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ABSTRACT

Phased-in tax reductions are a common feature of tax legislation. This paper uses a dynamic general equilibrium model to quantify the effects of delaying tax cuts. According to the analysis of the model, the phased-in tax cuts of the 2001 tax law substantially reduced employment, output, and investment during the phase-in period. In contrast, the immediate tax cuts of the 2003 tax law provided significant incentives for immediate production and investment. The paper argues that the rules and accounting procedures used by Congress for formulating tax policy have a significant impact in shaping the details of tax policy and led to the phase-ins, sunsets, and temporary tax changes in both the 2001 and 2003 tax laws.

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Legislating predictable changes in tax rates violates one of the cardinal principles of public finance: Changes in tax rates should be permanent and immediate. Taxation typically distorts economic behavior and, because the deadweight burden of taxation is a convex function of the tax rate, there are efficiency gains to equalizing tax rates over time. As Barro (1979) argues, this logic implies that changes in tax rates should be unpredictable, that is, tax rates should follow random walks. As intuitive as Barro's principle is, it is not universal. Chamley (1986) and Judd (1985) show that, in economies with capital, the optimal tax rate on capital income must be zero in the steady state. Because it is often optimal to tax the initial capital stock heavily, the optimal tax rate on capital income should be phased in.

In practice, however, government policy frequently ignores these principles and often specifies that tax rates should follow various phase-ins and sunsets. The 2001 and 2003 tax laws both feature changes in the tax code at prescribed times. The 2001 *Economic Growth and Tax Relief Reconciliation Act* (*EGTRRA*) called for a scheduled sequence of rate reductions in the top four tax brackets. The law cut tax rates for all brackets above the 28 percent tax bracket by 1/2 percentage point immediately and provided for further reductions effective in 2002, 2004, and 2006. By 2006, the top marginal tax rate was scheduled to fall by more than 4 percentage points. In 2011, the tax plan would sunset, so absent further legislation, tax rates would revert to their pre-*EGTRRA* levels in 2011. Two years later, the 2003 *Jobs and Growth Tax Relief Reconciliation Act* (*JGTRRA*) legislated further changes in the tax system. Reductions in income tax rates that were scheduled to occur in 2004 and 2006 under *EGTRRA* instead went into effect immediately. In addition, the 2003 law provided for temporary reductions in taxes on dividends and capital gains.

Phase-ins are not new to U.S. tax policy. The tax cuts of 1964, the Reagan tax cuts of 1982, and the tax reform of 1986 all featured phased-in reductions in tax rates. In contrast, recent tax increases (the 1990 and 1993 legislation under the Bush and Clinton administrations) took effect immediately or within one year of their passage.

This paper considers the macroeconomic implications of phasing in tax cuts. We focus on three issues. First, we show how the timing of economic activity is affected by phased-in tax cuts. As in the optimal tax literature, we show that there are important differences between phased-in tax cuts on labor income and phased-in tax cuts on capital income. Second, we discuss the implications of the phased-in tax cuts passed in 2001, and the subsequent acceleration of those cuts in 2003, for overall the performance of the economy. Finally, we ask why tax cuts are so often phased in. We argue that Congressional budget rules tend to encourage tax cuts that are phased in and temporary.

To address the first two sets of issues, we construct a simple dynamic general equilibrium model that allows the government to specify a path of tax rates on labor income and capital income. The model allows us to assess quantitatively the effects of tax changes under various timing assumptions.

We use the tax cuts in 2001 and 2003 as case studies. Our analysis suggests that the timing of the tax cuts had substantial effects on labor supply, investment and economic performance. In particular, the slow recovery from the 2001 recession may have been, in part, attributable to declines in labor supply owing to the phased-in nature of the income tax reductions.

During the period of the phase-in, taxes on labor income are high relative to future tax rates. Workers have an incentive to work less currently while taxes are temporarily high. The incentive to delay production and employment will be operative as long as the workers can

intertemporally substitute consumption and work. The strength of the motive to delay production depends on consumers' preferences. If labor supply is highly elastic but, at the same time, consumers are not willing to substitute consumption intertemporally, then the incentive to defer production will be strong. In a closed economy model, like the one we consider, workers and firms can accumulate (or decumulate) capital. In an open economy model, the nation as a whole can borrow or lend with its trading partners. In either case, phased-in tax cuts temporarily reduce investment and production as consumers try to reap the rewards of the future tax cut but delay working.

Deferred tax cuts on capital income have very different effects from delayed labor tax cuts. The reason for the difference is simple: The decision to invest in new plant and equipment depends on the expected total discounted returns over the life of the capital. To the extent that capital is long-lived, a large part of these returns will be realized in the future. As a result, provided that the delay is short enough, a phased-in tax cut on capital income provides almost the same incentive to invest now as an immediate tax cut. Moreover, compared to an immediate tax cut, a deferred tax cut also reduces the windfall to previously-installed capital. As a consequence, phased-in capital tax cuts have better efficiency properties than phased-in labor tax cuts.

The remainder of the paper is organized as follows: Section I presents the model. Section II illustrates the basic features of the model by analyzing separately the case of delayed labor tax cuts and delayed capital tax cuts. Section III describes the basic features of the 2001 and 2003 tax laws and uses the model to estimate their aggregate effects. Section III also considers the robustness of these findings to alternative parameter values and discusses the findings in the context of the literature. Section IV considers the influence that federal budget rules have on the timing of the tax changes. Section V presents our conclusions.

I. The Model

We consider a standard business cycle model extended to allow for a government sector.[1] The government finances spending with both distortionary and lump-sum taxes. We allow for both anticipated and unanticipated changes in tax rates and government purchases.

The representative agent derives utility from consumption (C_t) and experiences disutility associated with labor (N_t). The agent seeks to maximize

$$\sum_{t=0}^{\infty} \beta^t E_t \left[u\left(C_t\right) - v\left(N_t\right) \right] \tag{1}$$

subject to the constraints:

$$(1-\tau_t^N) W_t N_t + (1-\tau_t^K) R_t K_t + \tau_t^K \delta K_t + T_t = C_t + I_t + K_t \varphi\left(\frac{I_t}{K_t}\right)(1-\tau_t^K) \tag{2}$$

and

$$K_{t+1} = K_t\left(1-\delta\right) + I_t. \tag{3}$$

Here, W_t is the real wage, N_t is labor, R_t is the real rental price of capital, K_t is the level of the capital stock, and T_t represents any lump sum transfers. The tax rates τ^N and τ^K are distortionary taxes on labor income and capital income respectively. The adjustment cost function φ is convex with $\varphi\left(\delta\right) = 0,\ \varphi'\left(\delta\right) = 0$, and $\varphi''\left(\delta\right) = \phi \geq 0$. Note that we allow the representative agent to deduct both depreciation and adjustment costs from the tax bill.

[1] Auerbach and Kotlikoff (1987) present a detailed and comprehensive treatment of fiscal policy in a dynamic model. Barro (1989), Mankiw (1987), and Baxter and King (1993) consider the effects of government purchases and the financing of such purchases in general equilibrium models.

Firms produce output with the constant returns to scale production function $F(K,N)$. The firm's profit maximization conditions imply that

$$W_t = \frac{\partial F}{\partial N}(K, N) \tag{4}$$

and

$$R_t = \frac{\partial F}{\partial K}\left(K_t, N_t\right). \tag{5}$$

Finally, the goods market clearing condition is

$$Y_t = F(K_t, N_t) = C_t + I_t + G_t + K_t \varphi\left(\frac{I_t}{K_t}\right). \tag{6}$$

We abstract from international flows of goods and capital (reflected by the absence of net exports in the resource constraint (6)).

We assume that the government balances its budget each period. Thus,

$$G_t = \tau_t^N N_t W_t + \tau_t^K K_t \left[R_t - \delta - \varphi\left(\frac{I_t}{K_t}\right)\right] + T_t. \tag{7}$$

This assumption may seem extreme. In fact it is innocuous. Although the timing of the distortionary taxes (τ^N and τ^K) does influence the equilibrium, the timing of the lump sum transfers is irrelevant.

Utility maximization implies that, in equilibrium,

$$v'\left(N_t\right) = u'\left(C_t\right) W_t \left(1 - \tau_t^N\right), \tag{8}$$

$$u'\left(C_{t+1}\right) = \frac{\beta}{Q_t} E_t \left[u'\left(C_{t+1}\right)\left\{\left(1-\tau_{t+1}^K\right)\left[R_{t+1} + \frac{I_{t+1}}{K_{t+1}}\varphi'\left(\frac{I_{t+1}}{K_{t+1}}\right) - \varphi\left(\frac{I_{t+1}}{K_{t+1}}\right)\right] + \delta\tau_{t+1}^K + Q_{t+1}\left(1-\delta\right)\right\}\right] \tag{9}$$

and

$$\frac{I_t}{K_t} = (\varphi')^{-1}\left(\frac{Q_t - 1}{1 - \tau_t^K}\right) = h\left(Q_t, \tau_t^K\right), \tag{10}$$

Q_t is marginal Brainard-Tobin's Q, the ratio of the shadow value of additional capital to the marginal utility of consumption at date t. The investment rate depends on Q_t and the tax rate on capital income (because of the deductibility of investment adjustment costs). When there are no adjustment costs then $Q_t = 1$ in every period.

Given any initial position of the system, a rational expectations equilibrium requires that equations (3), (4), (5), (6), (8), (9) and (10) hold in every period. These are seven equations in the seven variables K_t, I_t, C_t, Q_t, N_t, Y_t, W_t, and R_t with the exogenous forcing variables $\left\{\tau_t^N, \tau_t^K, G_t\right\}_{t=0}^{\infty}$. Because of Walras's Law and Ricardian equivalence, we can ignore T_t (and the government's budget constraint).

