Government Consumption, Taxation, and Economic Activity

by Charles T. Carlstrom and Jagadeesh Gokhale

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Introduction

The size of government consumption relative to gross national product (GNP) has grown steadily in Europe and North America over most of the post–World War II period. In real terms, government expenditure in the United States has grown at nearly 4 percent annually over the last four and a half decades. As a percentage of GNP, it rose from approximately 13.7 percent in 1946 to 22.1 percent in 1989.[1]

Until recently, most of the increases in U.S. government spending have been financed through higher taxation (see Meltzer and Richard [1981]). What are the likely effects of such increases on output?[2] How would they differ if deficit financing were used? Our analysis seeks answers to these questions.

Although most increases in government expenditure over the past 45 years have been permanent, there have been a few notable exceptions when government consumption rose temporarily and then came back down to its trend level. These periods have typically been war years, with the World War II and Korean War eras being the most obvious examples. The effects on output of financing such temporary increases depend on whether deficit financing is used, and these effects can be quite different from those arising as a result of a permanent expansion in government spending.

It should be mentioned that increased levels of government spending can affect output directly by altering the conditions of production through the provision of infrastructural inputs. We do not analyze the effects of larger government expenditure on output due to improved productivity of inputs.[3] We also do not aim to provide an explanation for the growth in government expenditure, or to determine the optimal size of government.[4]

■ 1 It should be noted that growth in the share of government expenditure on goods and services in the post–World War II period is mostly due to growth in state and local expenditures. Federal spending as a share of GNP fell in the 1970s, from 10 percent to 8 percent, and remained around 8 percent in the 1980s. Our analysis deals with total federal, state, and local government expenditures on purchases of goods and services.

■ 2 We abstract from the question of whether permanent increases in government expenditure per se are good for the economy.

■ 3 Aschauer (1989) estimates that the public investment component of government expenditure has a positive and significant effect on the level of output.

■ 4 Meltzer and Richard (1981) develop a theory of the size of government.

Neither do we try to explain any particular episode in the United States.

Instead, our analysis is limited to tracing the causal links among higher government expenditure, tax policy, and the level of output. The reason is that increases in government spending — and the timing of taxation enacted to finance them — affect private incentives to work and save over time. Consequently, such increases affect the level of output, interest rates, and other economic variables. We also present some illustrative simulations of the effects of permanent and temporary increases in expenditure with and without deficit financing in a stylized model of the economy.

To conduct the analysis, we use the overlapping generations model developed by Auerbach and Kotlikoff (A-K) (1987), which is calibrated with parameter estimates from various studies based on U.S. data.[5] We present a brief description of this model in section I. Section II discusses the effects of permanent increases in government expenditure. Our simulations show that with no deficit financing, a permanent rise in government consumption leads to lower long-run output. For an increase in expenditure of the magnitude of 4 percent per year, output declines by about 2 percent. With deficit financing, output is higher in the short run, but declines considerably in the long run. Section III deals with the case of temporary increases. There are no long-run effects on output if balanced-budget financing is used. However, short-run effects on output are sensitive to financing considerations. Section IV concludes the paper.

I. The A-K Model

Most studies that have investigated the effects of permanent and temporary changes in government expenditure have used an infinite-horizon representative-agent framework. All agents are assumed to be identical and to live forever. These models typically assume that government revenues are raised by lump-sum taxes that are nondistortionary.[6] These two assumptions imply that the Ricardian equivalence theorem (RET) will be true. This theorem states that the timing of taxes will not matter for private consumption and leisure decisions, because if government expenditures are financed through a deficit rather than by current taxes, the infinitely lived agents will anticipate the future tax liabilities implied by the requirement that the government's intertemporal budget must be balanced. Both output and interest rates will be the same under either of these two financing arrangements.

Under the representative-agent framework, both permanent and temporary increases in government expenditure boost output. A permanent rise in government spending increases output because higher (lump-sum) taxes have a negative income effect that leads individuals to reduce leisure and thus to work harder. Temporary increases also lead to higher interest rates and output. If taxes are raised concurrently with greater government expenditure, they will be higher today than in the future. Individuals' attempts to smooth consumption over time will induce them to save less (or borrow more), causing interest rates to rise. The higher interest rates will induce greater work effort today because of the intertemporal substitution effect.

