Preannounced tax cuts and their potential influence on the 2001 recession

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Introduction and summary

The 2001 recession differed from previous recessions in several ways. First, it was quite mild in terms of its associated contractions in output and consumption. Also, since total hours worked fell sharply, labor productivity remained relatively high. Furthermore, while business fixed investment plummeted (actually, much more than in a typical recession), residential investment and purchases of durable goods remained surprisingly strong. This is highly unusual: Typically, residential investment and purchases of durable goods collapse during recessions, often leading the general contraction in economic activity by several quarters.

Another distinctive feature of the 2001 recession was that it was preceded by a presidential election dominated by tax cut discussions. The proposals of the two major candidates differed in crucial ways. While the Democratic candidate, Al Gore, promised cuts that would leave statutory income tax rates essentially unchanged (most cuts would come in the form of tax credits for particular economic activities), the Republican candidate, George W. Bush, announced a plan that would significantly reduce income tax rates across all income brackets. Thus, the outcome of the 2000 presidential election promised to have a large impact on the tax rates that households and businesses would face in the future.

A basic hypothesis in this article is that the two sets of facts—the unusual features of the 2001 recession and the tax cuts promised during the 2000 presidential election—could be related. The rationale for this view is that people and firms are forward-looking: Expectations about the future may have a significant effect on the decisions that they make today. For instance, the anticipation of higher demand may lead a producer to expand his production capacity, or the anticipation of higher wages in a particular occupation may induce a worker to acquire specific skills. Anticipated tax cuts are no exception. If tax rates are expected to decrease in one year, the current year becomes a relatively bad year for working and investing.[1] Forward-looking households and businesses may thus decide to devote less time to market activities, cutting back on time worked in the market and increasing time worked at home and substituting business investment for home investment. These contractionary effects of anticipated tax cuts could have played an important role in the patterns of activity observed during the 2001 recession.

Of course, the anticipated tax cuts were not the only factor potentially influencing economic activity during the 2001 recession. A number of other important shocks and policy responses also occurred in 2000 and 2001. For starters, market participants apparently began to reevaluate the profitability of many investment projects in the high-tech sector. This and other factors were reflected in a sharp decline in equity prices starting the spring of 2000. In addition, in 2001 there were the terrorist attacks on September 11, followed by the revelation of the Enron scandal later that fall. Moreover, the Federal Reserve lowered its policy rate substantially over the course of 2001, which influenced costs underlying household and business decisions regarding the purchase of durables and capital goods.

In order to determine the possible effects of anticipated tax cuts, we construct and analyze a theoretical model that abstracts from these other influences on the economy. The model will thus tell us if the anticipated tax effects can plausibly reproduce some of the patterns observed in the data. However, it is important to point out that since the other factors are excluded, we cannot use

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the analysis to rank the relative importance of taxes and these other influences on the economy over this period.

The model we use is a version of the Greenwood and Hercowitz (1991) home production model. In this model, the economy is populated by a representative household that values consumption of a market good and consumption of a home good. The home good is produced using home capital and time spent at home. The market good is produced using business capital and time worked in the market. Output of the market good can be consumed, invested in business capital, invested in home capital, or consumed by the government. The government finances its expenditures by taxing capital and labor income. Moreover, the government is assumed to balance its budget every period. Admittedly, the model is quite simple. However, it captures important decision margins, and therefore, we consider it a useful starting point for the analysis.

Selecting model parameters to reproduce salient features of the U.S. economy, we find that, while immediate tax cuts generate a boom in economic activity, delayed tax cuts initially generate a recession. Our analysis underscores the importance of taking forward-looking behavior on the part of households and businesses into account in considering the impact of policy alternatives. In particular, taking this behavior into account can help us understand some of the patterns in activity observed during the 2001 recession.

There are a number of papers that have previously analyzed the effects of anticipated changes to the economic environment (for example, Jaimovich and Rebelo, 2008, 2009; and Beaudry and Portier, 2007). However, the most closely related is the one by House and Shapiro (2006). Their paper also evaluates the effects of the 2001 tax reform. However, they focus on the effects of phased-in tax cuts from the time that the reform was signed into law, and they consider a model in which business capital is the only form of capital. Contrary to House and Shapiro (2006), we emphasize the anticipatory effects of the reform before it was signed into law, and introduce home capital into the analysis. Both extensions allow us to analyze the start of the 2001 recession and to evaluate whether the model is able to generate the unusual strength in home investment that was observed during that recession.

In the next section, we present the salient observations from the 2001 recession. Then, we describe the tax reforms that were promised during the 2000 presidential campaigns, as well as the tax reform that was actually implemented. Next, we explain the model economy. We describe the competitive equilibrium to be analyzed and how the model's parameters are selected. Finally, we present our results.

The 2001 recession

On November 26, 2001, the National Bureau of Economic Research (NBER) issued a statement announcing that the U.S. economy had reached a peak in business activity in March 2001 and had moved into a recessionary period.[2] The NBER report cited falling industrial production as the most significant piece of evidence to suggest the economy had slowed. Poor real sales and employment also provided evidence supporting the decision to announce a recession. While employment peaked in March, in parallel with the NBER peak date, both industrial production and sales had peaked six and seven months before that date, respectively. The NBER committee mentioned in its statement that *earlier* dates had been considered to reflect the "divergent paths" of manufacturing and employment, but these dates were dismissed because of the lower emphasis placed on the manufacturing and goods-producing sectors of the economy.[3]

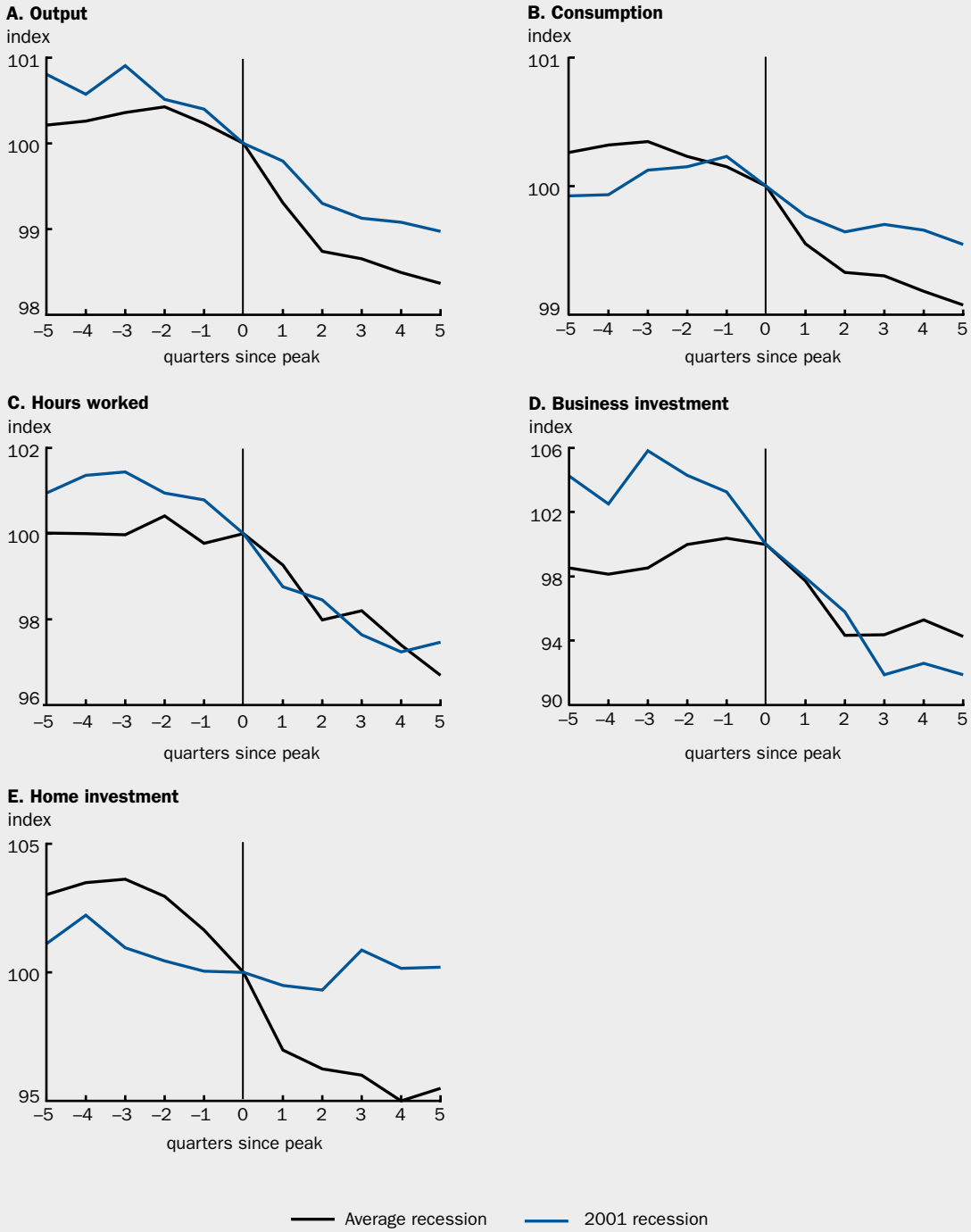
On July 17, 2003, the NBER reported that the economy had reached a trough in November of 2001, ending the recession.[4] The strength of both real gross domestic product (GDP) and real personal income relative to levels before the recession allowed the NBER committee to conclude that any future downturn in the economy would in fact be a separate recession and not a continuation of the 2001 recession. Nevertheless, industrial production and employment showed no sign of recovery.