Functional forms

To quantify the dynamic effects of changes in tax policy we solve the model for specific functional forms for the flow utility of consumption, the flow disutility of labor, the production function, and adjustment costs. Specifically:

$$u(C) = \left[1 - \frac{1}{\sigma}\right]^{-1} C_t^{1-\frac{1}{\sigma}}, \tag{11}$$

$$v(N) = \left[1 + \frac{1}{\eta}\right]^{-1} N_t^{1+\frac{1}{\eta}}, \tag{12}$$

$$Y_t = AK_t^{\alpha} N_t^{1-\alpha}, \tag{13}$$

and

$$\varphi\left(\frac{I_t}{K_t}\right) = \frac{\phi}{2}\left(\frac{I_t}{K_t} - \delta\right)^2. \tag{14}$$

The parameter σ is the intertemporal elasticity of substitution, η is the Frisch labor supply elasticity, α is capital's share in production and ϕ is the curvature of the investment adjustment cost function.

Parameters Values

Our quantitative results depend on the parameters of these functions. The parameter values we use in our baseline simulations are given in Table 1. These values fall within standard ranges of values used in typical dynamic general equilibrium models and models of economic growth. The discount factor is set at 0.98 to generate a 2 percent annual real interest rate. Capital's share is set to 0.35. We choose an annual economic depreciation rate of 0.10. The remaining three parameters—the Frisch labor supply elasticity, the elasticity of intertemporal substitution, and the curvature of the investment adjustment cost function—can have important effects on our results. Because of this, in addition to our baseline settings, we consider a range of alternative values for these parameters.

We use 0.5 as our baseline value for the Frisch labor supply elasticity (η). Although an elasticity of 0.5 is relatively high compared with evidence from much of the labor economics literature, it is much smaller than elasticities typically used in the real business cycle literature, which follows Prescott (1986) in adopting a value of at least 2. Our baseline value is in line with estimates found in more recent studies that focus on situations in which individuals have to make unconstrained choices about labor supply. (For a discussion of this literature, see Farber (2003) and Kimball and Shapiro (2003).)

Our baseline setting for the elasticity of intertemporal substitution (σ) is 0.2. The empirical evidence indicates that σ is substantially less than 1 (see Hall (1988)). Our favored

setting for this parameter is roughly the average estimate in Hall (1988), Campbell and Mankiw (1989) and Barsky, *et al.* (1997).

We assume that the economy begins in an initial steady state. We assume that the share of real government purchases in GDP is 0.2, which is roughly in line with historical averages. The initial tax rates are assumed to be $\tau^N = 0.362$ and $\tau^K = 0.183$. These correspond to the effective marginal tax rates on wage and capital income estimated by the Congressional Budget Office (CBO) prior to the 2001 tax bill. The tax rate on wage income includes the payroll tax for Medicare and Social Security as well as state income taxes. CBO's estimate of the tax rate on capital is low relative to statutory marginal rates. The CBO includes housing capital in its estimate, which according to the CBO, gets a tax subsidy.

Solution

At time $t = 0$, the government announces a new path for tax rates and government purchases. Agents have perfect foresight and take the sequences $\left\{\tau_t^N, \tau_t^K, G_t, T_t\right\}_{t=0}^{\infty}$ as given. We solve the model by taking a log-linear approximation in the neighborhood of the initial steady state. As a robustness check, we also solved the model with a nonlinear shooting algorithm. The results were, for all practical purposes, identical.

II. Dynamic Effects of Delayed Tax Cuts

Before turning to studying the effects of the 2001 and 2003 tax law changes, we examine the effects of stylized delayed tax cuts on economic activity.

Typically, tax cuts of any kind reduce tax revenue. As a result, at some point, the government will have to either reduce purchases or raise taxes to balance its budget. The effects

of tax cuts are typically influenced by how the government chooses to balance its budget in the long run. The government could balance its budget through some combination of lower government purchases or higher future distortionary taxes. We instead assume that the government makes up for the reduction in revenue by reducing future lump sum transfers. Unlike the timing of distortionary taxes or government purchases, the timing of lump sum transfers is irrelevant for economic activity. So using lump sum transfers to balance the budget focuses attention squarely on the effects of the phased-in tax cut. Allowing the government a non-distortionary option to adjust revenues and balance its budget overstates the long-run benefits of the tax cuts we study. In an earlier version of this paper, we analyzed the case where the budget was balanced by contemporaneous cuts in government purchases. While cutting government purchases has a significant impact on the level of economic activity because of the wealth effect, it does not affect the results on the relative timing of activity that we highlight in this paper.

A. Delayed Tax Rate Cuts: Labor Taxes

To illustrate how the timing of tax cuts affects economic activity, we contrast a delayed reduction with an immediate, but more modest, tax cut. Consider a policy that calls for a delayed reduction in the marginal tax rate on wage income by one percentage point. To mimic the basic shape of the 2001 tax cuts, we take the delay in the tax cut to be four years. We also consider an immediate 0.53 percentage point tax cut that has same revenue consequences over the subsequent 10-year period. The immediate tax cut is an illustrative, but salient alternative to the delayed tax cut.[2]

[2] We choose its size to be revenue-equivalent to the delayed tax cut using *static scoring*, that is, ignoring the endogenous response of revenue to changes in policy.

Figure 1 shows the effects of the delayed tax cut (the dark lines) and immediate tax cut (the light lines) under the assumption that the government reduces lump sum transfers to balance the budget. The top panel of Figure 1 shows the path of the tax rates for each of the two policies. The Debt/GDP ratio panel shows how much government debt would increase if the reductions in transfers were deferred.

Consider first the effect of the immediate tax cut. In the long run, production and income rises permanently. Because consumers are forward looking, the permanent income hypothesis (*PIH*) implies that consumption increases immediately in response to the tax cut. The increase in the after-tax real wage due to the reduction in labor income taxes increases the incentive to supply labor. At the same time, the income effect from the higher long run income decreases labor supply. In the model, the income effect is fairly strong so there is only a modest increase in employment. In the short run, because the capital stock cannot jump, output increases by roughly two-thirds of the percentage increase in labor.

In summary, with an immediate tax cut our model generates routine results. Output and employment (and the long run capital stock) do not change much. Consumption and production jump immediately. There are modest effects on investment. There is a very gradual increase in the capital stock that brings the capital-labor ratio back to its steady-state value.

The delayed tax cut produces sharply different results. Most notably, there is a substantial reduction in economic activity during the period of the delay. In the year following the policy announcement, employment is below trend by 0.28 percent, output is below trend by 0.20 percent and investment by 0.95 percent. During the period of the delay, the tax rate is temporarily high relative to the future, so labor supply is reduced. GDP falls proportionately. Since production falls, the increase in consumption comes at the expense of investment, which falls sharply during the period of the phase in. Employment falls further as the date of the

deferred tax cut approaches. The closer the future tax cut, the more powerful the incentive to defer work.

Another way to see the effect of the delay in the tax cut is to consider the labor supply decision of the representative consumer (equation 8),

$$v'(N_t) = u'(C_t) W_t \left(1 - \tau_t^N\right).$$

Although forward-looking consumers experience the income effects of the policy as soon as the tax plan is announced, because the tax reductions are delayed, the substitution effects are not realized until four years later. As a result, during the period of the phase in, employment must drop to workers on their labor supply curve given the increase in consumption.

When the tax rate cut occurs in year four, employment, output, and investment jump. Once the tax rate on labor income actually falls, workers have an increased incentive to supply labor. The increased labor supply raises the marginal product of capital and stimulates investment. As capital accumulates, output slowly rises to its new higher steady-state. Real interest rates are temporarily high during this period of time.

The message of this simulation is clear. Delayed tax cuts on labor income give workers and firms incentives to delay work and investment until the tax cuts are in effect. While the tax cuts may be stimulative in the long run, the fact that they are delayed reduces employment and production in the short run.

B. Delayed Tax Rate Cuts: Capital Taxes

We now turn to delayed tax cuts on capital income. Again, we compare the effects of a one-percentage point reduction in tax rates that goes into effect in four years with an immediate tax cut. In contrast to the case of labor tax cuts just discussed, we consider an immediate and

delayed tax cut of the same size (one percentage point). Because investment is inherently forward looking, current investment decisions depend mainly on the long-run tax rate. We consider equal delayed and immediate tax cuts so that the long-run consequences of the policies we consider do not diverge widely.

The tax treatment of depreciation has important interactions with the timing of tax rate changes. To show this, we consider two different tax treatments of depreciation. First, as in our benchmark model, firms deduct current economic depreciation from current profits. Second, we consider a variant of the model in which firms expense investment, that is, they deduct 100 percent of current investment expenditure from their current taxable profits. Expensing is an extreme version of the accelerated depreciation allowances that are a feature of current tax law. We use it to illustrate how accelerated depreciation interacts with the timing of taxes on capital income. House and Shapiro (2004) present a detailed analysis of accelerated depreciation and the timing of tax cuts with particular attention paid to the 2002 *Job Creation and Worker Assistance Act*.

Figure 2 shows the effects of capital tax cuts under the assumption that firms write off investment expenditures at the economic rate of depreciation. Unlike a delayed labor tax cut, which gives workers and firms the incentive to delay employment, the reduction in capital taxes stimulates employment and investment immediately regardless of whether the tax cut is delayed or not.

Figure 3 shows the response of the model when we allow firms to expense investment. The delayed tax cut is more stimulative than the immediate tax cut. Indeed, the immediate tax cut has essentially no effect on consumption, investment, employment or production. Moreover, the delayed tax cut has a much larger effect on economic activity compared to the previous situation in which firms deduct only current economic depreciation. In the quarter following the

policy announcement, employment is above trend by 0.31 percent. Delayed tax cuts have a large impact when investment expenditures can offset current taxable profits. There is a substantial incentive to move investment spending forward to take advantage of the write off when the tax rate on profits is high.

