this reinforces the intertemporal substitution just described, encouraging work while the tax cut applies. But if the expected tax increases are to *capital* income, then households are discouraged from saving, even before the tax increases occur. Thus, saving is lower under the *k* simulations than under the *w* simulations with the same tax-cut termination date, and everywhere below the baseline saving rate in every year for the 15- and 20-year *k* tax cuts.

In the longer run, the national saving rate falls, regardless of the simulation. When the tax cut is removed, the drop is substantial under all simulations, but larger under the *w* simulations because of the bigger shift in the incentive to work. Eventually, in the very long run, saving rates under all simulations converge to a narrow range just below the original, pre-EGTRRA rate. But this reversion in the saving rate is misleading, because the similar *rate* represents a lower *level* of saving. In the long run, the level of capital and hence output has been permanently reduced by the prolonged period of reduced national saving induced by the tax cut. This is quite evident from Figure 2, which shows the level of capital per capita, relative to its pre-EGTRRA value. While capital accumulates in the short run under some of the simulations, it falls by between 3 and 11 percent in the long run. The fall in capital is larger under the *k* tax cuts than under the *w* tax cuts of equal duration, because of the additional disincentive to save. Capital falls more under either type of tax cut (*k* or *w*), the longer the tax cut's duration, because of the larger initial wealth effects and higher distortionary taxes eventually needed to service the national debt.

Thus, in these basic simulations, a tax cut provides at best a short-run stimulus to saving. The longer the tax cut lasts, the weaker the short-run stimulus to saving, and the larger the eventual drop in capital accumulation.

Output

As already discussed, tax cuts may increase national saving in the short run by encouraging labor supply. A corollary of this short-run increase in labor supply should be a contemporaneous increase in output. As Figure 3 illustrates, this is indeed what the simulations predict. The increase occurs under all simulations, including those for which saving rates fall, because the labor supply effect outweighs the slow erosion of the capital stock. But output falls once the tax cut is eliminated. In only one simulation (*w10*) does the increase in output outlive the tax cut – the added saving during the tax cut overcoming the decline in the labor supply incentive; but even in this case, the higher output lasts for just one year. Thereafter, this simulation, like the others, projects a lower level of output, post-EGTRRA, as higher taxes discourage economic activity.

Dynamic Revenue Effects

As discussed above, the revenue losses used in calibrating the model are not those that actually result from the simulations, because of behavioral responses. Tax cut proponents have long argued that such dynamic feedback effects will lessen the negative effect of tax cuts on national saving, by reducing the amount of government debt that must be issued to finance the tax cuts. As is evident from the analysis thus far, the dynamic responses predicted by the model are not large enough to offset the negative impact of tax cuts on national saving. But this does not imply that the revenue feedback effects are inconsequential. Indeed, they are significant.

Figure 4 shows the revenue feedback effects for the five simulations already discussed. For each year, the curve for a particular simulation shows the fraction of that year's static revenue loss that is offset through revenue feedback effects in the same year. These feedback effects are attributable to changes in factor supplies and consumption demand, as well as to changes in factor prices. In all cases, these revenue offsets fall in the range of from 10 percent to 40 percent of the static revenue loss.

A more comprehensive concept of dynamic scoring would also account for debt service, which is affected by the tax cut even if other spending does not change. This broader approach involves two changes from the previous measure based on revenues alone. First, the overall static cost of the tax cut includes not only the static revenue cost, but also the induced increase in debt service. In keeping with the notion of this being a static benchmark, I calculate the induced debt service assuming that there is no change in the interest rate from the initial steady state. Second, the dynamic feedback now accounts not only differences in revenue from the static estimates, but also changes in debt service from the static estimates, resulting from (1) the dynamic revenue effects and (2) changes in interest rates.

Figure 5 presents estimates based on this more comprehensive concept of dynamic scoring, for the same five simulations considered in Figure 4. The feedback range is similar to that of Figure 4, here roughly from 5 percent to 35 percent. Except in the first year of the tax cut, the range in any given year across simulations is narrower than in Figure 4. This is because the simulations that tend to have larger revenue feedback – those based on labor income taxes as the residual instrument – are also those with higher debt accumulation in the first period and hence

higher debt service thereafter. This higher initial debt accumulation occurs because of higher

initial interest rates, attributable to a stronger initial demand for capital in these simulations.[10]

These results leave us with the mixed message that, on the one hand, dynamic revenue

effects matter but, on the other hand, they do not offer support for arguments that tax cuts can

increase national saving.

SENSTIVITY ANALYSIS

The preceding simulation results paint a bleak picture regarding the effects of tax cuts on

national saving and output. How dependent are these results on particular assumptions about the

behavior of households and government and the importance of international transactions, as well

as on restrictions imposed by the model?

Household Preferences

The intertemporal and intratemporal elasticities of 0.25 and 0.8 are within the range suggested by

the literature. The implied labor supply elasticity is relatively high, though[11], and recent

simulation exercises based on the *AK* model or its extensions (e.g., Auerbach 1996b, Altig et al.

2001) have provided sensitivity analyses based on lower values of the intratemporal elasticity.

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[10] Recall that the model incorporates capital adjustment costs. Thus, a stronger demand for capital results not only in more capital accumulation, but also a higher price of capital goods. In the first period of the transition, when this shift in capital goods demand occurs with the arrival of new information about the tax cut, the rate of return to capital, ex post, will be higher, the stronger the demand for capital. In the model, the interest rate rises immediately as result, to equate the after-tax returns to debt and real assets. This leads to higher debt service. In the five simulations analyzed, the interest rate rises in the first year in the *w* simulations, and falls in the *k* simulations. For example, the rise under the 10-year *w* tax cut is 18 basis points; the fall under the 10-year *k* tax cut is 24 basis points. These first-year results would be different if government debt were assumed to be of longer maturity, in which case debt service costs would not respond immediately to short-term rates of return.