To gain a more detailed understanding of the 2001 recession, figure 1 reports the paths of output, consumption, hours worked, business investment, and home investment leading up to and during the 2001 recession. For comparison, it also reports the average of those paths before and during the previous six recessions.[5] For consistency with the model used later on, residential investment and personal consumption expenditures on durables goods are combined into a single measure denoted home investment. In turn, business investment is defined as private nonresidential fixed investment plus changes in inventories, and consumption is restricted to consumption of nondurables and services. Because our model economy will be closed, output is defined as GDP minus net exports (that is, gross domestic purchases).[6] All of these variables are reported in real terms. For hours worked, we focus on a broad measure constructed by Prescott, Ueberfeldt, and Cociuba (2009), which includes military personnel. Because our model will have no growth component, we detrend each series using a deterministic trend.[7]

A quick glance at figure 1 indicates that, relative to the standard recession, the 2001 recession was highly atypical in several respects. Output and consumption (panels A and B) fell during 2001, but not as much as

FIGURE 1

2001 recession versus average recession



Notes: All variables are normalized (indexed) to 100 at the recession peaks. Time 0 indicates the recession peak quarter. The average recession is based on those that occurred in 1960–61, 1969–70, 1973–75, 1980, 1981–82, and 1990–91, according to the National Bureau of Economic Research.

Source: Authors' calculations based on data from the U.S. Bureau of Economic Analysis, *National Income and Product Accounts of the United States*, from Haver Analytics.

in the average recession.[8] Once the 2001 recession started, hours worked (panel C) behaved similarly to the average recession. However, during the three quarters leading up to the 2001 recession, there was a steady decline in hours worked compared with the constant levels leading up to the average recession. For the 2001 recession, the decline in business investment (panel D) was much sharper and started much earlier. Perhaps most notably, the 2001 downturn had minimal effects on home investment (panel E). On average, home investment's decline leads an upcoming recession, while there were no noticeable effects both before and during the 2001 recession.

Later on, we will show that the anticipation of future tax cuts could have contributed to some of these atypical features of the 2001 recession (for example, the relatively strong consumption and home investment). In order to do this, we must first identify reasonable estimates for two critical elements of the analysis: 1) when economic agents began anticipating the future tax cuts and 2) what was the particular tax cut schedule that economic agents were anticipating. We will examine the 2000 presidential campaigns and election, as well as the implementation of the Economic Growth and Tax Relief Reconciliation Act of 2001 (EGTRRA), to determine these two elements.

The presidential campaigns and the 2000 election

On March 14, 2000, both George W. Bush and Al Gore won their respective party's nomination to become the 43rd President of the United States. Over the next eight months, both candidates campaigned and presented the American public with their own proposals to stimulate the economy.[9]

The Republican candidate, George W. Bush, ran on a platform with across-the-board marginal rate tax cuts as one of its foundations. Leading up to the election, the total cost of the cuts was estimated at $1.3 trillion over the nine-year period 2002–10. In the plan, the 28 percent and 31 percent tax brackets would both be dropped to 25 percent. The 15 percent bracket would be dropped to 10 percent, and both the 36 percent and the 39.6 percent tax brackets would be reduced to 33 percent.[10] All of these cuts were proposed to be "phased in" starting in 2002, with a further reduction in 2004, and with all of the effects being implemented by 2006.

Al Gore, the Democratic candidate and incumbent Vice President, proposed a tax plan more conservative in cost (estimated at $500 billion) and more geared to the low- and middle-income classes. His tax reform included raising the standard deduction, with tax breaks and deductions for savings accounts, child care, college tuition, and long-term caregivers. A tax credit for new retirement savings accounts was the most substantial of these proposals.

Although both candidates promised significant tax cuts, their proposals differed in a fundamental way. While the Republican candidate promised reductions in marginal tax rates, the Democratic candidate promised cuts in inframarginal taxes. This is an important distinction, since reductions in marginal tax rates tend to increase labor supply, while reductions in lump-sum taxes have the opposite effect. These differences made it difficult for economic agents to adjust their behavior to the prospective tax cuts. The reason is that adjusting to one type of reform would have produced large errors had the alternative reform been implemented.

It would be extremely difficult to determine at each point in time the economic agents' beliefs about the likelihood of either type of reform being implemented and, therefore, the future taxes they were anticipating. However, it is convenient for the purposes of this article to make a number of not entirely implausible assumptions. First, since the election was so tight and the Florida recount actually postponed its outcome for almost a month after election day (November 7), it seems reasonable to assume that until the end of 2000, economic agents were putting a 50/50 chance on either type of reform being eventually implemented. Second, since adjusting to each type of reform required such drastically different types of labor supply responses, it is not implausible to assume that agents waited until the election outcome before making any changes to their behavior. Third, we assume that, once George W. Bush was declared the new President of the United States, economic agents immediately shifted their expectations about future tax cuts to what had been promised during his campaign. Fourth, we assume that once a slightly different reform was later implemented, economic agents adjusted their expectations accordingly. In the next section, we describe the reform that was actually implemented.

The implementation of the 2001 tax cuts

The Economic Growth and Tax Relief Reconciliation Act was signed into law by George W. Bush on June 7, 2001. As proposed in Bush's campaign for the presidency, the law's most substantial changes involved an across-the-board reduction in the marginal tax rates. A 0.5 percentage point cut in the marginal rates for all tax brackets above the 15 percent rate became effective immediately. The law stipulated subsequent cuts in 2002, 2004, and 2006 of 0.5 percentage points, 1 percentage point, and 1 percentage point, respectively, for each tax bracket (the only exception being a cut of 2.6 percentage points for the highest bracket in 2006). This schedule

TABLE 1

Statutory and effective marginal tax rates: Proposed and enacted

Date	Income tax brackets: $45,200 to $109,250	$109,250 to $166,340	$166,340 to $297,300	$297,300 and above	Effective marginal tax rates: Labor tax rate (τ^n)	Capital tax rate (τ^k)
	(percent)					
A. Pre-EGTRRA						
Before 2001:Q1	28	31	36	39.6	36.20	37.43
B. Campaign proposal						
2001:Q1–2001:Q4	28	31	36	39.6	36.20	37.43
2002:Q1–2003:Q4[a]	—	—	—	—	35.39	36.98
2004:Q1–2005:Q4[a]	—	—	—	—	34.58	36.52
2006:Q1 and beyond	25	25	33	33	33.77	36.07
C. EGTRRA						
2001:Q3–2001:Q4	27.5	30.5	35.5	39.1	35.92	37.27
2002:Q1–2003:Q4	27	30	35	38.6	35.64	37.11
2004:Q1–2005:Q4	26	29	34	37.6	35.08	36.80
2006:Q1–2010:Q4	25	28	33	35	34.40	36.41
2011:Q1 and beyond	28	31	36	39.6	36.20	37.43

[a]The campaign proposal by George W. Bush did not explicitly state the tax reduction schedule that would be implemented in 2002 and 2004.