In this paper, we adopt the A-K overlapping generations model, where individuals in each generation are concerned about their own welfare but not about that of their offspring. This implies that RET will not hold, because if taxes are increased in the future, rather than contemporaneously, some generations will escape the burden of higher taxation. Thus, deficit-financed increases in government expenditure will have different effects compared to those arising from balanced-budget increases. Empirical studies have not yet resolved the debate about the validity of RET.[7]

We also assume that government revenue is generated by income taxation rather than through lump-sum taxation. Unlike lump-sum taxes, income taxes distort the labor–leisure choice by driving a wedge between before- and after-tax wage rates. Income taxes also distort the consumption–saving decision by introducing a gap between before- and after-tax interest rates. Using income taxation rather than lump-sum taxation is largely responsible for the difference in our results compared to those derived from representative-agent models.

The A-K model incorporates perfect foresight on the part of individuals except with regard to the policy change, which is assumed to be unanticipated. The alternative would be to use a model with "myopia," where individuals behave as if economic conditions did not change from period to period. Under the latter assumption, however, it would be difficult to separate the effects of

5 See Wynne (1990) for an example of a representative-agent model used to explain output and interest-rate changes in the United States arising from increased government expenditure during World War II.

6 See, for example, Baxter and King (1990) and Aiyagari, Christiano, and Eichenbaum (1990).

7 A critical evaluation of the theory and evidence on RET is contained in Bernheim (1987).

irrational household behavior from those of the policy change itself. Although perfect foresight is an extreme assumption, it provides a useful benchmark for analysis.

In the A-K model, each cohort is identical, except for size differences due to population growth. Each generation is $1 + n$ times larger than its predecessor, and each has an economic life span of 55 years. The annual utility function is assumed to take a constant elasticity of substitution form given by

$$(1) \quad u_t = [c_t^{(1-\frac{1}{\rho})} + \alpha l_t^{(1-\frac{1}{\rho})}]^{\frac{1}{(1-\frac{1}{\rho})}} + v(G_t).$$

Here, the parameter ρ is the within-period elasticity of substitution between consumption and leisure, and is the intensity of preference for leisure relative to consumption. Government consumption in period t is represented by G_t, which is exogenous and enters separably in the utility function. This implies that the size of government consumption does not affect the marginal utilities of private consumption and leisure. Some evidence suggests that this assumption may not be completely justified.[8] If we assume that government expenditures are perfect substitutes for private consumption and that taxes are lump-sum, then increases in government expenditure, whether permanent or temporary, will have no effect on either output or interest rates. Thus, the assumption that government expenditure enters separably in the utility function will overstate the effect on output.

Individuals choose consumption and leisure for each period to maximize lifetime utility given by

$$(2) \quad U = \frac{1}{(1-\frac{1}{\gamma})} \sum_{t=1}^{55} (1+\delta)^{-(t-1)} u_t^{(1-\frac{1}{\gamma})},$$

where t indicates cohort age. The parameter γ is the intertemporal elasticity of substitution, and δ is the pure rate of time preference.

Households maximize utility (equation [2]) subject to a period-by-period budget constraint. The time s budget constraint for individuals aged t is given by

$$(3) \quad a_{s,t} - a_{s-1,t-1}[1 + r_s(1-\tau_s)] - w_s e_t(1-\tau_s) + c_{s,t} \geq 0.$$

8 Kormendi (1983) and Aschauer (1985) estimate that an extra unit of government consumption, all else equal, reduces private consumption by between 0.2 and 0.4 units.

Here, r_s refers to the before-tax rate of interest, τ_s refers to the income tax rate applied in period s, and $a_{s,t}$ refers to the nonhuman wealth held in period s by an individual aged t. The pre-tax wage rate at time s is given by w_s, and the variable e_t is an exogenous productivity parameter for an individual in the t^{th} period of life.