[11] As discussed in an unpublished appendix to Altig et al. (2001), available upon request, the labor supply elasticity is an increasing function of each of these parameters. For these particular values, the implied "λ-constant" labor supply elasticity (which measures the variation in labor supply along an optimal path with the marginal utility of income constant, and is greater than the more standard "compensated" elasticity) is about 0.7. In the recent labor supply literature, estimates for men are in some cases higher, but typically somewhat lower, while estimates for women are generally at least as high, and in some cases much higher.

Countering this argument for a lower implied labor supply elasticity is the recent literature, starting with Feldstein (1995), that has emphasized the many margins other than the labor supply decision over which taxable income may respond to the marginal income tax rate. Even if labor supply itself is reasonably inelastic, there may be large responses and distortions as households adjust their forms of compensation, levels of deductions, and so on. This would argue for allowing greater labor supply responsiveness in the *AK* model, in lieu of the other margins that the model does not capture. But, while Feldstein found taxable income elasticites with respect to marginal tax rates of unity or greater, more recent contributions to this literature, notably Gruber and Saez (2002), have found more modest responses in the neighborhood of 0.4. Thus, a lower value of the intratemporal elasticity parameter still seems plausible.

To evaluate the importance of these preference parameters on the responsiveness to saving, I consider two alternative simulations in which one of the parameters is reduced to a value at the low end of its plausible range. For the intertemporal elasticity, this reduction is from 0.25 to 0.1; for the intratemporal elasticity, the reduction is from 0.8 to 0.3. In each simulation, I simultaneously adjust the pure rate of discount from its initial value of 1.5 percent to generate the same initial capital-labor ratio (and hence the same wage and interest rates) in the initial steady state.[12] This also ensures that the national saving rate will be the same.

Figure 6 illustrates the impact of these assumptions on the national saving rate. It compares the results of reducing the intertemporal elasticity (*k10g1*) and the intratemporal elasticity (*k10r3*) with the base case simulation (*k10*), all for a 10-year tax cut after which the capital income tax serves as a residual. As the figure shows, the impact of these alternative behavioral assumptions on the national saving rate is relatively small. With the lower

intratemporal elasticity, labor supply increases by less during the period of the tax cut, and so does the saving rate.[13] On the other hand, the lower intertemporal elasticity enhances short-run saving slightly, because future capital income tax increases exert less of an impact on current behavior.

In the long run, all three simulations lead to similar declines in the capital stock. Under the base case, the capital stock declines by 3.5 percent; the lower intratemporal elasticity causes a larger decline, of 4.7 percent, while the lower intertemporal elasticity has a very small impact, causing the capital stock to decline by 3.6 percent. Given these small changes, it is clear that comparable *increases* in assumed elasticity parameters will not reverse the conclusion that the tax cut reduces capital formation in the long run. Even a substantial increase in the intratemporal elasticity to 1.3 (not shown) leads to a long-run decline in the capital stock of 2.9 percent. Thus, plausible parameter variations do not alter the basic conclusions about the impact of EGTRRA on national saving.

Government Spending

The simulations presented thus far treat all adjustments in fiscal policy as occurring within the tax system. Tax rates are reduced and then, eventually, increased. But there is another possibility, that tax rate reductions will be partially offset by reductions in spending. While one might counter that such spending reductions are not specified as part of EGTRRA, and therefore should not be considered as part of the legislation's effects, this argument is no

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[12] For the simulation in which the intertemporal elasticity is reduced, the pure rate of time preference must also be reduced, to –6.66 percent. For the simulation in which the intratemporal elasticity is reduced, the pure rate of time preference must be set to 0.31 percent.

[13] The smaller increase in labor supply under the lower assumed value of the intratemporal elasticity does have an important impact on estimated revenue feedback. It induces a roughly 15 percentage-point decline in the share of the static revenue loss recouped (from a 15-40 percent feedback range to a range of just below 0 to 25 percent) and a reduction of about 10 percentage points for most years in the full dynamic feedback effect.

more helpful than one suggesting that EGTRRA should be considered "permanent" with no further adjustments in the tax system. As discussed above, tax cuts alone are not feasible and therefore offer an incomplete specification of the path of fiscal policy. *Something* else not specified in the legislation must happen to compensate for the tax cuts. It is an empirical matter what the response will be.

An alternative to the responses considered thus far would be a reduction in government spending. There is some evidence that increases in the level of national debt lead not only to tax increases, but also to reductions in government spending. For example, Auerbach (2000) finds that legislated changes in both revenues and spending over the budget window react to the level and change in the government surplus. However, the magnitude of this response is not precisely estimated, and its timing and permanence is not well understood. The exact nature of the spending response is important, too, for reductions in government investment clearly would not contribute to increased national saving.

To evaluate the possible importance of this alternative response to tax cuts I provide two alternative simulations in which the tax cut is accompanied by reductions in government purchases, in the *AK* model all reductions in current government consumption. In the first simulation, *k10ca*, a 10-year tax cut with the capital income tax serving as the residual instrument is accompanied by a <u>c</u>ut in government spending that precisely equals <u>a</u>ll the static revenue loss. Thus, absent a private behavioral response, there would be no increase in national debt while the tax cut was in force, and no need to increase taxes thereafter. *With* a behavioral response, and dynamic revenue feedback, there is actually room for a permanent capital income tax reduction after the general 10-year tax cut. As this full spending response is extremely unlikely, I also consider the impact of a 50-percent offset, in which government spending

reductions offset half of the static revenue loss.[14] This simulation is labeled *k10ch*. Figure 7

displays the saving response to these two polices, for reference also including from Figure 1 the

saving response under the base case run, *k10*, in which the capital income tax serves as the

residual tax instrument after a 10-year tax cut, but with no government spending response.

Not surprisingly, the assumption that government spending declines generates a higher

level of saving, both before and after the tax cut, than is traced out for the base case. Whereas

the previous assumption of no government spending adjustment generates a saving rate that is

basically flat while the tax cut is in force and lower thereafter, even a partial spending adjustment

reduces the demand for current spending enough to increase saving noticeably. But this still is

true only while the tax cut applies. Once the tax cut is repealed (and, by assumption of the

simulation, spending reverts to its original level), the saving rate drops. In the long run, the

capital stock per capita is still lower than initially under the intermediate run; only when the full

spending offset is assumed does the capital stock converge to a higher value than before the tax

cut, and in this case the increase is just 0.5 percent.