To summarize, in contrast to taxes cuts on labor, delaying capital income tax cuts does not discourage current economic activity.[3] Current investment can be stimulated by future tax cuts because the payoff of current investment largely accrues in the future. This stimulus is magnified if depreciation allowances are accelerated. Moreover, there are advantages to delaying the tax rate cut on capital income. An immediate tax cut on capital is, for the most part, simply a windfall to existing capital and has no beneficial incentive effects. In contrast, a delayed tax cut provides incentives for current investment but still taxes existing capital at a high rate.

III. The 2001 and 2003 Tax Laws and Economic Activity

In this section, we use the model to analyze the tax policy changes enacted in 2001 and 2003. These policy changes included cuts in both the tax rate on labor and capital. The tax rate cuts under the 2001 law were phased in over a period of five years in a series of steps. Hence, the 2001 law had various effects on economic activity, with the capital and labor tax provisions potentially offsetting. The 2003 tax law accelerated the rate cuts called for in the original 2001

[3] Employment can share some of the characteristics of investment. Working currently raises productivity and wages in the future because of the returns to on-the-job training and experience. This is particularly true for workers early in their careers. If this channel were important, future wage tax cuts would encourage current labor supply though the human capital accumulation channel. If we incorporated this channel into our analysis it would partially offset the intertemporal substitution channel that is highlighted in the previous section and that dominates our analysis of the 2001 tax rate cuts in the next section.

law and also implemented an additional temporary reduction in the tax rate on capital income. The series of phase ins and phase outs included in the two laws does not complicate the analysis appreciably, but it is difficult to infer the overall result based only on the simple cases we have considered so far. In this section, we describe the 2001 and 2003 tax legislation and present estimates of the effect of these tax changes on economic activity. We also consider the robustness of our results to alternative parameterizations of the model.

A. The 2001 Tax Law: Provisions

The *Economic Growth and Tax Relief Reconciliation Act* of 2001 (*EGTRRA*) was approved by the congressional conference committee on May 25, 2001 and signed into law by President George W. Bush on June 7, 2001. Relative to their pre-*EGTRRA* values, marginal tax rates above the 15 percent rate were cut by 0.5 percentage points in 2001. The legislation called for subsequent rate cuts in 2002, 2004 and 2006. By January 2006, the taxes rates above the 15 percent bracket were scheduled to fall by 3 percentage points, except the top rate, which was scheduled to fall by 4.6 points. Under the 2001 tax law, these tax rates would remain in effect until 2011. In 2011, the tax reductions would sunset, that is, the tax rates were scheduled to revert to their pre-*EGTRRA* levels. See Joint Tax Committee (2001a) for a summary of the provisions. Table 2 summarizes the time path of marginal tax rates under the 2001 law.

In addition to the changes in marginal tax rates, the law also had several other noteworthy provisions. The law reduced the marriage penalty by extending the 15 percent tax bracket for married individuals filing joint tax returns. The law also featured a phased-in reduction and subsequent elimination of the estate tax. Finally, the law created a new 10 percent bracket for the first $12,000 of taxable income ($6,000 for singles) effective in 2001. The Treasury paid most households a rebate of $600 ($300 for singles) in July through September 2001 as an

advanced payment of the benefit of this new bracket. (See Shapiro and Slemrod (2003a, 2003b) for a discussion of this aspect of the tax bill and estimates of its effect on consumer expenditures.) These rebate checks, though highly visible in 2001, did little to reduce marginal rates. Only households with taxable income below $12,000 ($6000 for singles) experienced a reduction in their marginal tax rate as a consequence of the new 10 percent bracket. Hence, though the 10 percent bracket has a large impact on average tax liabilities and aggregate revenues, it has a minor effect on marginal rates.

The Congressional Budget Office (2001) produced estimates of the impact of the tax law on marginal tax rates. It estimated that the effective marginal tax rate on labor income would fall 1.8 percentage points from 36.2 percent before the law to 34.4 percent in 2006. It estimated that the effective marginal tax rate on capital income would fall 0.5 percentage point from 18.3 to 17.8 percent. The estimated effective marginal tax rate on labor income includes federal income taxes, payroll taxes, and state and local income taxes; for capital income, it includes federal income taxes, corporate taxes, and state and local income taxes. Since the housing stock is conceptually part of the capital stock in our model, it is appropriate to include its tax treatment in the analysis. Note also that significant investment incentives were passed in 2002. We do not address the 2002 tax law in this paper. The CBO did not provide a time series for the effective marginal tax rates, but it seems reasonable to interpolate them using the reductions in the statutory rates discussed in the previous paragraph. In Table 3, we present the precise tax path used in our simulations of the 2001 tax law.

B. The 2001 Tax Law: Aggregate Effects

Figures 4 and 5 report our estimates of the responses to the phased-in tax changes legislated in 2001. In analyzing the tax policy, we need to incorporate what economic agents expect to

happen in 2011, when tax rates are legislated to revert to their pre-2001 levels. In Figure 4, we assume that, as the 2001 tax law requires, the tax rates revert to their original, pre-*EGTRRA*, levels in 2011. In Figure 5, we assume that the 2006 tax rates remain in place indefinitely. In both cases, the expectations and realizations of tax rate coincide. In each figure we also report the model's response to an immediate tax cut. The size of the immediate tax cut is calculated as in Section II to yield the same discounted revenue loss over a 10-year budget window ignoring feedback effects (static scoring).

Except for the timing and pattern of the phase ins, the results of the 2001 tax cuts in Figure 4 shows similar effects of the delayed labor tax cut shown in Figure 1. Employment, output, and investment fall in response to the announcement of the phased-in path. In the six months immediately following the policy, employment and output are slightly below trend (on impact, employment falls below trend by 0.13 percent and GDP falls below trend by 0.9 percent). Investment falls sharply initially, and remains below trend for two and a half years. The drop is greatest in the early stages of the policy; in the first quarter, investment falls below trend by 0.58 percent. Consumption rises immediately and remains high for the foreseeable future. In 2002, employment and output are only slightly above their initial level (employment is 0.05 percent above trend and GDP is 0.02 percent above trend). Investment remains below trend until 2004 (it is below its initial level by 0.20 percent throughout 2002-2003).

The reduction in employment is due to the incentive to shift work from the present to the future combined with a substantial income effect associated with the tax cut. The agents finance the increase in consumption by reducing investment while they wait for the lower taxes. In contrast, the immediate tax cut stimulates production, employment and investment as soon as it is passed. Employment rises immediately by more than 0.5 percent, GDP increases by more than

0.3 percent and investment rises by more than 0.9 percent in the quarter following the passage of the law.

Figure 5 shows the perfect foresight equilibrium when the tax cuts remain in effect indefinitely. The short run effects of the tax plan are even more dramatic in this case. The reduction in employment and production are most severe in the initial stages of the policy. In the first six months, employment is below trend by 0.38 percent; GDP is below its trend level by 0.25 percent. Investment spending falls by 1.4 percent immediately following the passage of the 2001 tax law and remains below its initial level until 2006. Unlike the previous simulation, when the tax cuts are perceived to be permanent, employment and GDP remain below their original levels for more than two years after the policy change. In 2002, GDP is 0.18 percent below trend and employment is 0.21 percent below trend. The reason for the difference is simple: if the tax plan were understood to be permanent, the wealth effects associated with it would be much greater and there would be an even greater incentive to postpone production. Gale and Orszag (2003) show that eliminating the sunsets would have a very large impact on future tax revenues.

Why do the 2001 phased-in tax cuts, which are mixtures of capital and labor tax cuts, lead to aggregate implications that match the behavior of a labor tax cut rather than a capital tax cut? The reductions in labor taxes are larger than the capital tax rate reductions. A cut in the labor tax rate of 1.8 percentage points from a starting point of 36.2 percent is a 5.0 percent cut in the tax rate. A cut in the capital tax rate of 0.5 percentage point from a starting point of 18.3 percent is a 2.7 percent cut in the tax rate. Additionally, because labor income is roughly two-thirds of total income, the larger tax rate cut applies to a larger base. (Tax changes in 2002 may have significantly affected investment. See House and Shapiro (2004)).

To summarize, whether the tax cuts are perceived to be permanent or sunsetting in 2011, the immediate effect to the 2001 phased-in tax cuts was to reduce output and employment. The contractionary effects of the law are greater if the tax cuts are perceived to be permanent. Our calculations suggest that the phased-in tax cuts in the 2001 tax law reduced GDP in 2002 by roughly 0.4 percent relative to a more modest but immediate tax cut.

C. The 2003 Tax Law: Provisions

On May 28, 2003, President Bush signed the *Jobs and Growth Tax Relief Reconciliation Act* (*JGTRRA*). We focus on major provisions of the 2003 law. It made immediate the phased-in tax rate reductions enacted in 2001, so that the rate cuts scheduled for 2004 and 2006 went into effect retroactively to the beginning of 2003. The sunset provisions of the 2001 tax law remained in place. The 2003 tax law also reduced tax rates on capital income for seven years. The dividend tax rate and the tax rate on capital gains were reduced to 15 percent for 2003 to 2008. (For low income individuals, the tax rate on capital gains and dividend income were cut to 5 percent for 2003 to 2007 and to zero in 2008.) The dividend tax rates revert to the ordinary income tax rates in 2009; the capital gains tax rates revert to 20 percent (10 percent for lower income individuals) in 2009. (See Joint Tax Committee (2003a, 2003b).)

There were several other prominent changes to the tax code that are worth mentioning. The expansions of the 15 percent bracket for married couples, and the 10 percent bracket for all taxpayers, that were to be phased in under the 2001 law were accelerated to 2003. In 2005 these brackets revert to the paths specified in the 2001 law. As with the income tax rates, the sunset provisions of the 2001 tax law remain in place. Also, the exemption of the individual Alternative Minimum Tax (AMT) was increased for 2003 and 2004 only. This provision prevented roughly

8 million taxpayers from losing the full benefits of the marginal rate cuts in these years. In 2005 and beyond, these taxpayers will be subject to the AMT under current law.