Notes: EGTRRA means the Economic Growth and Tax Relief Reconciliation Act of 2001. This table shows the tax rates for the brackets above the 15 percent rate. The schedule for the effective marginal tax rates on both labor and capital is taken from House and Shapiro (2006). By using the same weighting procedure used by House and Shapiro (2006), we interpolate the effective marginal tax rates if George W. Bush's *proposed tax schedule* (panel B) had been enacted.

Sources: Authors' calculations based on data from House and Shapiro (2006) and Congressional Budget Office (2001).

would remain in effect until 2011, when the tax rates would revert, or "sunset," to their pre-EGTRRA rates.

In addition, the law phased out the estate tax and sent a tax rebate check of $300 to each individual. An increase in the child credit from $500 to $1,000 and relief from the alternative minimum tax (AMT) and the marriage penalty rounded out the bill. Although the rebate checks were highly visible in 2001, they did very little to affect marginal tax rates (House and Shapiro, 2006).[11] The effects of the other provisions on marginal tax rates will be discussed shortly.

Relative to the tax cuts that George W. Bush had proposed during his campaign, EGTRRA differed in several ways. First, the initial cuts to marginal rates of EGTRRA became effective immediately (in June 2001) and were retroactive to the beginning of the year. In proposals during the campaign, the Bush tax cuts were not to take place until 2002. Next, as seen in table 1, the ultimate percentage cuts for some tax brackets signed into law were slightly smaller than what had been proposed to Congress. For the 31 percent and 39.6 percent tax brackets (panel A), proposed cuts of 6 percentage points and 6.6 percentage points, respectively (panel B), were scaled back to 3 percentage points and 4.6 percentage points (panel C). In addition, an explicit "sunset" date of January 2011 was put on all marginal tax rate changes (Brumbaugh et al., 2002).

A study administered by the Congressional Budget Office (2001, p. 34, boxes 2–3), or CBO, estimated the *effective* marginal tax rates (for both labor and capital income) before and after EGTRRA. Effective marginal tax rates depend on other features of tax law beyond the statutory rate, including the earned income tax credit, the child tax credit, and the AMT, among others. The analysis by the CBO attempted to take these other provisions into account when determining the estimated change due to EGTRRA.[12]

The CBO's estimates of effective marginal tax rates of labor and capital income are reported in table 1 (the last two columns of data). We see that, according to the CBO, the effective marginal tax rate on labor fell from a pre-EGTRRA level of 36.20 percent (panel A) to 34.40 percent (fourth row of panel C) and that the effective marginal tax rate on capital fell from 37.43 percent to 36.41 percent, once EGTRRA was fully phased in (in 2006).[13] A more formal discussion on the taxation of capital can be found in the appendix.

The effective marginal tax rates estimated by the CBO for the years 2000 and 2006 can be interpolated to all other years by using the corresponding tax rates for the different income brackets (the first through fourth columns of panel C in table 1).[14] The results are shown in the last two columns of panel C. This procedure can also be used to construct the implicit effective marginal

tax rates that were proposed by George W. Bush during the presidential campaign. These tax rates are reported in the last two columns of panel B. The effective marginal tax rates in panels B and C are the ones that will be used to determine economic agents' expectations at each point in time. In particular, we will assume that starting in 2001:Q1 agents were anticipating the effective marginal tax rates provided in panel B, but that in 2001:Q3 (that is, after the passage of EGTRRA) they switched their expectations to the effective marginal tax rates listed in panel C. These expectations will play an important role in the model economy to be described next.

The model

The model economy consists of three sectors: a household sector, a firms sector, and a government sector. The household sector is composed of a large number of identical individuals that supply labor and business capital to the firms. In addition, they produce a home good, using time and home capital. The firms sector is constituted by a large number of identical firms that produce the market good, using business capital and labor. The market good is sold to the households, which use it for consumption and investment. The government needs to purchase a certain amount of the market good every period. These expenditures are financed with a combination of capital income, labor income, and lump-sum taxes.[15] In what follows we describe the model in detail.

The household sector

The representative household has preferences described by the following utility function:

$$1) \quad \sum_{t=0}^{\infty} \beta^t \left[\psi \ln c_t + (1-\psi) \ln h_t \right],$$

where c_t is consumption of a market-produced good, h_t is consumption of a home-produced good, $0 < \beta < 1$ is the subjective time discount factor, and $0 < \psi < 1$. The representative household is endowed with one unit of time.

At the beginning of period t, the household owns k_t units of business capital and d_t units of home capital. Both types of capital can be accumulated using a standard linear technology. In particular,

$$2) \quad k_{t+1} = \left(1-\delta^k\right) k_t + i_t^k$$

and

$$3) \quad d_{t+1} = \left(1-\delta^d\right) d_t + i_t^d,$$

where i_t^k is gross business investment, i_t^d is gross home investment, $0 < \delta^k < 1$ is the depreciation rate of business capital, and $0 < \delta^d < 1$ is the depreciation rate of home capital. At the beginning of date 0, the stock of business capital k_0 and the stock of home capital d_0 are given.

The home good is produced according to the following production function:

$$4) \quad h_t = d_t^{\alpha} (1-n_t)^{1-\alpha},$$

where n_t is the amount of time spent in market activities, and $0 < \alpha < 1$. Observe that since the time endowment is equal to one, $1 - n_t$ is the amount of time that the household spends in home activities.

The household's budget constraint is given as follows:

$$5) \quad c_t + i_t^k + i_t^d + T_t \leq \left(1-\tau_t^n\right) w_t n_t + \left(1-\tau_t^k\right) r_t k_t + \tau_t^k \delta^k k_t,$$

where w_t is the wage rate, r_t is the rental rate on capital, τ_t^n is the tax rate on labor income, τ_t^k is the tax rate on capital income, and T_t is the lump-sum taxes. Observe that the household receives a tax depreciation allowance given by $\tau_t^k \delta^k k_t$. Also observe that the household uses its after-tax labor and capital income to consume, to invest in business capital, to invest in home capital, and to pay lump-sum taxes. The household takes the lump-sum taxes T_t, the tax rates τ_t^n and τ_t^k, and the prices w_t and r_t as given.

The household's problem is to maximize the utility function (equation 1) subject to equations 4 and 5.

The firms sector

The representative firm produces the market good using the following production function:

$$6) \quad y_t = K_t^{\theta} N_t^{1-\theta},$$

where y_t is output, K_t is business capital, N_t is labor, and $0 < \theta < 1$.

The firm solves the following static profit maximization problem:

$$7) \quad \max \{ y_t - r_t K_t - w_t N_t \},$$

subject to equation 6. That is, the firm maximizes the difference between the revenues that it receives from selling its output and the total rental payments on capital and labor. The firm takes the rental rate of capital r_t and the wage rate w_t as given.

The government sector

The government needs to make a sequence of expenditures $\{g_t\}_{t=0}^{\infty}$. These expenditures are exogenous—that is, they are determined outside the model.[16] However, the following government budget constraint must be satisfied:

$$g_t = \tau_t^n w_t n_t + \tau_t^k r_t k_t - \tau_t^k \delta^k k_t + T_t.$$

That is, government expenditures must be financed with tax revenues.[17]

Market clearing

At equilibrium all markets must clear. In particular,

8) $$c_t + i_t^k + i_t^d + g_t = y_t.$$

That is, consumption of the market good c_t plus total investment $i_t^k + i_t^d$ plus government expenditures g_t must be equal to output y_t.

Also,

$$K_t = k_t,$$

and

$$N_t = n_t.$$

That is, the rental markets for capital and labor must clear.[18]

Selection of parameter values

With constant government expenditures and tax rates, the model economy eventually settles into a steady state where consumption, business capital, home capital, output, hours worked, and all prices are constant over time. In what follows, model parameters are chosen so that this steady state reproduces key observations about the U.S. economy. Since there are nine parameters to choose, we target nine observations. The parameters to be selected are β, ψ, α, θ, δ^d, δ^k, g, τ^n, and τ^k.