One might object to these scenarios, arguing that if there is a spending response, there is

no need for the tax cut to be repealed. Thus, the tax cut can be given more time to work. But

this logic works only if the spending response is complete. Figure 8 displays saving rates under

the same three scenarios as depicted in the previous figure, except that the tax cut is assumed to

last for 20 years. As discussed previously, the base case for a tax cut of this length (*k20*)

generates a large eventual decline in the capital stock, 11 percent. Under the full-spending offset

scenario (*k20ca*), capital per capita does rise by more with the lengthier tax cut, now by 2.5

percent. But it still falls under the intermediate policy, by 4 percent.

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[14] Regressions presented recently by Calomiris and Hassett (2002) suggest a still smaller spending response, roughly a quarter of revenue "surprises," although it is hard to translate this result directly to the case of an expected tax cut.

Clearly, there are other scenarios under which a smaller spending offset might be required to keep capital from falling. But these results suggest that even a sizable government spending reduction may not be enough to undo the negative effects of a tax cut like EGTRRA on national saving.

The Open Economy

The simulations thus far treat the United States as a closed economy, in which changes in national saving are identical to changes in national investment. Although the closed-economy assumption is clearly counterfactual concerning trade flows, it may still make sense as a characterization of the relationship between increments to saving and investment; there continues to be considerable debate on this point, dating from the seminal contribution of Feldstein and Horioka (1980). Still, it is worth considering the impact of greater independence between saving and investment flows.

For purposes of comparison, I examine the impact of the alternative polar assumption of completely free capital flows, with rates of return on capital equated at all times between the United States and the rest of the world. Starting from the same initial steady state as before, the simulation allows capital to flow in or out of the United States to maintain the same factor returns despite changes in labor supply and national saving. Now, as national saving falls, there is no increase in the rate of return to dampen the fall in saving; instead, foreign capital enters the country to fill the void. As one would expect, this exacerbates the decline in national saving. Figure 9 shows national saving rates under the 10-year *k* tax cut, under the closed-economy assumption used until now, and the open economy assumption (*k10oe*). The saving rate is reduced by the ability of the United States to import capital.

Modeling Restrictions

Using a parsimonious simulation model to evaluate the impact of a complex tax system on a complex economy requires a variety of simplifying assumptions, a number of which have already been discussed. In the current context of studying policies involving national debt accumulation, one that might be of concern is that all assets in the economy have the same after-tax rate of return.

With no aggregate risk, private assets and government debt logically must have the same yield. As the model is calibrated to have realistic values for the capital-output ratio and the marginal product of capital, this means that the yield on government debt is substantially higher in the model than in the actual economy. Might this overstate the long-run damage to the economy of short-run debt accumulation induced by the tax cut? It is impossible to answer this question fully without a model that incorporates asset risk, but some insight may be gained by considering how the results change if the equilibrium rate of return is set at a substantially lower rate through adjustment of the household's preference parameters.

In the initial steady state for the simulations discussed thus far, the before-tax rate of return to capital is just over 9 percent. To consider the impact of a smaller initial rate of return, I lower the household rate of time preference from 1.5 percent to -7 percent, introduce a strong bequest motive[15], and then readjust the tax parameters to achieve the same targeted values of revenue, marginal tax rates and the debt as before. The result is an initial steady state with a before-tax return of just 3.4 percent, but an unrealistically high capital-output ratio and a national saving rate over 11 percent.

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[15] The bequest is generated, as in Altig et al. (2001), by a "utility of bequest" specification, with bequests being received by generations 20 years younger than those leaving the bequest. With no uncertainty and perfect foresight, households fully anticipate the receipt of bequests.

Figure 10 shows how this change in specification affects the tax cut's impact on saving. It repeats two of the original simulations in Figure 1 (*w10* and *k10*) for the lower initial interest rate. To facilitate comparison, I subtract the initial interest rate difference from the new series (*w10s* and *k10s*).

For the experiment in which the wage tax is used as residual after the tax cut ends in 2010, the change in assumption has virtually no impact on the saving rate in the short run or the long run. Output and capital still decline in the long run, although by somewhat less in percentage terms. On the other hand, the lower interest rate does lead to a higher saving rate when the capital income tax is the residual instrument. The intuition for this result is that lowering the rate at which debt accumulates lowers the extent to which the capital income tax must be raised after the tax cut. This encourages more saving not only after tax cut expires, but also while it is in place, because behavior is forward-looking. Even in this case, however, the net impact on capital accumulation and output is still negative in the long run.

CONCLUSION

Simple economic intuition about the effects of tax cuts suggests that, by creating wealth effects for current households, they stimulate current consumption and reduce national saving. There is much more to consider, though, in tracing through the effects of a particular tax cut such as EGTRRA, including changes in behavioral incentives due to marginal tax rate changes, general equilibrium effects, and the specification of how fiscal policy will adjust in the future. At the end of the day, though, the simple intuition holds, at least in this case. It is difficult to put together a combination of reasonable assumptions regarding household and government behavior under which this tax cut will increase national saving and capital formation.

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APPENDIX

This appendix describes how the labor and capital income taxes in Table 1 are adjusted to take account of important characteristics of the U.S. tax system. The methodology closely follows that in Auerbach (1996b), to which the reader is referred for further discussion.

Labor Income Taxes

In the model, the tax on labor income applies to all compensation. Under the actual tax system, the tax on labor income does not apply to pension contributions, which are taxed only upon the receipt of benefits. To take account of this, I treat the existing labor income tax as a hybrid of a wage tax on direct compensation and a consumption tax on pension contributions and benefits. Based on Federal Reserve statistics (Board of Governors 2002, Tables B.100 and L.225.i) data, pension fund reserves plus balances in IRAs accounted for roughly a quarter of all net household assets at the end of 2000. Given that household pension reserves plus IRA balances equal about one-fourth of household wealth, I set the average consumption rate at one-third the average wage tax rate, with the total tax wedge on labor supply of the two taxes combined equal to that of the actual tax system. This is the same ratio used in Auerbach (1996b).