We do not attempt a quantitative analysis of all of these complex provisions. Instead, we focus attention on the changing of the time of the income tax rate cuts and the seven-year tax cut on capital income. First, we present estimates of the effect of the immediate implementation of the phased-in income tax rate cuts. Second, we estimate the effects of the temporary tax cuts on capital gains and dividend income by reducing the tax rate on capital income in the model for the years 2003 through 2008 by 1.37 percent.[4]

D. The 2003 Tax Law: Aggregate Effects

Unlike the 2001 law, the 2003 law provided strong incentives to increase employment and production immediately. Under the 2003 law, tax rates fell immediately to their long run levels, where they will remain until the sunset date. Moreover, the additional reductions in capital gains and dividend income taxes made the tax rate on capital lower than it was under the 2001 tax law. These rate reductions are set to remain in effect until 2009.

Figure 6 shows the effect of the 2003 law. The estimated effects under the 2001 law are also included for comparison (in the simulation, we take the change in policy in 2003 to be completely unanticipated though this is clearly a simplification). Because it calls for an

[4] To calibrate the amount of the reduction, we focused on the dividend tax cut. First, we calculated the fraction of dividend income in total capital income. For the years 1990-2002 this fraction was .0914. Second, because dividend income is highly skewed towards upper income households, we treated all dividend income as though it were taxed at a rate of 30.0 percent prior to *JGTRRA* and 15.0 percent afterwards. This gives us an additional reduction in the effective tax rate on capital income of 1.37 points. This calculation neglects any endogenous response of the dividend payout rate to the change in dividend taxes. Poterba (2004), based on time series evidence, projects that tax change should eventually increase dividend payouts by almost 20 percent. Blouin, Raedy, and Shackelford (2004) estimate that the change in the payout rate as a

immediate reduction in labor income taxes, the 2003 law causes employment, output and investment to all rise sharply. Relative to the equilibrium implied by the 2001 tax rates, in the third quarter of 2003, employment increased by 0.80 percent, GDP increased by 0.52 percent, and investment increased by 1.83 percent. Although it increases, consumption does not respond as much to the policy change since the moving forward the rate cut has a relatively small effect on after-tax permanent income.

E. Recession in 2001 and Growth in 2003

The NBER business cycle committee dated a business cycle peak in March 2001 and a trough in November 2001. The recovery of both income and employment from the trough has been unusually slow. Payroll employment has not yet regained the level it achieved at the previous peak. Output growth has been positive, but more sluggish than previous recessions.

The phased-in tax cuts enacted in 2001 are a potential explanation of the failure of employment and output to recover rapidly during the period from 2001 to mid-2003. As the results of the previous section make clear, the phased-in nature of these tax cuts provides a powerful incentive for businesses and workers to defer production and employment while at the same time it gives consumers reason to maintain high levels of consumption spending. The combination of high consumption and relatively lower levels of production means that investment spending will be particularly weak. To the extent that workers and firms responded to these incentives, the 2001 tax plan may have inadvertently worked to prolong the recession and stifle investment. While there are, of course, many other factors that influenced employment and

consequence of the 2003 law was about 10 percent. Such changes would have only a modest effect on our calculations.

production decisions, it is likely that the phase-in features of the 2001 tax law contributed to the tepid economic performance of the period.

Following the passage of *JGTRRA* in mid-2003, economic performance in the United States improved somewhat. Unemployment reached a peak of 6.3 percent in June of 2003 and declined slowly during the remainder of 2003. In the third quarter of 2003, real GDP expanded at a rate of 8.2 percent. This rate was more than double the highest growth rate in the previous two years. Just as the phased-in nature of the 2001 tax law may have delayed production and employment, the immediate tax relief included in the 2003 law may have contributed towards the increased pace of economic activity in the second half of 2003.

F. Robustness

Alternative elasticities

We now consider how the simulated effects of phased-in tax cuts depend on the elasticity of labor supply (η) and the elasticity of intertemporal substitution (σ). We confine our attention to the effects of the 2001 tax law. Figure 7 shows the simulated time paths for consumption, employment, and investment (we omit the time path for GDP since it is almost identical to the time path of employment). The rows give results for σ equal to 0.2, 0.5., 1, and 2. The different lines in each panel correspond to different values of η. The light line is for η equal to 0.2, the dark line is for η equal to 1, and the dotted line is for η equal to 2. Recall that our baseline case in the previous figures has been σ equal to 1 and η equal to 0.5.

Consider first the paths for consumption. Lower labor and capital taxes imply that income and consumption are higher in the long run. The new long run level of consumption increases with a higher labor supply elasticity and with a higher elasticity of intertemporal

substitution. The more elastic labor supply is, the greater the increase in future income. Not surprisingly, as the elasticity of intertemporal substitution increases, the consumers are more and more willing to tolerate changing consumption over time. For $\sigma = 0.2$, consumption is nearly constant. As this elasticity gets higher, households are more willing to defer consumption. This makes the path of consumption steeper and makes future income higher due to high capital accumulation. Note that consumption always rises immediately following the announcement of the policy change.

Now consider the paths for employment. As the labor supply elasticity becomes higher, labor becomes more and more responsive to both immediate and anticipated tax changes. For low levels of η, the long run increase in labor is very modest; for high levels, there are much bigger increases in labor as each successive tax rate cut is put into effect. The *level* of the path of labor is depends on the value of σ. High values of σ shift this time path up. Notice that for values of σ less than one, the wealth effect dominates the substitution effect and employment falls in the short run. For values greater than one, the substitution effect dominates, so the combination of current and future tax cuts causes employment to rise in the short run. Anticipated future tax cuts will be more likely to cause current reductions in employment if consumers are willing to delay employment but not willing to delay consumption.

Notice that for all of the parameterizations, investment falls during the period of the phase in. The immediate increase in consumption always outweighs the short run changes in production, which are often negative.

The long run effects of the tax cut need to be interpreted with caution. To focus on the short run effects stemming from the timing of tax changes we suppose that the government cuts lump-sum transfers to balance its budget. This is not a realistic assumption for long run analysis.

A suitable analysis of the long run would wrestle with the hard choices that actual policy makers face. Because the government does not cut spending or raise distortionary taxes in our simulations, the long run forecast from our model overstates the benefit of these tax policies.

Adjustment costs

If consumption rises in response to future tax cuts without a contemporaneous increase in production then investment must fall. If adjustment costs inhibit large changes in the flow of investment, consumption smoothing and the intertemporal reallocation of labor are less attractive. Here, we consider the effects such adjustment costs. Again, we focus on the 2001 tax law. Adjustment costs are governed by the parameter ϕ, the curvature of the adjustment cost function. We consider various values, including zero, to show the role of adjustment costs.

In Figure 8, we show the response of consumption, employment, and investment to the phased-in tax cuts for different values of the adjustment cost parameter ϕ. Recall that our baseline setting for this parameter was zero (no adjustment costs). Here we consider three cases: our baseline case ($\phi = 0$), moderate investment adjustment costs ($\phi = 2$), and high investment adjustment costs ($\phi = 6$). Shapiro (1986) and Hall (2002) present evidence consistent with moderate to negligible adjustment costs. While high adjustment costs are consistent with estimates from *q*-theoretic investment regressions, they are generally regarded as implausibly high. We include a higher adjustment cost to illustrate the point that it is the ability to move consumption over time easily that makes an announcement of future tax cuts affect current real economic activity.

In the Figure 8, the dark solid line corresponds to our baseline settings, the light solid line represents an economy with moderate adjustment costs and the dotted line corresponds to the

high adjustment cost model. In the baseline model, consumption jumps as soon as the policy is announced and then rises smoothly from then on. Investment drops initially to finance the increased consumption. Employment responds only slightly to the tax policy in the first year. In contrast, in the adjustment cost models, consumption rises by less initially and then jumps each time the labor income taxes fall. Investment falls by less and employment responds more to the initial tax cuts.

Another interesting consequence of the adjustment cost models is that Brainard-Tobin's Q (in the bottom center panel) drops immediately. Consumers desire the additional consumption immediately but are restricted (by the adjustment costs) in their ability to intertemporally substitute. If we take Q as an indicator of stock market valuation then the 2001 tax cut policies also provide a reason for the poor stock market performance in the wake of the policy.

G. Related literature

Several other papers examine the 2001 tax cuts. Auerbach (2002) uses the Auerbach and Kotlikoff (1987) model to study the 2001 tax rate changes. The focus of Auerbach's analysis is the effect of the tax policy on national savings and investment. Though it is not the central focus of his paper, his analysis does take into account the phased-in nature of the tax cuts. He reports a pattern of output effects similar to those shown in our simulations (Figure 4) under the assumption that the tax cuts sunset as scheduled.

Gale and Potter (2002) provide a valuable summary and evaluation of the provisions of the legislation. They also provide an estimate of the effect of the tax changes on labor supply, savings, and GDP growth. Their analysis is confined to the long run effects of the policy so it is difficult to make direct comparisons with our paper. They estimate that labor supply increases in steady state by 0.48 percent by multiplying an average uncompensated elasticity of 0.17 by a 2.8

percent increase in the after-tax real wage. The uncompensated elasticity is not relevant for phase-in effects, which depends on the compensated or Frisch elasticity, so we cannot infer what their analysis would predict about the dynamic response of labor. (Our model implies an uncompensated elasticity of zero only if $\sigma = 1$.) Their results for saving and investment are also hard to compare with our results because they implicitly hold the interest rate constant on one hand, but consider offsetting changes in the current account on the other. In contrast, our approach does allow for endogenous changes in the interest rate but abstracts from international borrowing and lending.

Gale and Potter conclude that the tax law would depress the level of GDP once it is phased in. In contrast, we find a modest increase in GDP. One important factor explaining this difference is that the capital stock increases in our simulations. The increase in the capital stock comes not only from the incentive effects of the capital tax rate reduction, which are modest in our calculations, but from the equilibrium response of the capital stock to the increase in labor supply. An increase in labor supply puts downward pressure on the wage and therefore stimulates capital accumulation.