Output in the model is produced by competitive firms that combine capital (K) and labor (L) using a constant-returns-to-scale production technology. The production function is given by

$$(4) \quad Y_s = K_s^{\theta} L_s^{1-\theta}.$$

Y_s stands for output in period s, and θ is capital's share in production. Note that this functional form implies that government purchases of goods and services do not enter as inputs into the production function. This amounts to ignoring government investment in public services and infrastructure, which could have positive effects on the productivity of private capital and labor, as well as on the level of total output. Aggregate capital and labor supplies are determined from individuals' asset holding and leisure supply decisions:

$$(5) \quad K_s = (1+n)^{(s-1)} \sum_{t=1}^{55} \frac{a_{t,s-1}}{(1+n)^{t-55}}$$

and

$$(6) \quad L_s = (1+n)^{s} \sum_{t=1}^{55} \frac{e_t(1-l_{s,t})}{(1+n)^{t-55}}.$$

Equations (5) and (6) represent the capital and labor-market-clearing conditions, where $l_{s,t}$ stands for the leisure of an individual aged t at time s.

Under the assumption of competitive markets, the pre-tax real wage and interest rates are given by

$$(7) \quad w_s = (1-\theta)(K_s/L_s)^{\theta}$$

and

$$(8) \quad r_s = \theta (K_s/L_s)^{\theta-1}.$$

We complete our description of the model with the goods-market-clearing condition

$$(9) \quad Y_s = C_s + G_s + K_{s+1} - K_s,$$

where

$$(10)\quad C_s = (1+n)^s \sum_{t=1}^{55} \frac{c_{s,t}}{(1+n)^{t-55}}.$$

Equations (8) and (9) assume that the depreciation rate on physical capital is zero.

To solve the model, one must choose values for the model's parameters. Auerbach and Kotlikoff parameterize the model based on findings of various empirical studies. Although we have retained their choice of parameters in the simulations presented here, we do not examine the sensitivity of the results to parametric variation. However, tests of parametric sensitivity in the A-K study indicate that the results are likely to be fairly robust. In any event, the primary purpose of this paper is to examine the qualitative nature of the effects of the policy changes considered.

The parameter ρ in equation (1), which determines how an individual's annual labor supply responds to a change in the wage rate, is set to 0.8.[9] The intertemporal elasticity of substitution, γ, is set to 0.25 based on various estimates.[10] The pure rate of time preference, δ, is set to 0.015. This implies an annual real interest rate of 6.9 percent per year, which is slightly less than the estimated marginal productivity of capital.[11] The leisure preference parameter, α, is set to 1.5; it is chosen so that individuals in the middle of their working lives work approximately 40 percent of their nonsleeping hours. The parameter estimates lie within the ranges estimated in various empirical studies using U.S. data.

The parameter θ in the production function, which determines the share of capital in production, is set to 0.25, approximating the historical share of capital. The constancy of this measure over time suggests the use of a Cobb–Douglas production function. The effects on output due to increased government expenditure will be sensitive to the age-specific productivity profile that is assumed. Rather than assume a flat age-productivity profile, we assume an inverted U-shaped profile. That is, productivity rises and reaches a maximum at about the twenty-fifth year of an individual's working life, and declines thereafter. The variable e_t represents the productivity of an individual aged t and is based on estimates obtained by Welch (1979). The equation used in the following simulations is

$$(11)\quad e_t = 4.47 + 0.033t - 0.00067t^2.$$

The solution to the model is obtained by finding the wage and interest rates, so that labor and capital markets clear in every period, s.

First, we solve the model for the initial steady state, that is, before any policy changes are introduced. It is assumed that in this steady state, the government consumes 15 percent of output and levies a 15 percent proportional income tax to finance it. We selected this rate for our experiments to mimic the level of government expenditure that has prevailed over the post–World War II period. This implies that the government's budget is initially balanced. After a policy change is undertaken, we solve the model for 150 years into the future. This is sufficient to ensure that the model's economy converges to the final steady state after each policy change. Policy changes are assumed to be unanticipated.