To account for the progressivity of the income tax, I set the average marginal wage tax rate above the average wage tax rate. The average wage tax rate is determined by the overall revenue target, while the average marginal rate set so that, in combination with the consumption tax rate, it yields a total effective marginal tax rate on labor income equal to the appropriate value in Table 1.[16] For 2001 (pre-EGTRRA), this procedure yields an average wage tax of 9.16

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[16] The effective marginal wage tax, t, taking account of both wage and consumption tax effects, is defined by the expression $(1-t)=(1-t_w)/(1+t_c)$, where t_w is the average marginal wage tax rate and t_c is the consumption tax rate.

percent, an average consumption tax rate of 3.06, and an average marginal wage tax rate of 22.94 percent, with a resulting effective average marginal wage tax rate of 25.22, as required.[17]

Capital Income Taxes

The version of the *AK* model used in this paper has a proportional capital income tax, with a provision for partial expensing to take account of accelerated depreciation and other provisions that reduce tax rates on new investment relative to existing assets. Auerbach (1996b) provides a detailed calculation resulting in an estimate of an overall federal tax rate on capital income of 16 percent that is effected through a 20 percent statutory tax rate and 20 percent fractional expensing of new investment. Because of the complexity of this calculation, I do not repeat it here, but take these figures as the base case for 2001 (pre-EGTRRA). I then consider the impact on the 16 percent effective tax rate of the changes in tax rates on dividends, interest and capital gains given in Table 1, taking into account the fraction of capital income to which these rates apply.

Two major factors attenuate the impact of these marginal tax rate changes. First, roughly half the capital stock takes the form of housing, which is already largely tax exempt. Second, large shares of debt and equity are held by tax exempt entities or entities, such as insurance companies, whose tax rates are not affected by EGTRRA. Based on Board of Governors (2002, Tables B.100.e and L.225.i), I estimate that roughly 60 percent of equity is held by households in taxable form. I assume this figure also applies to debt. The equity fraction is lower than in Auerbach (1996b). This makes sense given the increasing share of wealth held by pension funds.

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[17] The corresponding tax rates for the base case in Auerbach (1996b) were .075, .025, .217 and .236, reflecting the slightly lower income tax rates and revenues of the time.

To calculate the effective tax rate on capital in each regime of the tax cut, I follow the procedures outlined in Auerbach (1996b, Appendix A). I use the cost of capital expressions given there and the same assumptions about the debt-asset ratio, corporate-noncorporate asset division, inflation rate, real required rate of return, and insurance companies' tax rates and shares of debt and equity. The first step is to use the cost of capital formulas and various parameter assumptions to estimate the effective tax rate for the base year. In this calculation, the rate of economic depreciation is left unspecified, and solved for as a residual to ensure that the calculation results in the assumed baseline effective tax rate of 16 percent. Then, for each of the different regimes of the tax cut, I hold all parameters fixed except for the individual tax rates on interest, dividends and capital gains, which are set at their appropriate values. Finally, I adjust all resulting effective tax rates to account for the fractional expensing rate, which is assumed to remain constant at 20 percent.

Table 1

Marginal Tax Rates Under EGTRRA and Prior Law

(Percent)

| Year | **Prior Law** | | | **EGTRRA** | | | **Change** | | | **Change** |
	Wages	Interest & Dividends	Capital Gains	Wages	Interest & Dividends	Capital Gains	Wages	Interest & Dividends	Capital Gains	Revenue/ NNP
2001	25.22	26.26	20.01	24.43	25.08	20.30	-0.79	-1.18	0.29	-0.45
2002	25.31	26.21	20.00	23.95	24.49	20.30	-1.36	-1.72	0.30	-0.70
2003	25.39	26.34	20.04	24.04	24.60	20.28	-1.35	-1.75	0.24	-0.75
2004	25.47	26.43	20.05	23.54	24.16	20.45	-1.93	-2.27	0.41	-0.81
2005	25.53	26.40	20.11	23.52	24.12	20.49	-2.01	-2.28	0.38	-0.86
2006	25.61	26.32	19.98	23.04	23.37	20.59	-2.58	-2.96	0.61	-1.04
2007	25.71	26.65	20.17	23.16	23.32	20.39	-2.55	-3.33	0.22	-1.09
2008	25.75	26.59	20.12	23.24	23.35	20.52	-2.51	-3.24	0.41	-1.09
2009	25.80	26.50	20.04	23.37	23.40	20.40	-2.43	-3.09	0.36	-1.08
2010	25.84	26.59	20.11	23.45	23.38	20.44	-2.38	-3.21	0.33	-1.09

Sources: Marginal tax rates from the NBER TAXSIM Model, based on 1996 sample of tax returns, with assumed inflation rate of 3 percent, population growth rate of 1.2 percent, and real growth rate of 1 percent per capita.

Revenue losses equal ratio of JCT (2001) revenue estimates to CBO (2001) estimates of GDP, adjusted by 2000 NNP-GDP ratio.

Table 2

Marginal Tax Rates for Assumed EGTRRA Regimes

(Percent)

Marginal Tax Rate on

Regime	Wages	Interest & Dividends	Capital Gains	Revenue/NNP
(base year) 2000	25.22	26.26	20.01	15.00
2001	24.43	25.08	20.30	14.55
2002-2003	23.87	24.53	20.28	14.28
2004-2005	23.25	23.99	20.40	14.16
2006-2010	22.73	23.09	20.39	13.92

Source: Based on average changes in Table 1, starting from 2001 pre-EGTRRA values of tax rates
and an assumed pre-EGTRRA ratio of revenue to NNP of 15.0 percent

Table 3

Tax Rates Used for Simulations

(percent)

Tax Rate on

Regime	Wages (Average)	Wages (Marginal)	Consumption	Capital Income
(base year) 2000	9.16	22.94	3.06	20.00
2001	8.68	22.12	3.06	19.68
2002-2003	8.38	21.55	3.06	19.52
2004-2005	8.28	20.91	3.06	19.37
2006-2010	8.06	20.37	3.06	19.11