Calomiris and Hassett (2002) present a survey of the evidence that leads them to make an optimistic forecast about the output and revenue effects of the 2001 tax law. They do not produce quantitative estimates, and in particular, do not address the issue of the phase in.

Burman, Gale and Rohaly (2003) show that the number of taxpayers affected by the alternative minimum tax (AMT) will grow dramatically in the next decade because the interaction of economic growth and non-indexation of the AMT with the lower marginal tax rates in the 2001 and 2003 tax laws. In later years, the non-indexation of the AMT leads effective tax rates to increase. Roughly speaking, the effects of such an increase will be similar to a mix of the estimates with the sunset (Figure 4) and without it (Figure 5).

IV. Government Budget Rules

The previous section showed how the timing of tax changes in recent tax legislation had substantial, and perhaps undesirable, effects on the timing of output, employment, and investment. Given that phased-in tax changes have these effects, it is natural to ask why they are so often features of tax policy. In this section we argue that legislative rules pertaining to the framing and scope of tax policy play important roles in shaping actual policy.

Budget rules shaped both the 2001 and 2003 tax laws. First, federal budget rules mandate reporting the revenue consequences of tax laws over 10-year windows. This rule frames the debate and the description of the legislation. Second, provisions of the Budget Act allow senators to raise a point of order concerning tax changes that have an effect beyond ten years. This rule, called the Byrd rule, effectively requires a supermajority of 60 votes to pass tax reductions that extend beyond 10 years.

A. Budget Rules and the 2001 Tax Law

The 10-year budget window had a major effect in shaping the 2001 legislation. The centerpiece of the 2001 tax cut proposal was the phased-in marginal tax rate reductions discussed in Section III. The phase in allowed the budget consequences of the first 10 years of the tax cut to be much smaller than long run impact. According to the Bush Administration's 2002 budget, the President's tax cut proposal would reduce revenues by 1.5 trillion dollars in the ten-year period after passage of the law. According to the administrations estimates, the revenue losses for the years 2007 – 2011 were more than twice the revenue losses for the first five years (2002 – 2006). Because the debate over tax laws focuses on the first ten years rather than their steady-state impact, phased-in tax reductions make long run reductions in tax rates appear to be smaller than

they truly are. The effort to fit the magnitude of tax cuts into particular 10-year targets strongly suggests that this rule has real consequences for the details of tax changes.

As it happened, President Bush could not secure the permanent, phased-in tax rate reduction that he proposed in the budget. A majority of the Senate favored these provisions, but not the 60 senator supermajority required by the Byrd rule. Accordingly, the Congress enacted a ten-year tax cut whose provisions sunset in 2011.

The combination of the 10-year budget accounting and the Byrd rule produced a schedule of tax rate cuts that phased in slowly and then disappeared after 10 years. A natural question arises: Did the public (and the members of Congress) expect the tax provisions to expire? Advocates of the tax cut clearly hoped that they would ultimately be made permanent. Indeed, a bill proposing to do so was introduced in the House in 2002. Moreover, President Bush proposed making them permanent both after the 2002 election and again in the 2004 State of the Union Address.

In our quantitative estimation of the effects of the policy, we were agnostic about the public's expectations about the sunset. To this end, we presented estimates with and without the sunset. The sunset was far enough in the future that it does not affect the temporal pattern economic activity during the years of the phase in, though it affects the overall level of activity.

B. Budget Rules and the 2003 Tax Law

The 2003 tax law was also shaped by a debate that focused on the 10-year budget window. President Bush originally proposed a bill that would have eliminated the personal taxation of dividends and accelerated the tax rate cut provisions of the 2001 law and made them permanent. In their original analysis of the administration's proposal, the Joint Committee on Taxation

scored the revenue loss from the President's proposals at $725 billion over the eleven-year period 2003 through 2013 (see Joint Tax Committee (2003c)).

There was resistance, however, to a tax cut of this size from moderate Republican Senators. In particular, Senator George Voinovich, a pivotal member of the Finance Committee, announced he would support a cut of no more than $350 billion over ten years. Senator Voinovich cosponsored a resolution limiting the cuts to that amount. Though that resolution failed in a vote in the Senate on March 21, the $350 billion figure continued to frame the debate.

The House passed a bill with a revenue cost on $550 billion early in the morning on April 11. The Senate, later that day, approved a bill with a $350 billion 10-year revenue cost. Approval was narrowly won in the Senate—Vice President Cheney had to vote to break a tie—only because Finance Committee Chairman Senator Grassley promised the moderate Republicans that the bill that emerged from the conference committee would respect the $350 billion 10-year cost in the Senate bill.

The details of the final law as discussed in the previous section were driven by the $350 billion, ten-year constraint. Unlike in 2001, there was substantial sentiment to front-load the tax cuts for several reasons. First, there was an aim to address the weak economy though tax cuts.[5] Indeed, 83 percent of the total effect on the budget of the 2003 law was in the first three fiscal years of the 10-year window. (See Joint Tax Committee, 2003b.) Second, there was hope among those who sought larger tax cuts that the phase-outs (e.g., of the Alternative Minimum Tax relief and of the dividend and capital gains tax reductions) could be eliminated in the future. Critics of the law also saw this as a likely outcome, and therefore complained that the budgetary impact of the law was understated.

Given that extending provisions of the bill was already part of the debate even as it was passed, it is very hard to assess how the 2003 law changed expectations about future taxes. Moreover, to the extent that it was credible that the phase-outs would not be allowed to take effect, it is hard to understand what the moderates achieved in forcing the $350 billion limit onto the conference report. In any case, by framing the debate in terms of ten-year sum of budgetary impact, a law emerged with a complicated pattern of temporary tax changes and with little certainty about long run tax rates.

C. Discussion

The history of the 2001 legislation suggests that budget windows and budget rules have a substantial effect on the timing of tax rate changes. We should emphasize that these influences are not incorporated in our model. Indeed, it is difficult to do so convincingly.

Auerbach (2003) also identifies budget rules as having potentially significant effects on the design of tax policy. He considers a political economy model that allows for transitions in legislative control from one party to another. Budget windows that are too short allow policy makers understate the true financial cost of policy changes by cutting taxes or raising spending after the short horizon of the budget window. Budget windows can also be too long. Long windows allow policy makers to take credit for tax levies or spending cuts that are very far in the future even though there is no way to commit to the policy.

Although his model is quite stylized, Auerbach's approach is clearly fruitful for making sense of the very complicated reality of the political process. It also highlights how innovations such as moving from 5-year to 10-year budget windows, which were meant to improve

[5] When the Bush Administration proposed the 2001 tax bill, little emphasis was placed on stimulus. The 2001 tax rebates were introduced by Democrats, though as the economy slowed in

budgeting by focusing on the longer term, can have perverse implications for policy. Finally, we would emphasize how rules inherited from history, e.g., the supermajority requirements of the Byrd Rule, can have considerable, though unintended, consequences for policy.

V. Conclusions

Phased-in tax changes have significant incentive effects that should not be overlooked when evaluating economic policy. Phased-in tax cuts on labor income give workers and firms an incentive to delay production until the tax cut takes effect. In contrast, phased-in tax cuts on capital income provide immediate incentives to work and produce and especially to accumulate capital to take advantage of tax rates that will be low in the future.

The 2001 tax law featured phased-in reductions in labor taxes and capital taxes. The calculations we present show that the short run effects of the phase in may have reduced output, employment, and investment relative to trend. The phased-in tax cuts also reduced economic activity relative to what it would have been with a smaller, but immediate tax cut. Accordingly, the 2001 tax law may account in part for the slow recovery from the business cycle trough of 2001. The analysis also indicates that phasing in tax rate cuts contributed to the poor performance of both investment and equity markets. The long-run effect of the tax cuts, which is not the focus of this paper, depends critically on how the budget is eventually balanced.

The 2003 tax legislation reversed the phased-in nature of the 2001 law and also called for substantial temporary reductions in tax rates on capital income. The immediate tax rate cuts under the 2003 law provided incentives for production and investment to rise substantially relative to a baseline with phased-in tax rate cuts. These incentives likely contributed to the stronger economic performance in late 2003.

2001, the rebates were embraced by the Bush administration as a stimulus measure.

Why might policymakers implement tax changes that phase in and phase out over time? It is possible that policymakers are intentionally trying to affect the timing of households' and firms' decisions. For example, temporary investment incentives are sometimes advocated for short run stimulus. Moreover, as we have already discussed, delayed reductions in capital taxation stimulate investment without giving a windfall to previously installed capital.

In contrast, the effects of the timing of labor taxes hardly features in the professional or political debate. Perhaps no one thinks intertemporal effects are important for labor. As our robustness analysis makes clear, however, for parameter values where the timing of the tax cut has little effect on the allocation of labor across time, the tax cuts also have little effect on the steady-state level of labor. Hence, it not possible to advocate that tax cuts have favorable long-run supply side impacts while ignoring the intertemporal effects.

Perhaps features of behavior or institutions not captured by the model could rationalize large steady state effects of tax cuts, but minimize the intertemporal effects. Candidates include adjustment costs in labor supply or labor demand, or institutional rigidities. We believe such frictions are important for very short-run changes in tax rates. For example, we would not expect to see large intertemporal effects on labor supply of the one-month payroll tax holiday proposed by some Democratic leaders in early 2003. Yet, there are reasons to doubt that such frictions are substantial for the multi-year horizons analyzed in this paper. First, econometric estimates of adjustment costs for production workers and their hours over quarterly horizons are small. Second, periods of several years should be long enough to overcome institutional rigidities. Third, if there are substantial steady-state impacts of tax rates on labor supply, adjustment costs and institutional rigidities must be overcome at some point. Instead, those who doubt the intertemporal effect of tax changes such as we analyze are likely adhering to a low estimate of

the elasticity of labor supply with the implication that the long run effects of tax changes are also low.