II. Permanent Increases in Government Expenditure

Balanced-Budget Increases

In the first simulation, government expenditure is increased permanently by 5 percent of initial steady-state output. Because government consumption was 15 percent of output in the initial steady state, this represents a 33 percent rise, which is financed by a balanced-budget increase in income taxes. Thus, the government's budget is balanced both before and after the upturn in government expenditure.

In the short run, higher income tax rates reduce after-tax wage and interest incomes. These reductions have an income effect on individuals' consumption and labor supply. The decline in after-tax income leads to lower consumption and longer hours worked. However, there are also substitution effects. A lower after-tax wage rate implies that leisure is cheaper and induces individuals to work fewer hours. The reduction in the after-tax interest rate has an intertemporal substitution effect leading to reduced saving and lower labor supply. Because people work in order to consume both today and tomorrow, the lower after-tax interest rate reduces the incentive to work

■ 9 Ghez and Becker (1975), for example, estimate the value of ρ to be 0.83.

■ 10 See, for example, Grossman and Shiller (1981), who estimate γ to lie between 0.07 and 0.35.

■ 11 We estimate that the average rate of return on capital was about 9 percent per year over the past decade.

for greater future consumption. The results show that substitution effects dominate income effects in the short run (see figure 1). Labor falls by 0.5 percent, and saving declines to 1.8 percent, from 3.7 percent of output in the first period. The reduction in hours worked leads to a decline in output of 0.4 percent.

The lower saving rate causes the capital stock to fall in the subsequent period. A lower capital stock increases the marginal productivity of capital, and hence the before-tax interest rate. This helps to mitigate the intertemporal substitution effects, causing the saving rate and hours worked to expand gradually from their new lower levels. As the charts in figure 1 show, the saving rate in the long-run steady state is somewhat lower than in the initial one.

After year six, individuals work longer hours than they did before government expenditure began to rise. The reduction in substitution effects causes income effects to dominate eventually; in the long run, labor supply is higher by 1.1 percent. Output, however, is lower due to the decrease in the capital stock. The charts show that the convergence to the new steady state is gradual. The new steady-state capital stock is reduced by 7.7 percent, and output by 1.2 percent. Private consumption is 7.3 percent lower than it was before government spending rose.

Increases in government expenditure cause output to decline because an income tax is distortionary. That is, the higher taxes distort the labor–leisure and savings decisions of individuals. Baxter and King (1990) show that in a representative-agent model with lump-sum (nondistortionary) taxes, permanent increases in government expenditure actually cause output to be higher. No within-period substitution effect is associated with lump-sum taxes. Higher lump-sum taxes, however, reduce lifetime resources, and individuals optimally choose lower levels of consumption and leisure, so that employment and output are higher. It should be emphasized that increased output does not imply that people are better off. This depends on how much individuals on the margin value private consumption and leisure compared to public consumption.