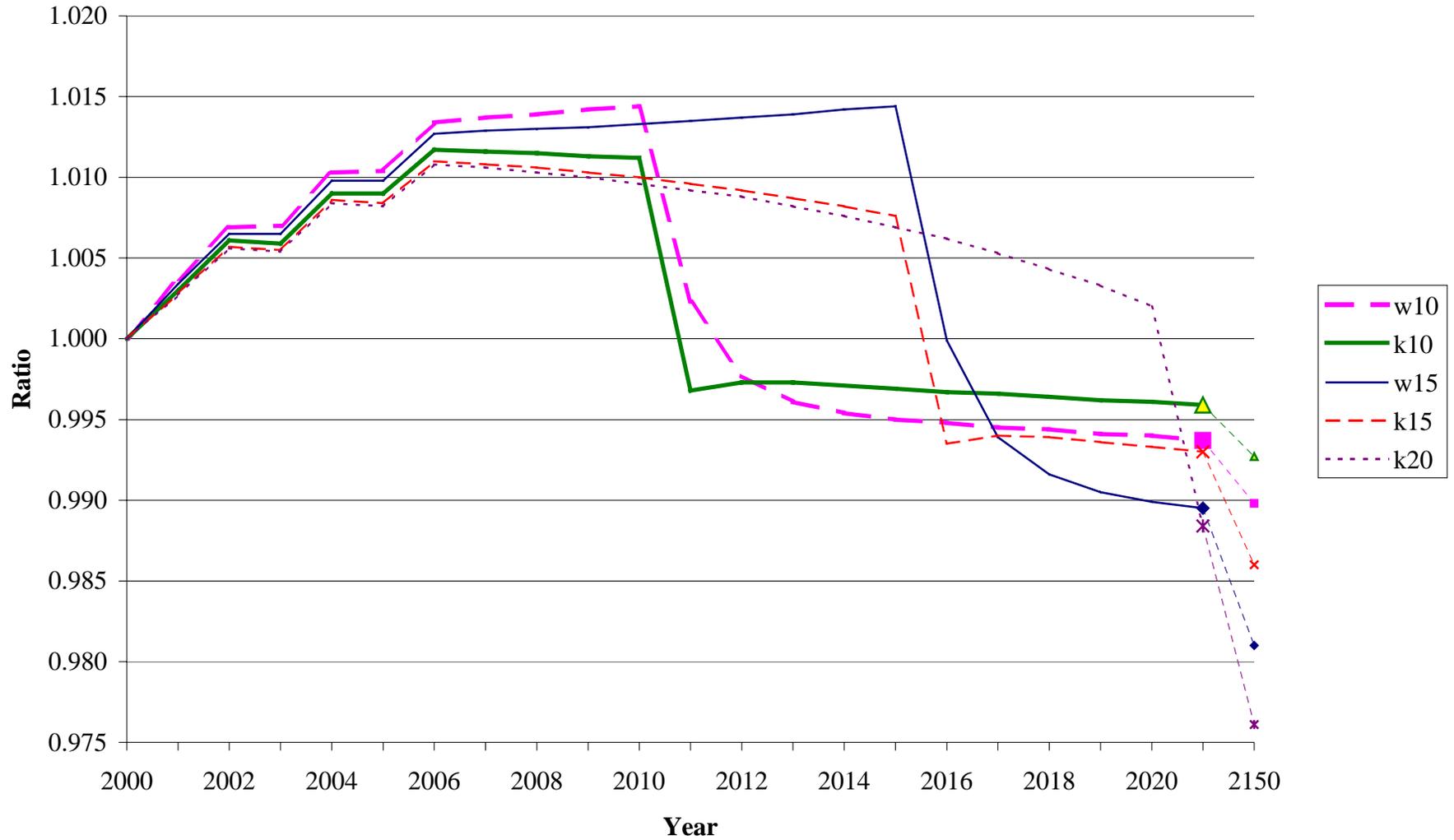Source: Based on Table 2 and calculations described in the Appendix