Before proceeding we need to identify empirical counterparts for the different types of capital. In what follows we identify the stock of home capital d with the sum of residential structures and consumer durable goods. As a consequence, we associate home investment i^d with gross private residential fixed investment plus personal consumption expenditures on durable goods (from the U.S. Bureau of Economic Analysis's national income and product accounts, or NIPAs). In turn, we identify the stock of business capital k with total fixed assets minus residential structures. That is, k includes private business structures, equipment, and software, as well as all forms of government capital. As a consequence, we associate business investment i^k with private nonresidential fixed investment plus government gross investment (from the NIPAs).

Using annual data from 1967 through 2007 published in the NIPAs, we find that the corresponding average annual investment rates i^d/d and i^k/k are equal to 9.1 percent and 8.5 percent, respectively, and that the average investment–output ratios i^k/y and i^d/y are equal to 14.9 percent and 12.7 percent, respectively.[19] This provides four target observations.

Two additional target observations are the share of labor in national income (equal to 70 percent) and the average fraction of time spent working by the total civilian noninstitutional population aged 16–64 and military personnel (equal to 27 percent).[20] The first observation, which is standard in the macroeconomics literature, is obtained from the NIPAs. The second observation, which corresponds to the period 1967–2007, is from Prescott, Ueberfeldt, and Cociuba (2009).

The last three observations that we use are associated with the government sector. The first of these observations is a government expenditures ratio g/y equal to 16 percent, which is the average over the period 1967–2007 in the NIPAs. The other two observations are the pre-EGTRRA effective marginal tax rates on labor and capital that were described in table 1 (p. 21).

Table 2 lists the parameter values that generate these nine observations when the model's time period is set to one quarter.

Results

In this section, we analyze the effects of introducing different types of tax reforms to the economy calibrated in the previous section. The purpose of the exercises is twofold: to compare the effects of anticipated tax cuts with those of unanticipated tax cuts and to explore whether anticipated tax cuts may have contributed to generating some of the atypical features of the 2001 recession. In all cases we will assume that in 2000:Q4, the economy was at the steady state calibrated in the previous section.

The effects of immediate tax cuts

The first experiment is to evaluate the effects of immediate tax cuts—that is, a tax cut reform that introduces no delays between the time of its announcement and the time of its implementation. The experiment's purpose is to illustrate how the model works and to facilitate comparisons with a delayed reform later on. The particular tax cuts considered are the total tax cuts promised by George W. Bush during the presidential campaign. In particular, we assume that in 2001:Q1 economic agents learn that their marginal tax rate on capital (τ^k) is immediately and permanently reduced from its pre-EGTRRA rate of 37.43 percent to 36.07 percent. Similarly, we assume that

the marginal tax rate on labor (τ^n) is immediately and permanently reduced from 36.20 percent to 33.77 percent (see first and last rows of panel B in table 1, p. 21). We want to emphasize that this exercise is purely illustrative: As was described previously, George W. Bush did not promise that these tax cuts would take place immediately but that they would be phased in over a period of several years.

Figure 2 shows the evolution of the economy after this reform. We see that, in the model, the reform generates a boom in economic activity. The lower income tax rates increase the returns to working in the market and to investing in business capital. As a consequence, hours worked (panel C) and business investment (panel E) increase during the first period of the reform. Also, the lower reliance on distortionary taxes makes households feel richer, and they respond by increasing their consumption (panel B). Observe that during the first period of the reform there is a sharp drop in home investment (panel F). The reason is that the lower tax rate on business capital changes the desired mix of capital. In particular, households want to hold more business capital and less home capital.

During the second period of the reform, business investment drops and home investment increases. The reason is that once the correct capital mix is achieved during the first period of the reform, both types of capital start growing at a more balanced pace. As business capital increases during the subsequent periods, output (panel D) and consumption continue to grow and hours worked start to decrease.

The effects of delayed tax cuts

In the previous section, we considered a scenario in which the total tax cuts promised by George W. Bush during his presidential campaign were immediately implemented. The scenario was highly unrealistic: In actuality, his promise was to gradually reduce tax rates in 2002, 2004, and 2006, with the total tax cuts taking full effect only by 2006. Here we consider the scenario in which not only the total tax cuts but their pace of reduction are the ones promised during the campaign. In particular, the sequence of tax rates τ_t^k and τ_t^n introduced are those given by the last two columns of panel B in table 1 (p. 21). The purpose of this experiment is twofold: First, it illustrates the effects of preannouncing tax cuts instead of implementing them as surprises; second, it evaluates the effects that might have been obtained had the tax reform promised by George W. Bush during his campaign been implemented.

Figure 3 shows the evolution of the economy starting in 2001:Q1, when economic agents first learn that tax rates will be reduced in the future. We see that in the model economy the delayed reform generates a *recession* during 2001. The reason is that the anticipated tax reduction makes 2001 a relatively bad year for working and investing. Economic agents essentially take a break from market activities, substituting time worked in the market for time worked at home and substituting business investment for home investment. Most of the investment adjustment takes place in 2001:Q1, when there is a sharp decline in business investment (panel E) and a sharp increase in home investment (panel F). Also observe that consumption (panel B) immediately jumps to a permanently higher level because the lower future tax rates make the representative household richer. Later, in 2001:Q4, agents know that taxes are going to be cut the following quarter, so they prepare for this by increasing business investment and decreasing home investment. This leaves agents at the start of 2002:Q1 with a higher stock of business capital and a lower stock of home capital, which are appropriate for the sharp substitution in time worked at home for time worked in the market (panel C) and for the increase in output (panel D) that subsequently takes place.

TABLE 2

Parameter values

Parameter	Value
β	0.9868
ψ	0.286
α	0.143
θ	0.30
δ^d	0.02274
δ^k	0.02112
g	$0.16 \times y$
τ^n	0.362
τ^k	0.3743

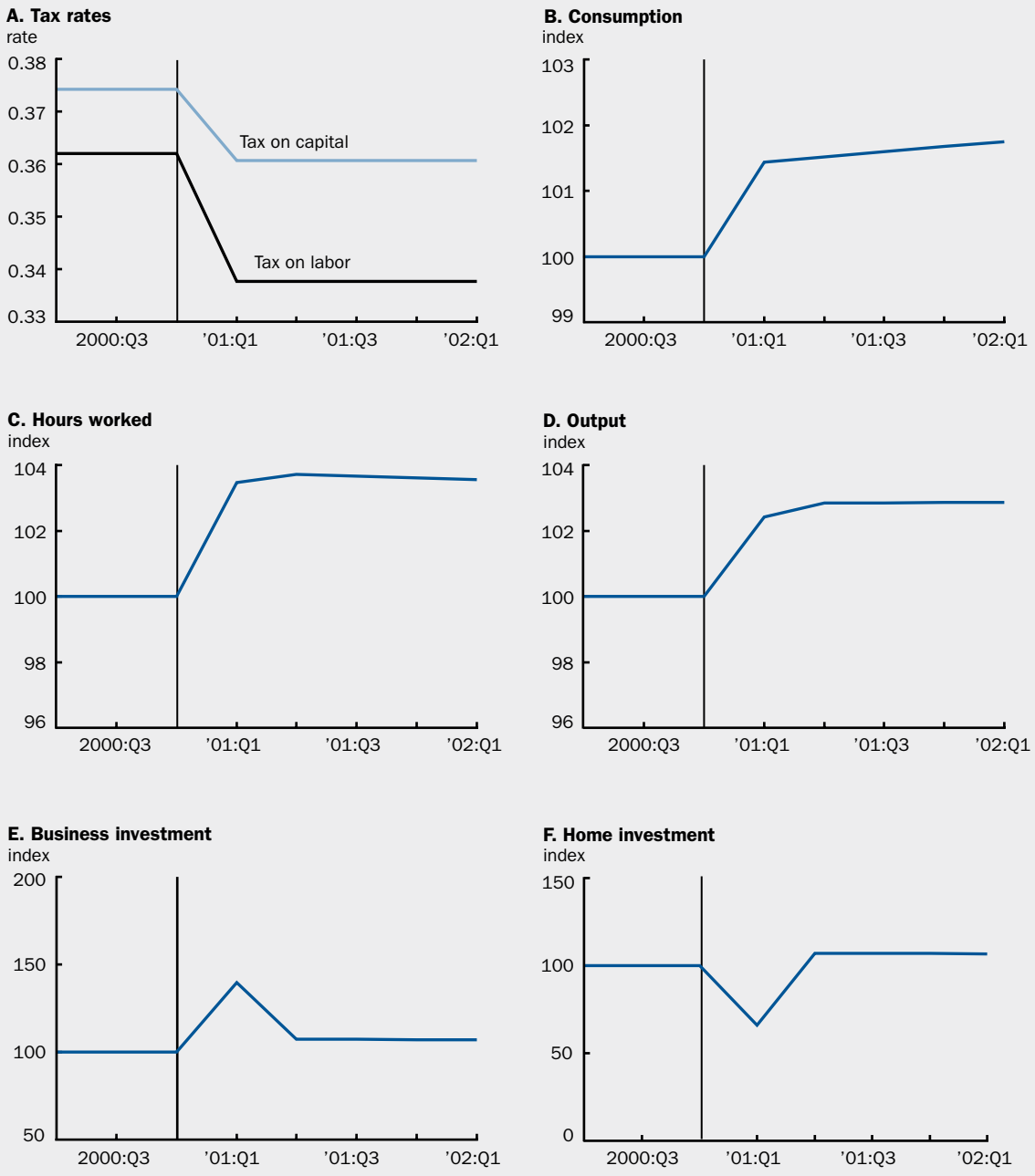
Note: The government-expenditures-to-output ratio (g/y) is equal to 0.16.