Phasing in of tax cuts on labor is difficult to rationalize with standard economic models. That basic economic reasoning cannot rationalize phased-in tax cuts lends credence to the view presented in the previous section—that the phased-in and temporary tax increases witnessed since 2001 are a sub-optimal outcome driven by the legislative process. In particular, the absence of a strong majority in the Senate, interacting with strict adherence to procedural and accounting rules for legislating tax policy, may have lead to compromises that resulted in phase ins and sunsets of tax rate changes. In 2003, when the objective of short-run stimulus was prominent, the same rules and a similar political balance led to tax cuts that were temporary and front-loaded.

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Table 1. Baseline Parameters

Parameter	Baseline Value
Discount factor, annual rate (β)	0.98
Capital share (α)	0.35
Depreciation Rate, annual (δ)	0.10
Labor supply elasticity (η)	0.5
Elasticity of intertemporal substitution (σ)	0.2
Curvature of adjustment cost function (ϕ)	0

Table 2. Time Path of Upper-Bracket Marginal Income Tax Rates Under the 2001 Tax Law

	Tax Brackets (Joint Returns)			
Date	$45,200-109,250	$109,250-166,340	$166,340-297,300	$297,300 and above
pre-*EGTRRA*	28	31	36	39.6
2001:3-2001:4	27.5	30.5	35.5	39.1
2002:1-2003:4	27	30	35	38.6
2004:1-2005:4	26	29	34	37.6
2006:1 and beyond	25	28	33	35

Note: The table shows tax rates for tax brackets above the 15 percent rate. The 2001 tax changes were retroactive of January, though enacted in the middle of the year. The tax brackets are for 2001, married filing jointly, and are adjusted annually for inflation. Under the *EGTRRA* of 2001, tax rates revert to their pre-*EGTRRA* levels in 2011.

Table 3. Time Path of Effective Marginal Tax Rates Resulting from the 2001 Tax Law

Time (quarters)	Date	Labor tax rate (τ^N)	Capital tax rate (τ^K)
initial steady state	pre-*EGTRRA*	36.2	18.3
0,1	2001:3-2001:4	35.92	18.22
2-9	2002:1-2003:4	35.64	18.14
10-17	2004:1-2005:4	35.08	17.99
18 and beyond	2006:1 and beyond	34.4	17.8

Source: Congressional Budget Office (2001) for initial and 2006 figures interpolated as described in the text. Under the *EGTRRA* of 2001, tax rates revert to their pre-*EGTRRA* levels in 2011.

Figure 1. Immediate versus Delayed Labor Tax Rate Reductions

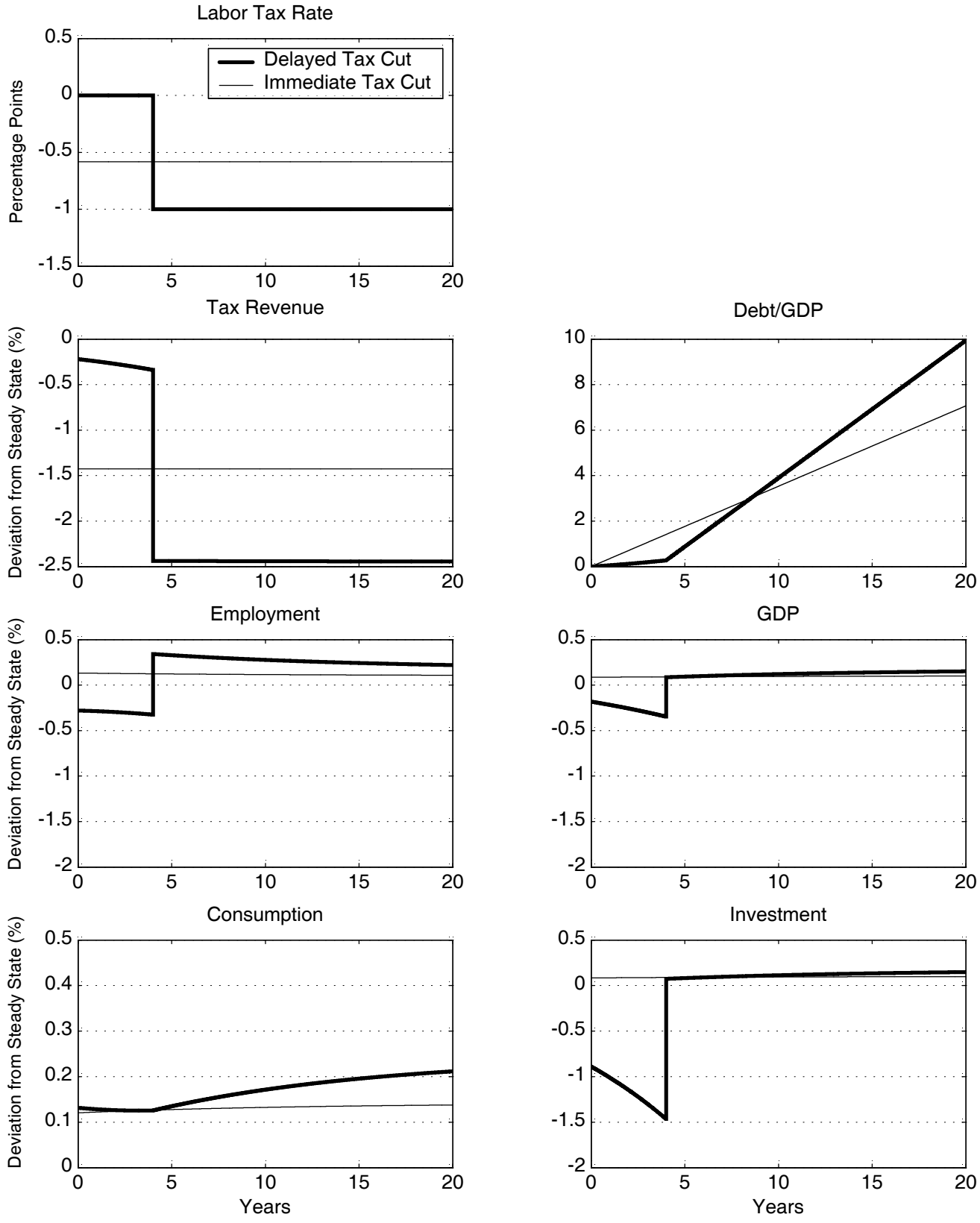

Figure 2. Immediate versus Delayed Capital Tax Rate Reductions: Economic Depreciation Allowances

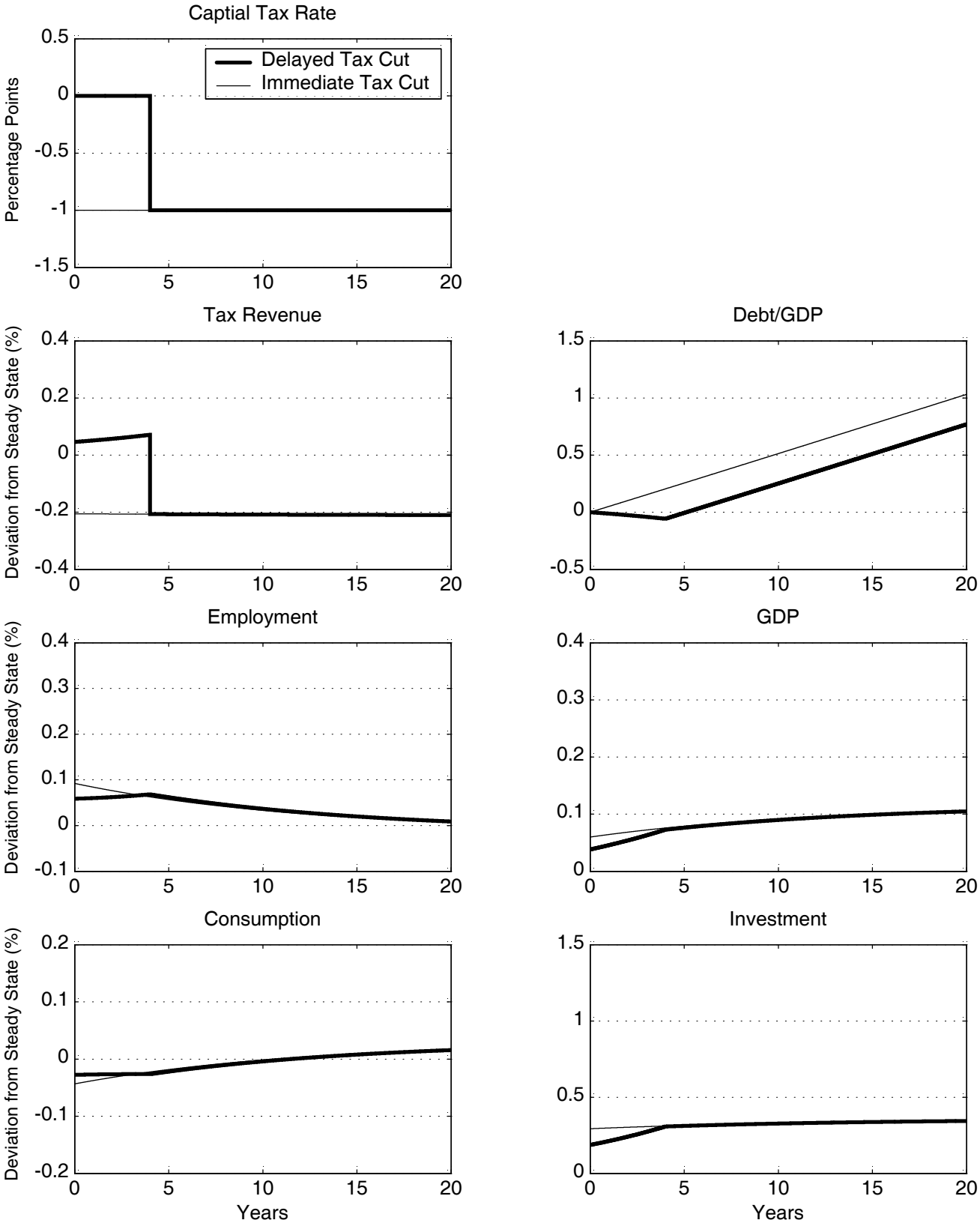

Figure 3. Immediate versus Delayed Capital Tax Rate Reductions: Investment Expensing