Figure 1
National Saving Rate
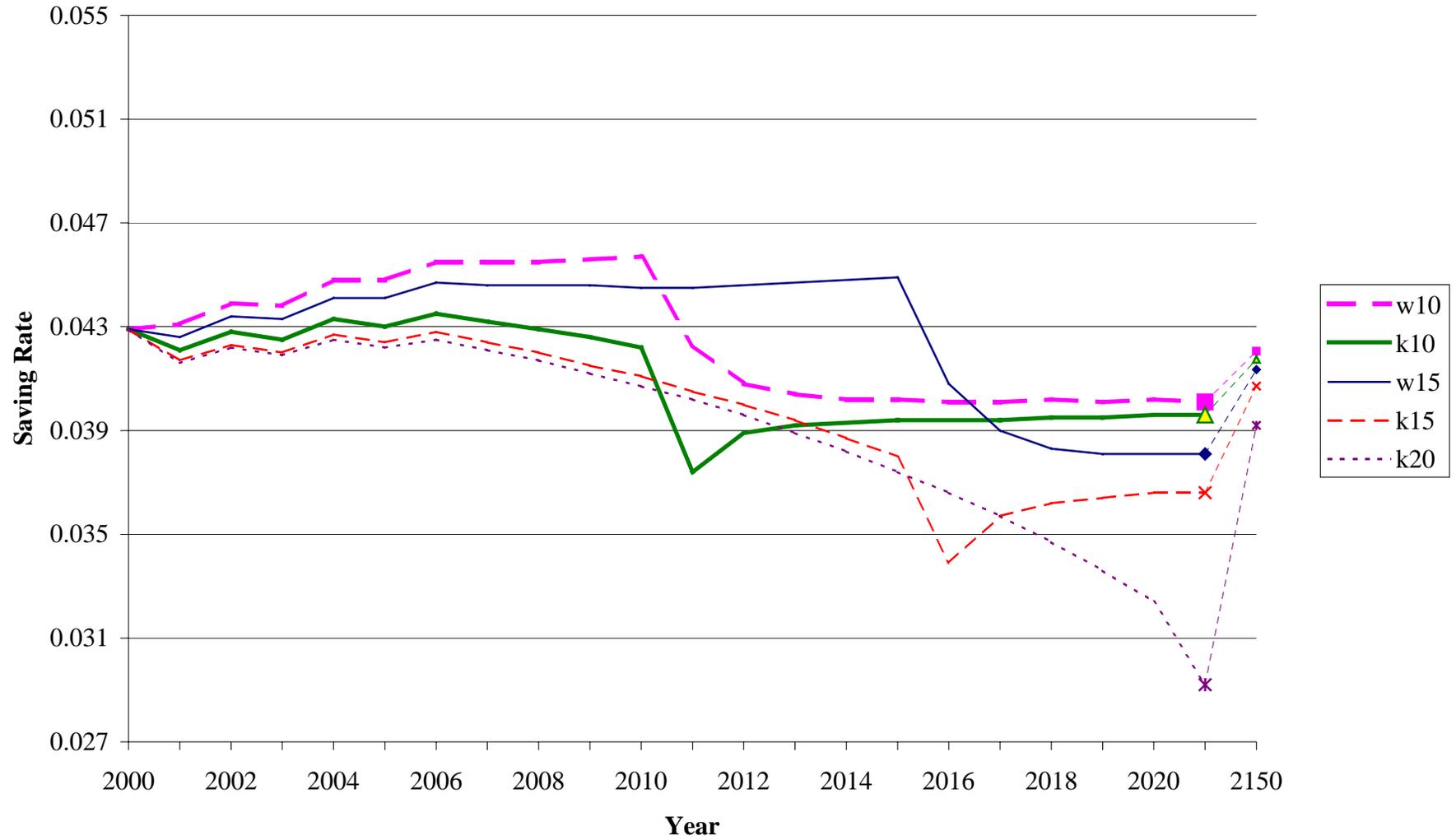
Figure 2
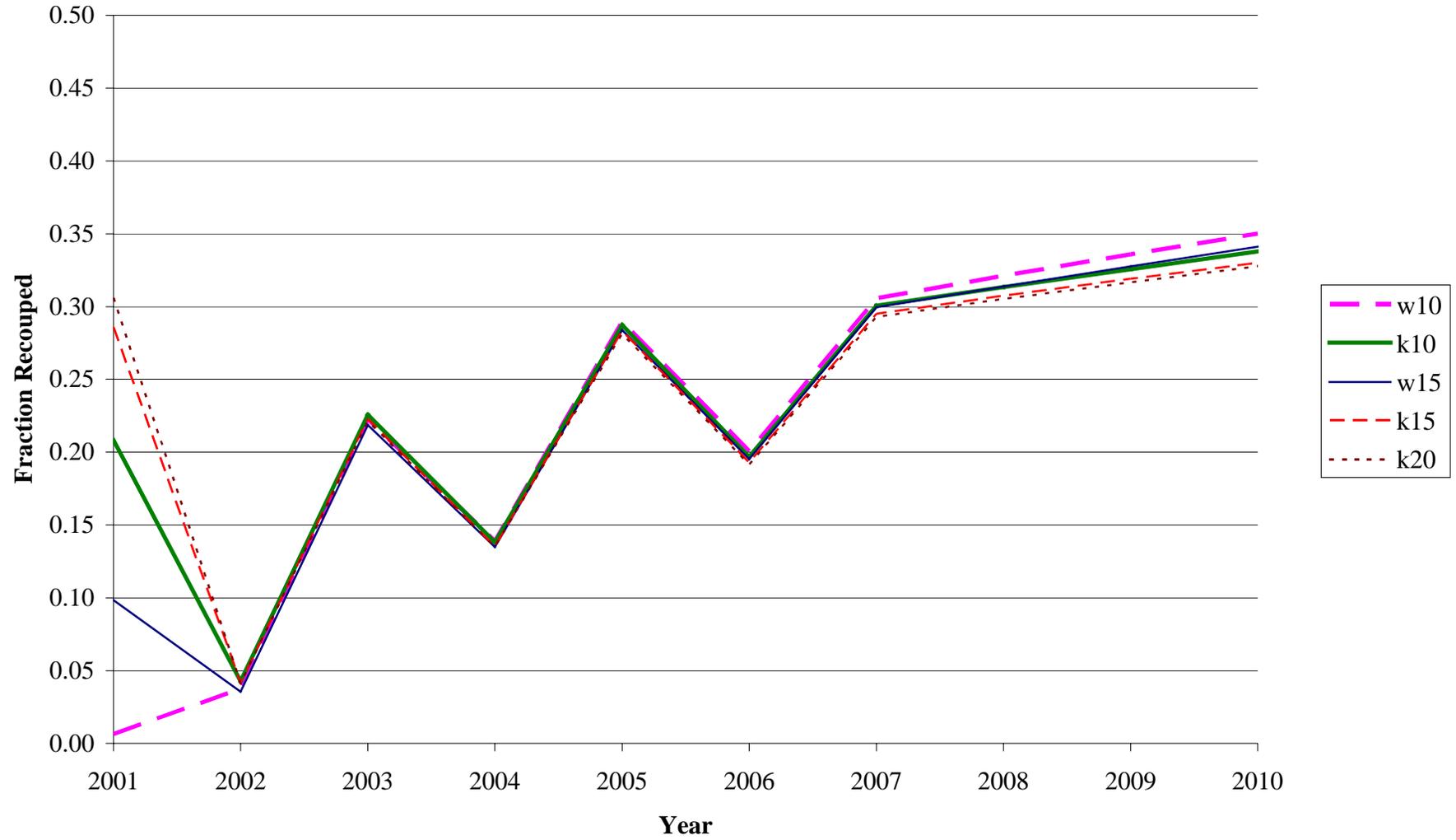## Capital Stock Relative to Baseline
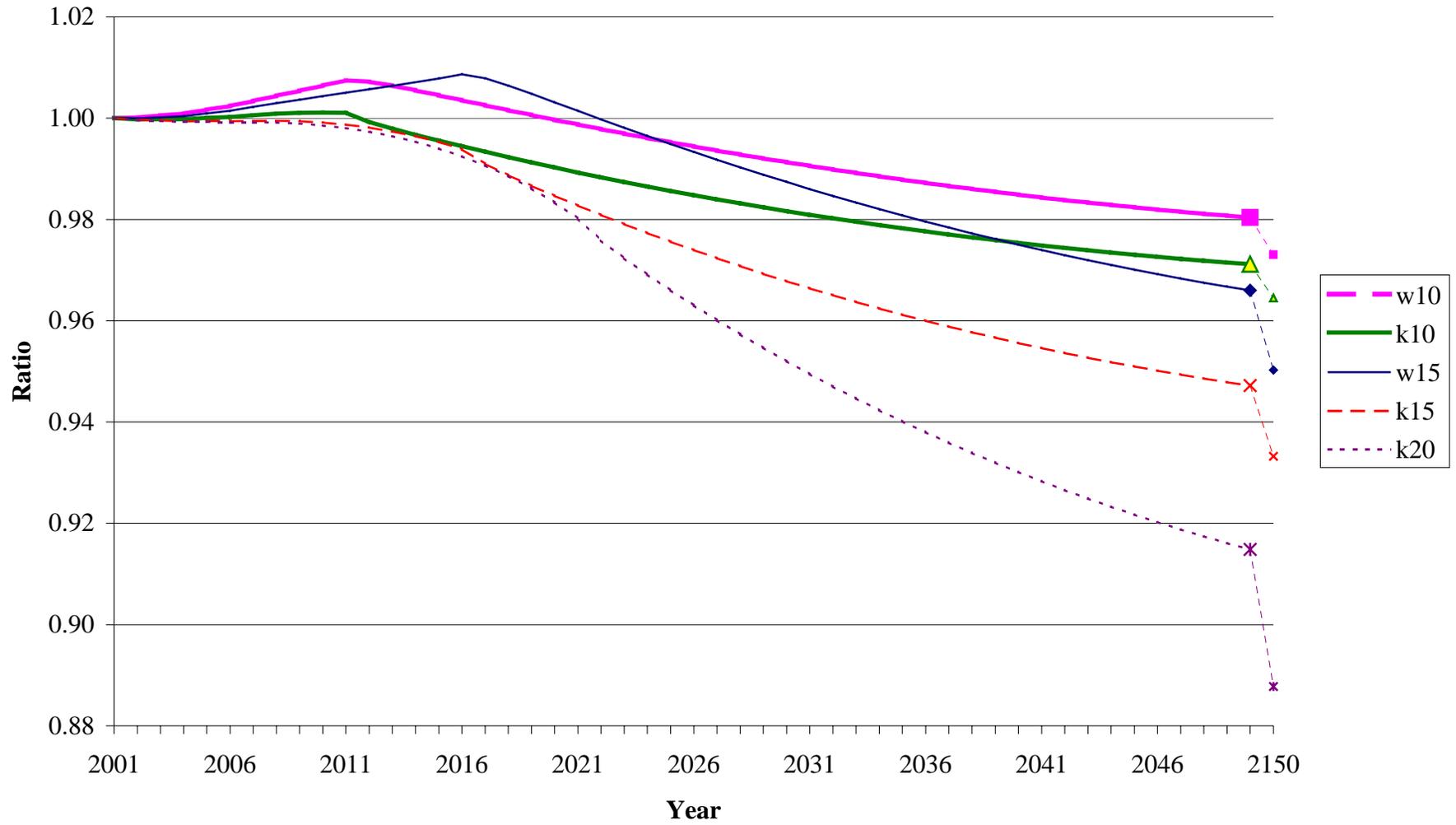
Figure 3
Output Relative to Baseline