The effects of EGTRRA

The "delayed tax reform" scenario of the previous section seems to be a plausible description of how prospective tax cuts may have affected the economy through 2001:Q2. There are two reasons for this. First, although George W. Bush was already announcing his intentions of cutting marginal tax rates during his 2000 presidential campaign, it seems unlikely that this may have had significant effects on economic decisions before 2001:Q1. If economic agents had changed their behavior in anticipation of George W. Bush winning the election (and marginal tax rates being reduced), they would have regretted it later on had Al Gore become the new president (and marginal tax rates had remained unchanged). Given the high uncertainty about the election outcome and given

FIGURE 2

Effects of immediate tax cuts



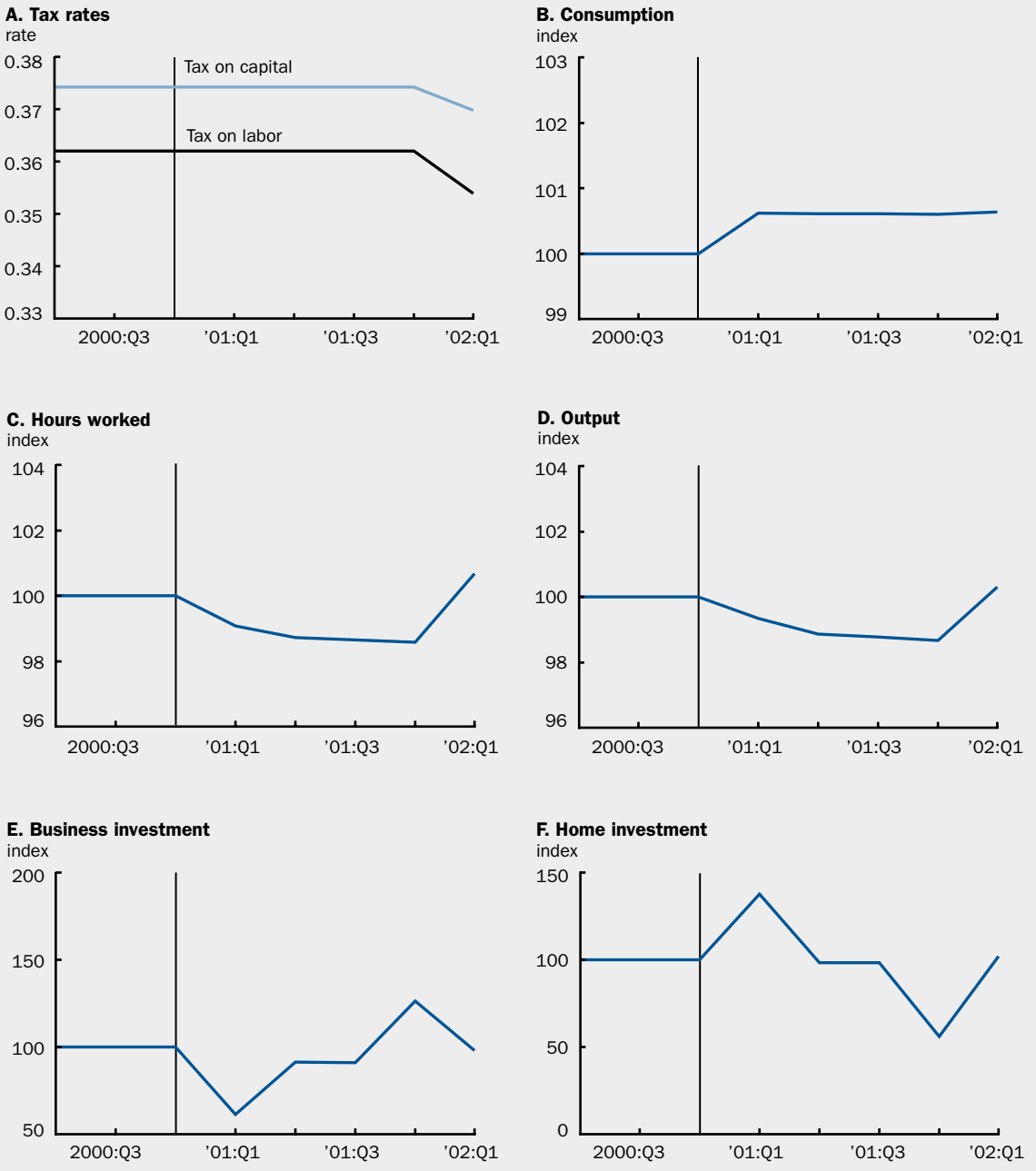
Note: Panels B through F are normalized (indexed) to 100 at 2000:Q4.

the risk of erring in either direction, it seems reasonable to assume (as a first approximation) that economic agents waited until the election outcome before changing their behavior. Second, it seems plausible to think that once forward-looking economic agents learned by the end of 2000:Q4 that George W. Bush would become the new president, they started to adjust their behavior in anticipation of the tax cuts announced during his presidential campaign.

While being a plausible description of the effects of prospective tax cuts through 2001:Q2, the "delayed tax reform" scenario of the previous section does not apply

FIGURE 3

Effects of delayed tax cuts



Note: Panels B through F are normalized (indexed) to 100 at 2000:Q4.

after 2001:Q2. The reason is that the actual tax reform passed by Congress and signed into law in June 2001, EGTRRA, differed in significant ways from the tax reform that George W. Bush had announced during the campaign: 1) The total tax cuts were smaller (although they would still take full effect by 2006), 2) a "sunset" provision was incorporated, and 3) small tax cuts were already given for the year 2001 (retroactively to the beginning of the year). So, in a third scenario that follows, we will assume that economic agents are surprised by the actual passage of EGTRRA and that they revise their expectations accordingly. In particular, we will assume

that in 2001:Q3 economic agents start to believe that the future sequence of tax rates τ_t^k and τ_t^n will be given by the last two columns of panel C in table 1 (p. 21).

Figure 4 shows the complete evolution of the economy. By construction, the path that the economy follows through 2001:Q2 is identical to that of the "delayed tax reform" scenario. However, starting in 2001:Q3, the path is significantly different. Since now households find out that some tax cuts already take place in 2001, they immediately shift hours worked at home to hours worked in the market (panel C) and increase the amount of output produced (panel D). Because of the substitution toward market activities, we also see that in 2001:Q3 there is an increase in business investment (panel E) and a drop in home investment (panel F). Consumption (panel B) drops, however, because agents learn that they are not as rich as they initially believed: EGTRRA now incorporates a "sunset" provision. In anticipation of further tax cuts that will take place in 2002:Q1, business investment remains relatively high in 2001:Q4 and home investment remains relatively low. Once the tax rates are reduced in 2002:Q1, there is an additional increase in hours worked and output, while business investment and home investment stabilize around their pre-EGTRRA levels.