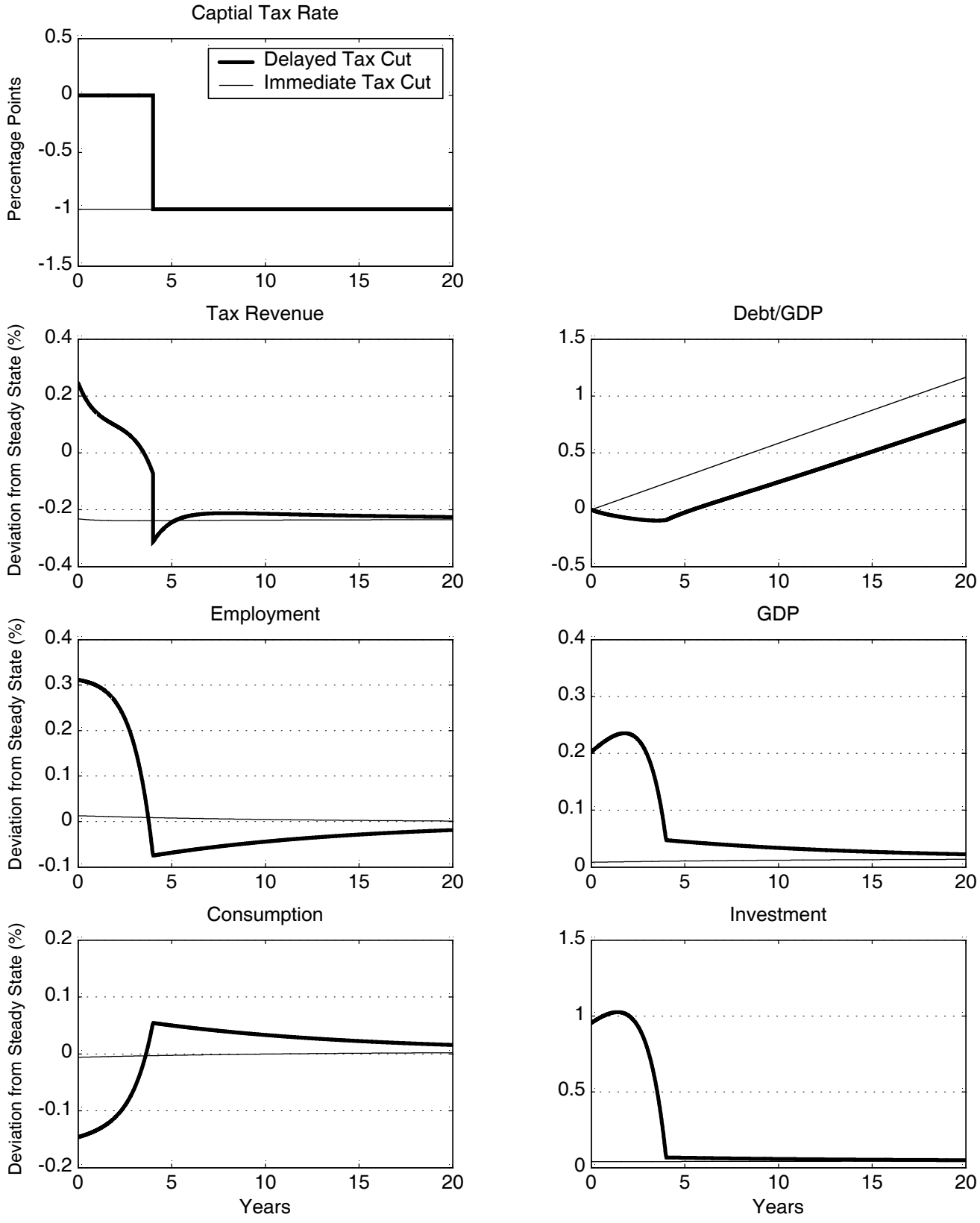

Figure 4. 2001 Tax Law with Sunset Provision

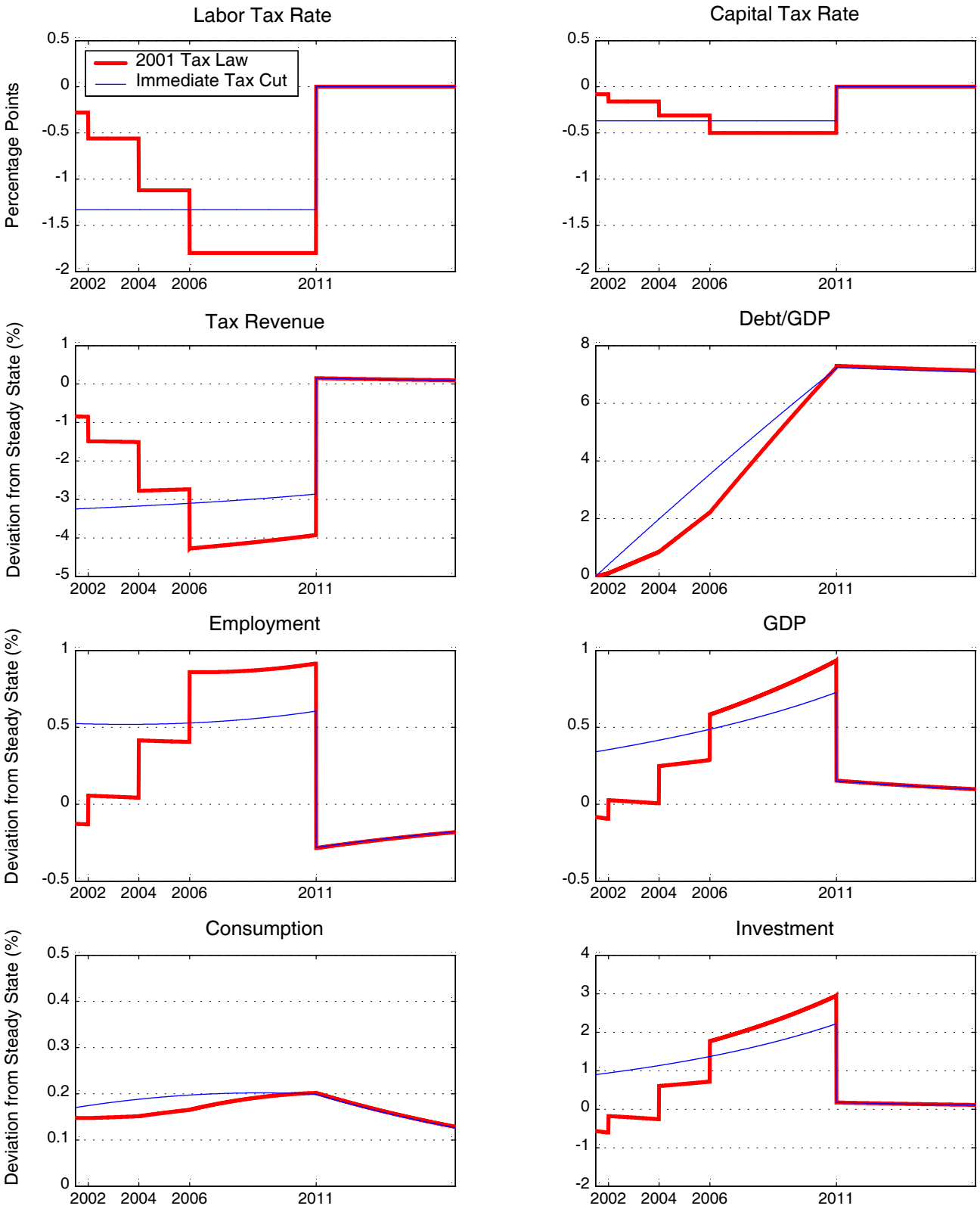

Figure 5. 2001 Tax Law without the Sunset Provision

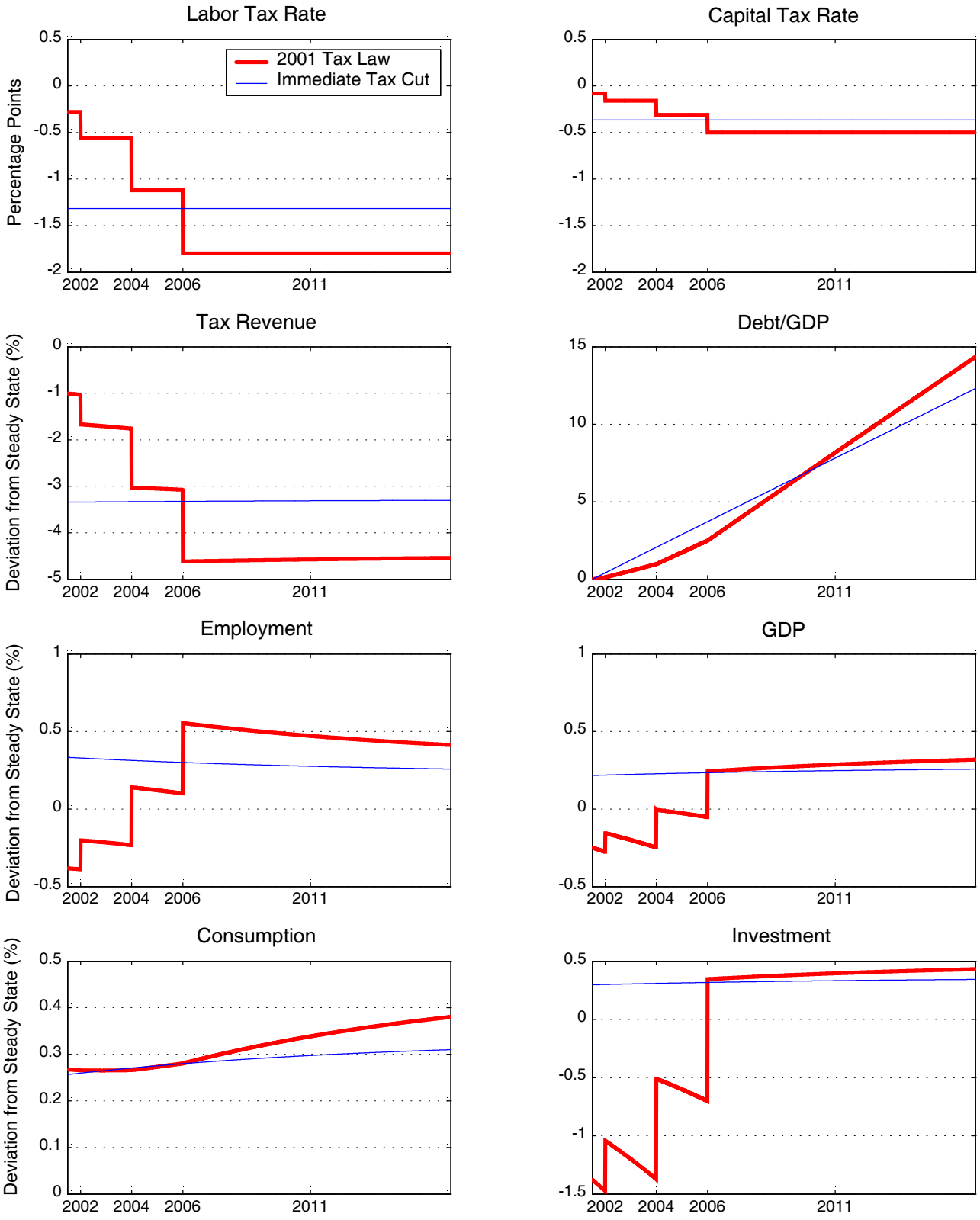