Figure 4
Recoupment of Static Revenue Loss
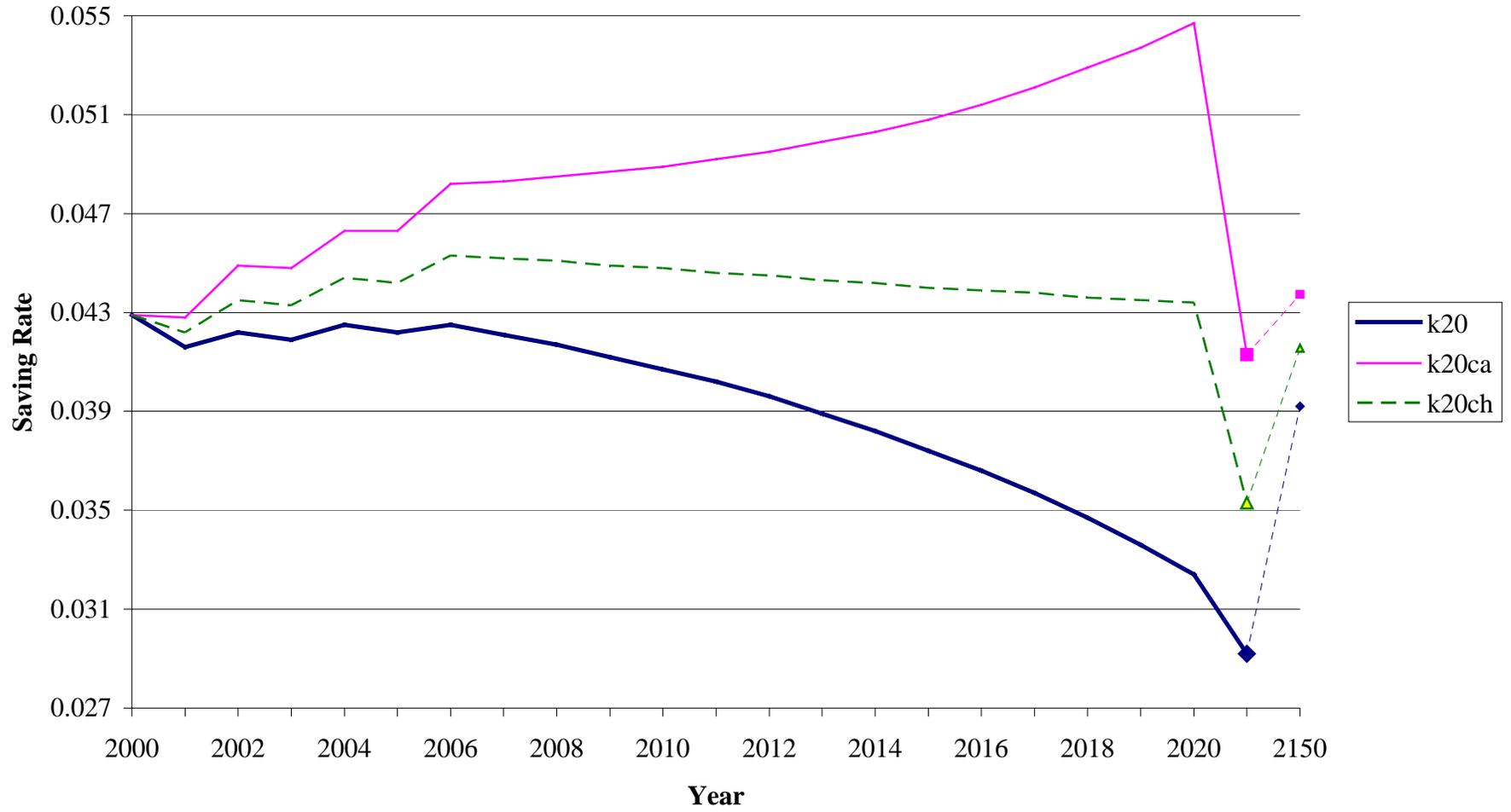
Figure 5
Full Dynamic Effect