Adjustment costs

We saw in the previous section that in the model economy, the expectations of future tax cuts during the early part of 2001, followed by the actual implementation of EGTRRA, generate a short-lived recession during 2001 in which hours worked and output fall, while consumption remains relatively strong. These are features observed in the actual 2001 recession (see figure 1, p. 19). However, home investment is extremely strong during the early part of the year and extremely weak during the second half of the year (panel F in figure 4). The opposite is true with business investment (panel E in figure 4). These large swings in investment are highly counterfactual (see figure 1, p. 19).

In order to improve the performance, we introduce adjustment costs to the model economy. In particular, we assume that it is costly to change both types of investments from their levels in the previous period. Under this assumption, the household's budget constraint (equation 5) becomes

$$c_t + i_t^k + i_t^d + \frac{\phi_k}{2}\left(i_t^k - i_{t-1}^k\right)^2 + \frac{\phi_d}{2}\left(i_t^d - i_{t-1}^d\right)^2 + T_t \leq \left(1-\tau_t^n\right) w_t n_t + \left(1-\tau_t^k\right) r_t k_t + \tau_t^k \delta^k k_t,$$

and the market-clearing condition (equation 8) becomes

$$c_t + i_t^k + i_t^d + \frac{\phi_k}{2}\left(i_t^k - i_{t-1}^k\right)^2 + \frac{\phi_d}{2}\left(i_t^d - i_{t-1}^d\right)^2 + g_t = y_t,$$

where $\phi_k \geq 0$ and $\phi_d \geq 0$.

In what follows, we will assume that $\phi_k = 0.01$ and $\phi_d = 0.01$. These adjustment costs are quite small. To see this, consider starting from the steady state calibrated previously and doubling the amount of business investment i^k and home investment i^d. As a fraction of total output, the associated adjustment costs turn out to be

$$\frac{\phi_k}{2}\frac{\left(i^k\right)^2}{y} = 0.007\%$$

and

$$\frac{\phi_d}{2}\frac{\left(i^d\right)^2}{y} = 0.005\%,$$

respectively, which are small numbers indeed.[21]

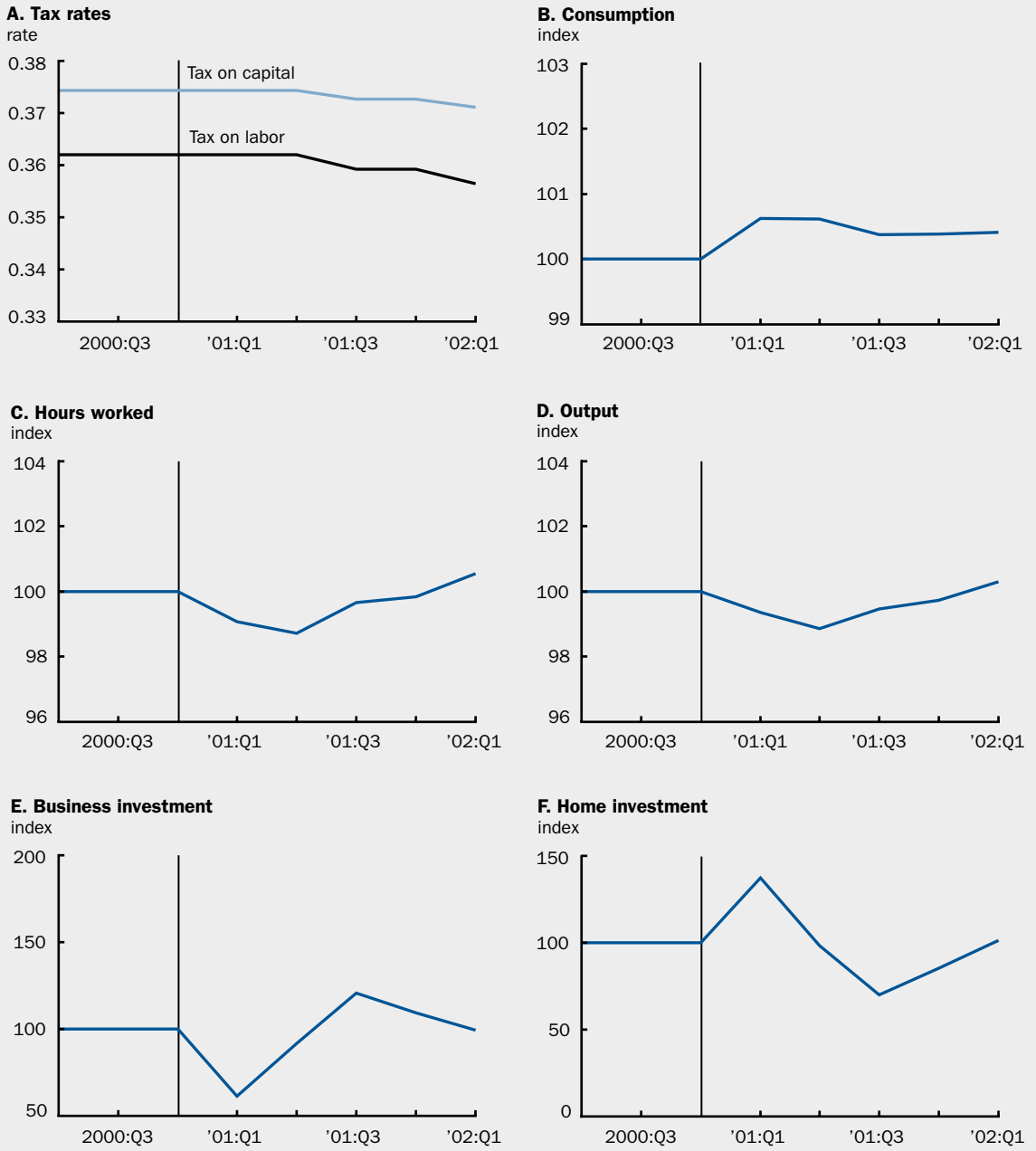
Figure 5 reproduces the experiment that we performed in the previous section to measure the effects of EGTRRA, but subject to the small adjustment costs described here. We see that the behavior of the model economy resembles the broad features described in figure 4, but without the large swings in the investment components.[22] We conclude that the model with adjustment costs broadly reproduces some of the activity patterns observed during the 2001 recession. During the first year after the initial steady state, the model economy goes into a recession with low levels of hours worked, output, and business investment (panels C, D, and E) but with relatively strong consumption and home investment (panels B and F). The recovery starting in the second half of 2001 seems to be too strong, though. However, this is not surprising, since the model abstracts from important subsequent shocks to the economy, such as the Enron accounting scandal and September 11 terrorist attacks, and the cyclical propagation of earlier shocks, such as the high-tech bust and the associated stock market decline of 2000.

The 2008 presidential election

So far we have focused on the effects of anticipated tax cuts following the 2000 presidential election. In this section, we consider the mirror image: the aftermath of the 2008 presidential election. During the 2008 presidential campaigns, the Republican candidate, John McCain, promised to make permanent the tax cuts that were implemented by the George W. Bush administration. Contrary to that campaign proposal, the Democratic candidate, Barack Obama, made it clear that, at least for high-income