Figure 6. 2001 and 2003 Laws with Sunset Provision

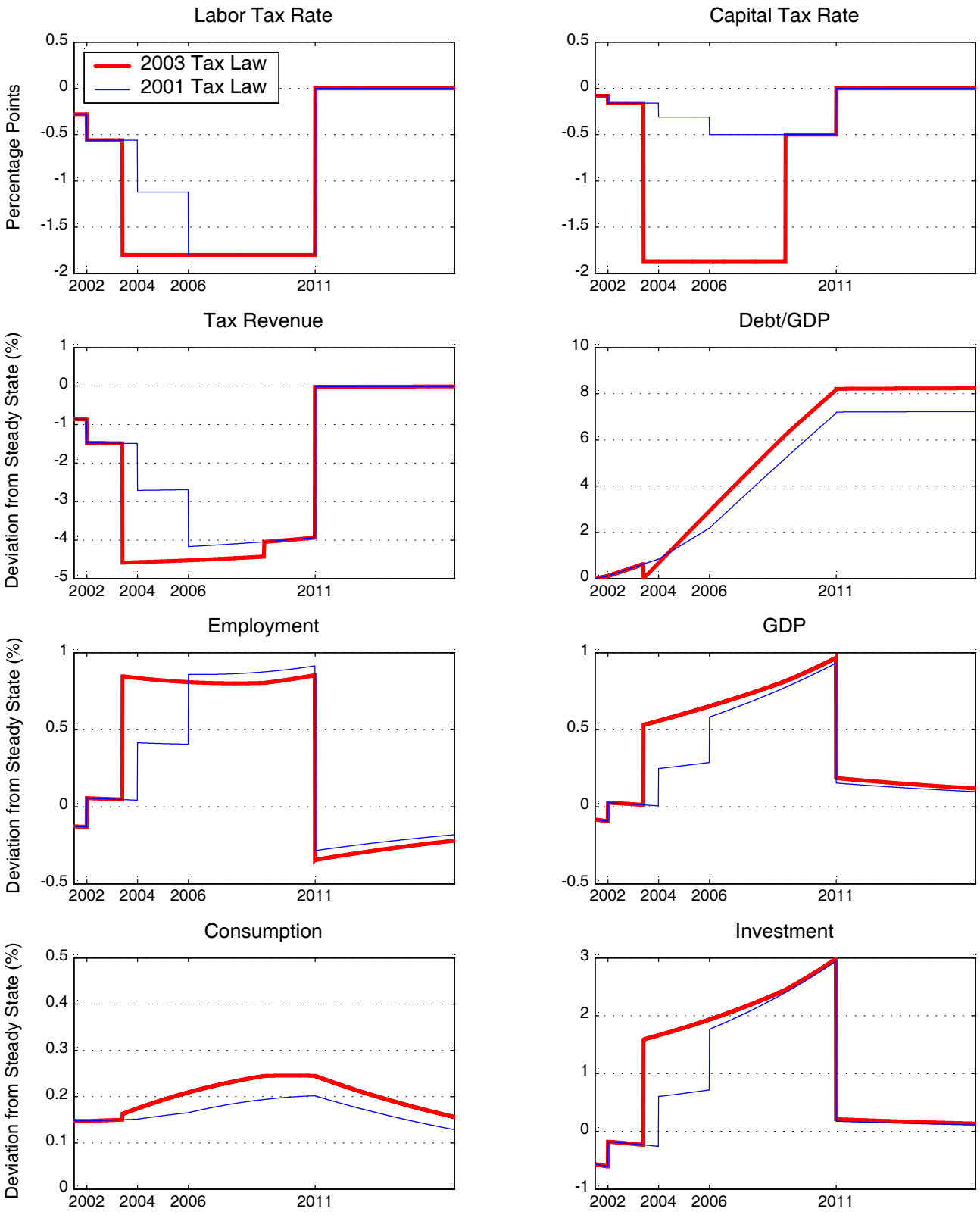

Figure 7: 2001 Phased-In Tax Reductions: Alternative Elasticities

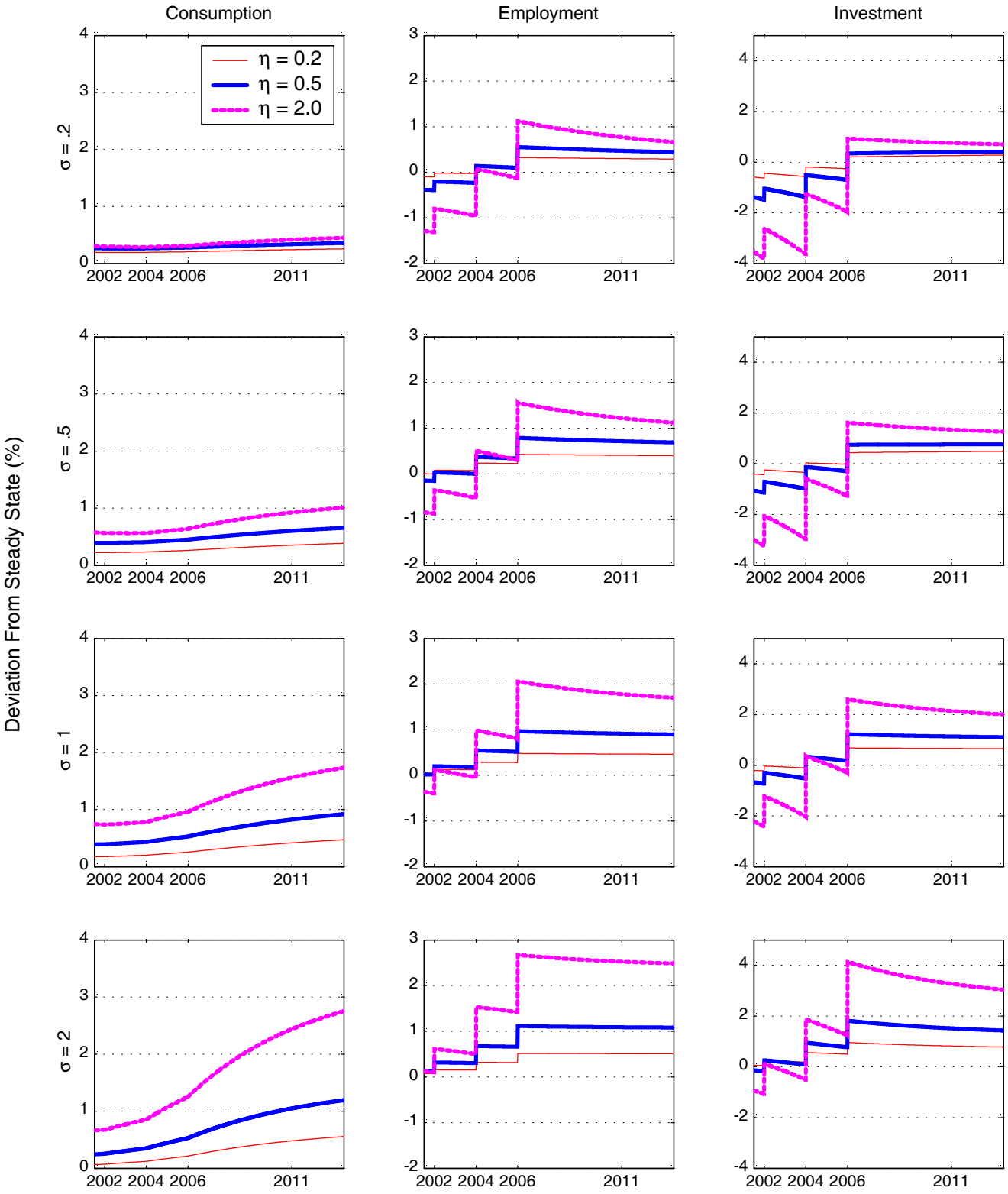

Figure 8: 2001 Phased-In Tax Rate Reductions: Alternative Adjustment Costs