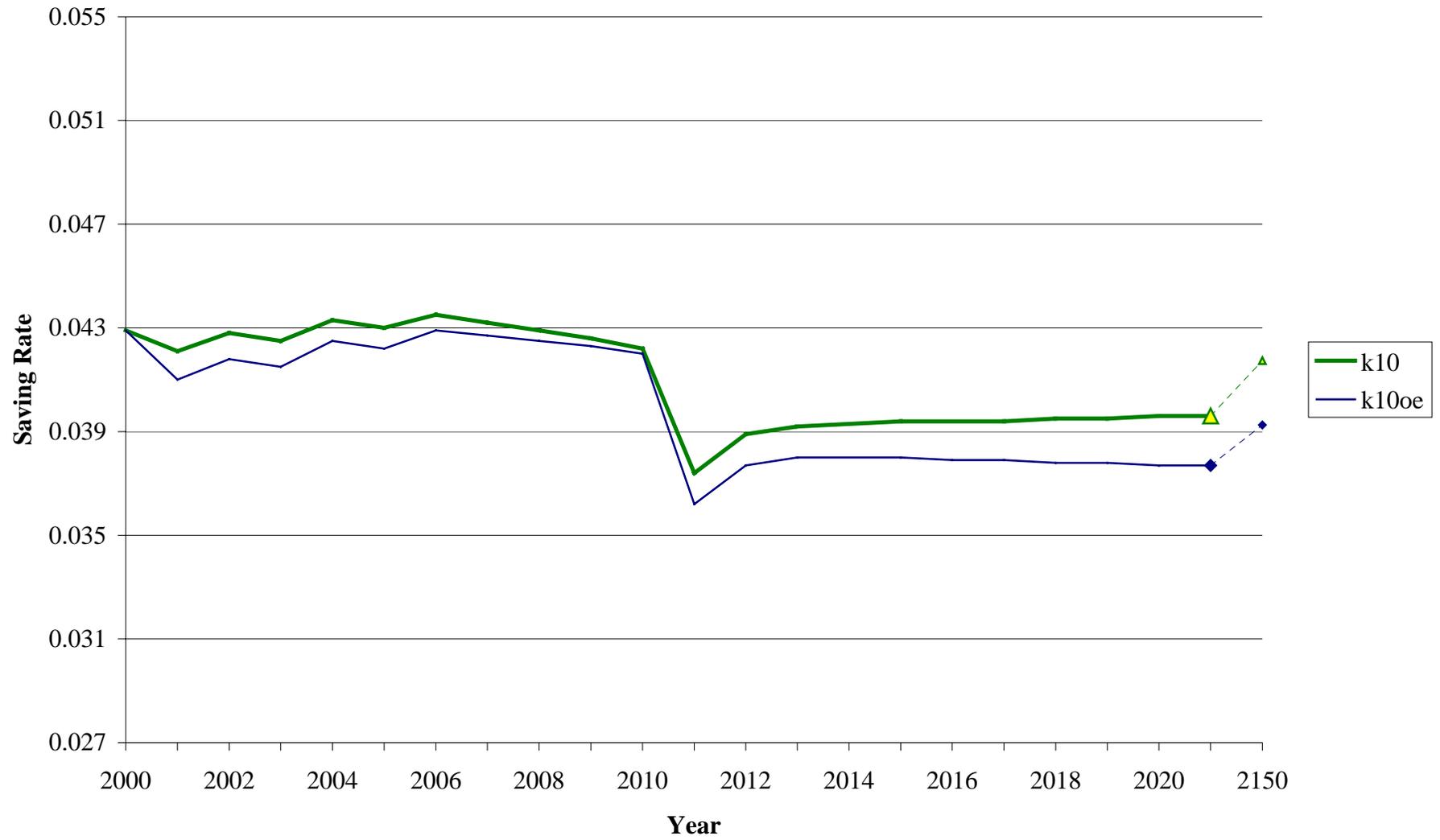**Figure 6**
Sensitivity Analysis: Saving Rate

Figure 7
Government Spending Response: Saving Rate (10 Year Cut)

Figure 8
Government Spending Response: Saving Rate (20 Year Cut)

Figure 9
Open Economy: Saving Rate

Figure 10
Low Interest Rate: Saving Rate