FIGURE 4

Effects of EGTRRA



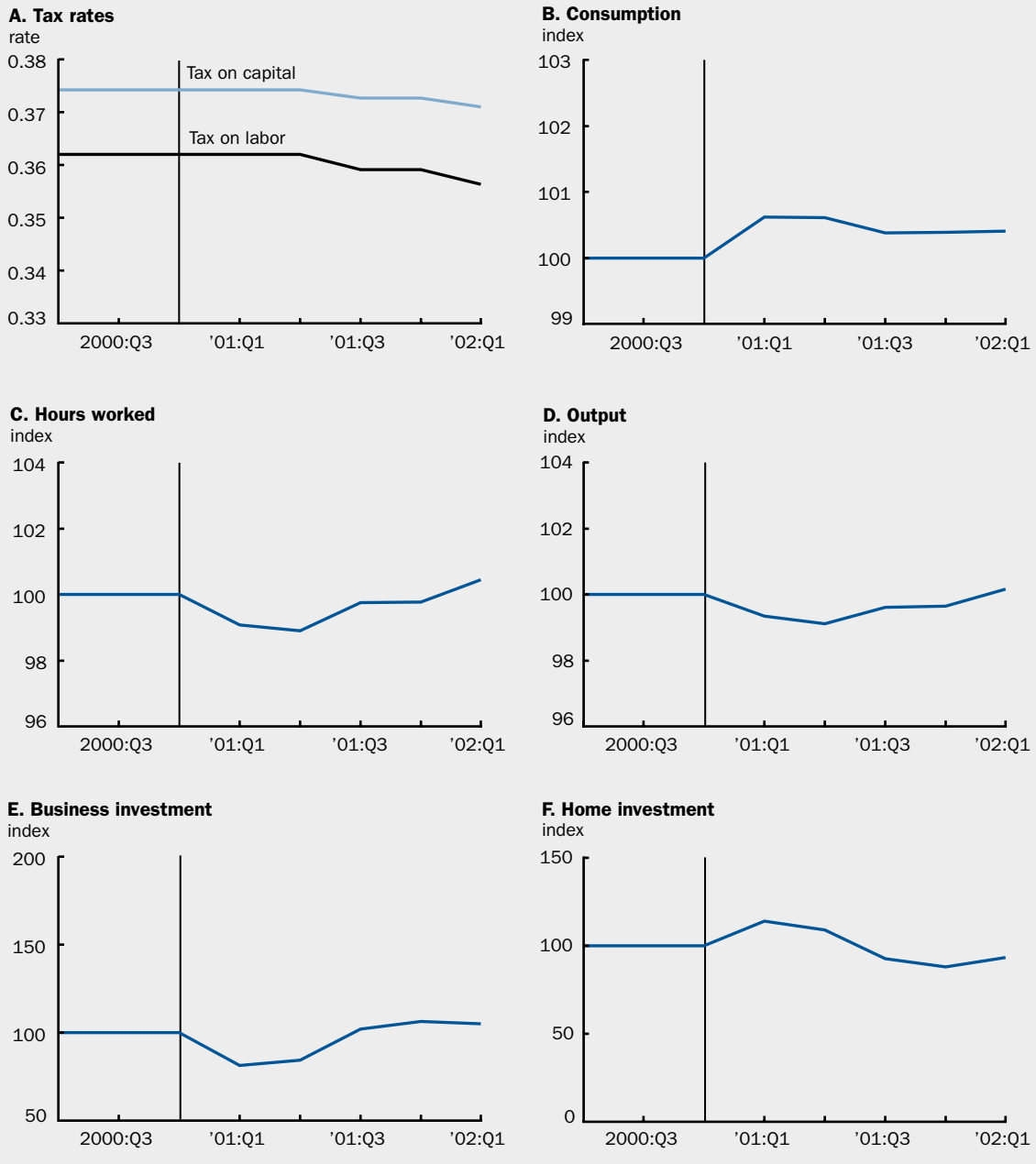
Notes: EGTRRA means the Economic Growth and Tax Relief Reconciliation Act of 2001. Panels B through F are normalized (indexed) to 100 at 2000:Q4.

individuals, he would let those tax cuts expire with the existing "sunset" provision. With Barack Obama winning the presidency in 2008 and his party retaining control of Congress, economic agents are likely to have concluded that tax rates would partly revert in 2011 to their pre-EGTRRA levels.

In what follows, we illustrate the effects of this type of *anticipated tax increase*. Since it is extremely difficult to determine what tax increases might eventually be implemented and what impact they might have on effective marginal tax rates, we make an extremely simplistic assumption: That all tax rates will

FIGURE 5

Effects of EGTRRA with adjustment costs



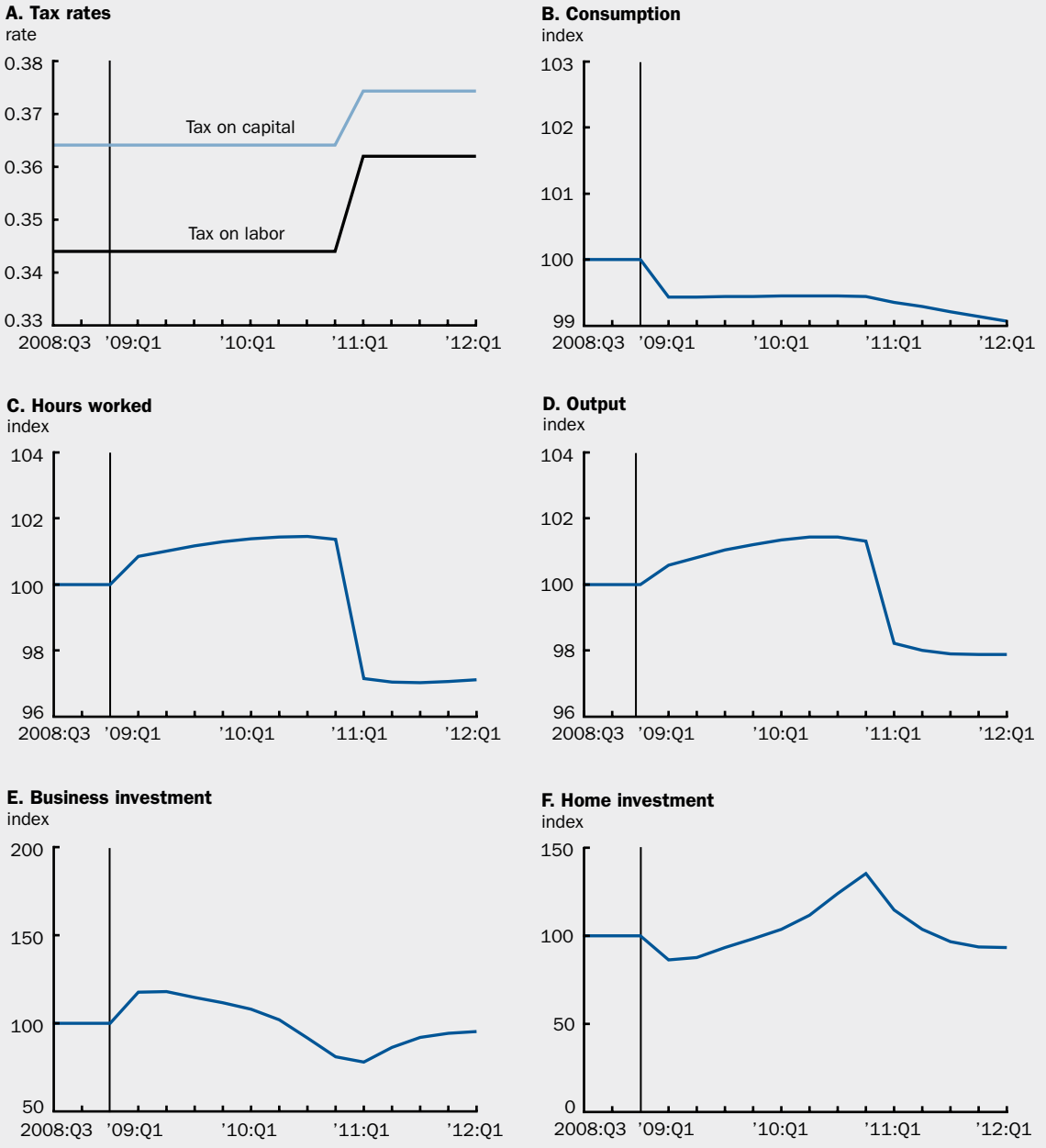
Notes: EGTRRA means the Economic Growth and Tax Relief Reconciliation Act of 2001. Panels B through F are normalized (indexed) to 100 at 2000:Q4.

revert to their pre-EGTRRA levels by 2011 and that all economic agents believe that this will be the case. While this is a highly unrealistic assumption, it will suffice for our illustrational purposes.

Specifically, we assume that in 2008:Q4 the economy was at the steady state corresponding to the low marginal tax rate on capital (τ^k) of 36.41 percent and on labor (τ^n) of 34.40 percent introduced by the George W. Bush administration (see fourth row of panel C in table 1, p. 21). We also assume that in 2009:Q1 economic agents find out that marginal tax rates on capital (τ^k) and labor (τ^n) will be permanently increased to their

FIGURE 6

Effects of reverting to pre-EGTRRA tax rates



Notes: EGTRRA means the Economic Growth and Tax Relief Reconciliation Act of 2001. Panels B through F are normalized (indexed) to 100 at 2008:Q4.

pre-EGTRRA levels of 37.43 percent and 36.20 percent, respectively, starting in 2011:Q1. For comparability, we introduce the same adjustment costs considered in the previous section.

Figure 6 presents the results. We see that during 2009 and 2010 the model economy experiences a marked boost in economic activity, with hours worked and output increasing monotonically over time (panels C and D). Business investment (panel E) is strong during 2009 but weak during 2010. The opposite is true for home investment (panel F). Consumption (panel B) drops immediately because economic agents feel poorer from the higher expected tax rates. The reason for the early economic boom is that agents realize that the period before the tax

increase is relatively attractive for working and investing. Once the tax increase takes place in 2011:Q1, there is a sharp drop in hours worked and output.

So, according to the model, the current recession would have been even worse in terms of hours worked and output had there not been expectations of future tax increases. However, these expectations might be contributing to the weakness in consumption and residential investment that we currently see. The model expects a further downward influence on economic activity in 2011 once tax rates are increased.

Conclusion

In this article, we used a stylized model economy to investigate the hypothesis that some of the unusual features of the 2001 recession may have been influenced by the tax cuts promised during the 2000 presidential campaigns. We found that the model is consistent with this hypothesis: In the model economy, anticipated tax cuts generate a mild recession with relatively strong consumption and home investment, but with weak hours worked and business investment. Because the 2008 presidential election also had a significant impact on future tax rates, but in reverse, we also used our model to illustrate the possible effects on the economy of anticipated future tax increases. Both of these applications illustrate a more basic result in economic theory: That anticipated future changes in economic policy might have large effects on current economic activity.

NOTES

[1]The argument that expected tax cuts one year down the road decrease investment during the current year is based on the assumption that investment affects the stock of capital rather quickly (say, within one quarter). If there were long gestation lags in building capital, anticipated tax cuts in one year may actually increase investment during the current year. The assumption that capital is quickly built will be maintained throughout this article.

[2]See www.nber.org/cycles/november2001/.

[3]The NBER looks at more than gross domestic product (GDP) in determining when a recession starts, so that the timing can differ from that of declines in GDP. According to revised estimates, the annualized growth rates in GDP were +2.1 percent, –0.5 percent, +1.2 percent, and –1.4 percent in 2000:Q4, 2001:Q1, 2001:Q2, and 2001:Q3, respectively. However, at the time that the NBER declared that the recession had started, these numbers were +1.9 percent, +1.3 percent, +0.3 percent, and –0.4 percent, respectively.

[4]See www.nber.org/cycles/july2003.html.

[5]The six previous recessions had occurred in 1960–61, 1969–70, 1973–75, 1980, 1981–82, and 1990–91, according to the National Bureau of Economic Research.

[6]The source of all data unless otherwise specified is the U.S. Bureau of Economic Analysis's *National Income and Product Accounts of the United States* (NIPAs) from Haver Analytics.

[7]The deterministic trends are determined by regressing the log of the different variables against time.

[8]Output started to decline a few quarters before the start of the 2001 recession, as it did before some previous recessions. However, once the 2001 recession started, output did not fall as much as during the average recession.

[9]Prior to the campaigns, two pieces of legislation defined the existing tax structure: the Omnibus Budget Reconciliation Act of 1993 and the Taxpayer Relief Act of 1997. While the latter only had effects on capital gains taxes, the former created the 36 percent and 39.6 percent income tax brackets and set the statutory rates at the levels seen in table 1, panel A (p. 21).

[10]Bush (2001).

[11]According to House and Shapiro (2006), only households with taxable income below $12,000 actually experienced any reduction in their marginal tax rate as a result of the new 10 percent bracket. Though this change can be expected to have had large effects on average tax liabilities, marginal rates remained relatively unaffected.

[12]The CBO simulated income tax liability for each return in a sample of all tax returns filed in the United States. The analysis then calculated marginal tax rates by adding $1,000 to the earnings on each return and recomputing the amount of income tax owed. The difference between the two tax liabilities, divided by $1,000, equals the effective marginal tax rate.

[13]Our effective marginal tax rates on capital are roughly twice as large as the CBO's estimates, since our notion of capital does not include residential structures, while the CBO's does. See the appendix for a brief discussion regarding the treatment of housing capital.

[14]Among other things, this implicitly assumes that the AMT is changing in a similar way.

[15]By allowing for lump-sum taxes, the optimal tax system is to set the capital and labor income taxes to zero and rely exclusively on lump-sum taxes. However, the focus of our analysis is not on optimal taxation but on the effects of actual tax rates.

[16]Although the 2000 election outcome may have had implications for prospective government expenditures, we abstract from these.

[17]Observe that we are assuming that government expenditures are unproductive. However, this could be modified without altering the analysis by assuming that government expenditures enter the utility function in a separable way.

[18]Observe that there is no rental market for home capital: All home capital is directly owned by the household sector. This is a limitation of the model economy. In practice, a significant fraction of residential structures are rented, and the income generated is subject to taxes. Another limitation of the model is that the stock of home capital is not taxed at all, although in the U.S. economy, housing is subject to property taxes.

[19]Since ours is a closed economy, the measure of output that we use is GDP minus net exports.

[20]The implied Frisch elasticity of labor supply is equal to 2.7. This is somewhat lower than the Frisch elasticity of labor supply used by Prescott (2004) in his cross-country analysis of labor income taxes but much higher than econometric estimates based on microeconomic data. However, recent research has shown that the large elasticity of labor supply used by the macro literature can be reconciled with the micro evidence through heterogeneity in labor supply (for example, Chang and Kim, 2006; Rogerson and Wallenius, 2009; and Gourio and Noual, 2007).

[21]We make no claim that these adjustment costs are empirically plausible. However, they improve the model's performance quite significantly.

[22]The investment measures reported in figure 5 (p. 29) include the adjustment costs. However, in practice this does not matter because the adjustment costs are extremely small.

APPENDIX: CALIBRATION OF THE TAX RATE ON CAPITAL (τ^k)

When the Congressional Budget Office (2001) estimates the effects of EGTRRA on effective marginal tax rates for labor and capital income, it includes residential structures in its notion of capital. Because owner-occupants of residential structures "exclude their implicit gross receipts (i.e., the rental value of the home) from taxable income ... [and may] deduct mortgage interest and property tax payments if they itemize their deductions," the CBO concluded that owner-occupied housing capital is *subsidized* (Congressional Budget Office, 2005). Since this subsidy is not given to tenant-occupied housing capital, the CBO concluded that this form of capital is *taxed*. Using the CBO's estimates of the effective tax rates on both tenant-occupied (18.2 percent) and owner-occupied (–5.1 percent) housing capital income, as well as the proportion of each type of capital in total housing capital, we obtain that the "housing capital income tax rate" $\tilde{\tau}^h$ is given as follows:[1]

$$\begin{aligned}\tilde{\tau}^h &= (\%\ \text{Tenant-occupied housing}) \times (0.182) \\ &\quad + (\%\ \text{Owner-occupied housing}) \times (-0.051) \\ &= (0.20) \times (0.182) + (0.80) \times (-0.051) \\ &= -0.0044 \cong 0.\end{aligned}$$

Since the services from consumer durables are not taxed and $\tilde{\tau}^h \cong 0$, we have that the effective marginal tax rate on capital income estimated by the CBO is equal to:

$$\tau^k_{CBO} = \frac{k}{k+d} \times \tau^k + \frac{d}{k+d} \times 0,$$

where k represents business capital and d represents home capital.

Using the average ratio $(k + d) / k$ over the period 1998–2003, we have that the tax rate on business capital income is then given by:

$$\begin{aligned}\tau^k &\cong \tau^k_{CBO} \times \left(\frac{k+d}{d}\right) \\ &\cong (0.182) \times (2.0456) \\ &\cong 0.3743.\end{aligned}$$

[1]The fractions of each type of housing capital are obtained from Congressional Budget Office (2005), p. 19, table A-1.

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