Deficit-Financed Increases

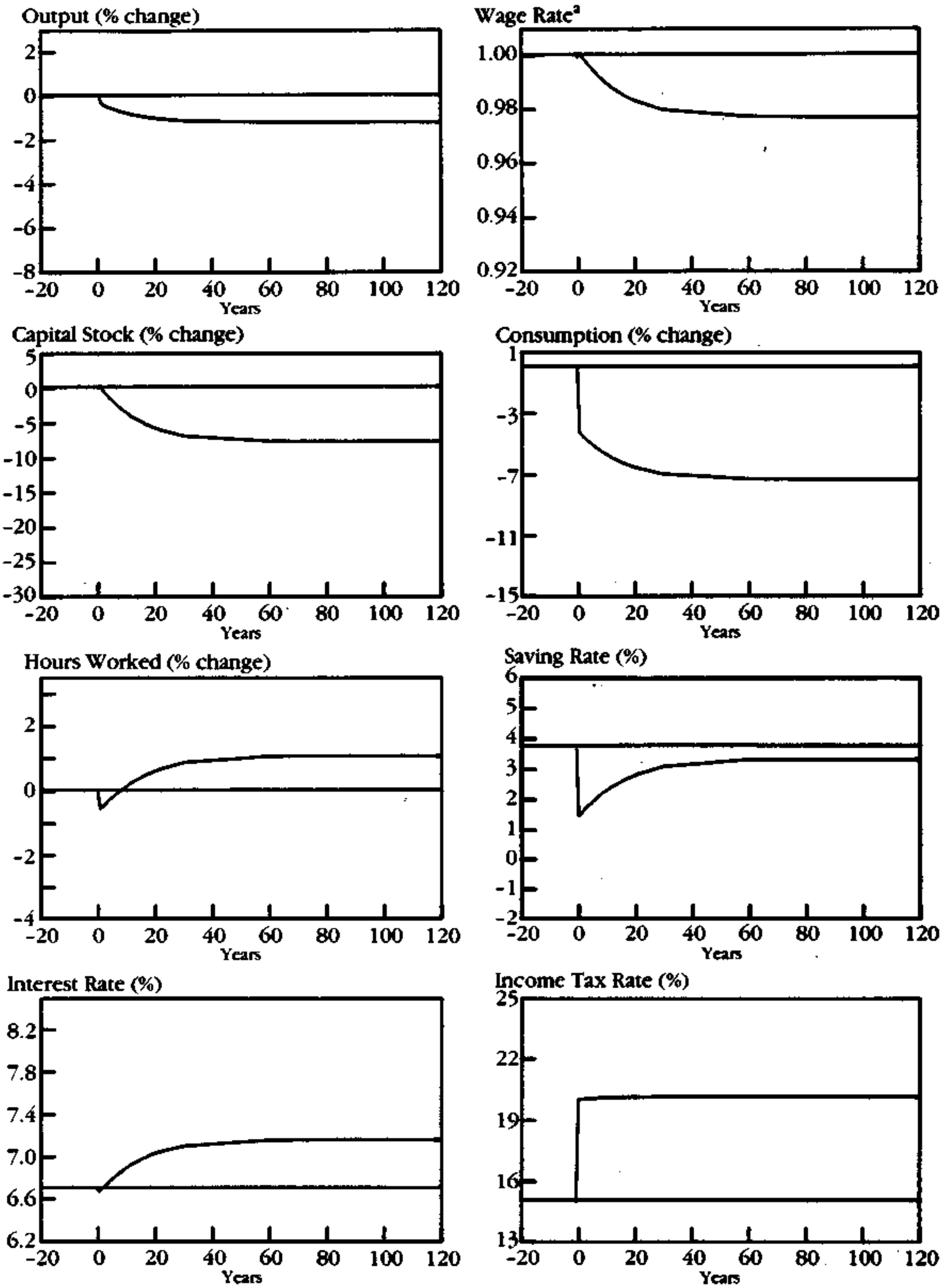
The next simulation shows the effects of an identical increase in government expenditure that is deficit financed. Deficit financing is used for the first 10 years, after which taxes are increased by enough to cover both greater spending and the interest on the government's debt. This time profile of taxation results in intertemporal substitution effects. Lower taxes today compared to tomorrow induce individuals facing higher future taxes to work more today and less tomorrow. Figure 2 shows that labor supply rises by 2.7 percent in the first period. It also causes the younger generations to consume less today in order to save for consumption tomorrow. Aggregate private consumption falls by 2 percent initially, but this is not enough to offset the increase in government consumption. Thus, the economy's saving rate falls from 3.7 percent to 2.3 percent. Furthermore, given the initial stock of capital, the higher labor supply in the short run causes a small rise in the interest rate, from 6.7 percent to 6.8 percent. Higher labor supply also causes output to jump by 2 percent in the first year after the policy change.

A further effect arises from the intergenerational redistribution of resources caused by deficit financing. Since taxes do not increase at all for the first 10 years, some initial older generations escape the burden of higher future taxes. Their lifetime resources expand because of the higher interest rates during this period. This induces greater consumption on the part of the older generations, which helps to explain why the decline in total private consumption is insufficient to offset the increase in government consumption.

When taxes increase after year 10, the intertemporal substitution effects are reversed. Labor supply contracts sharply. This, along with the continual decline in the capital stock, causes output to fall. The interest rate drops dramatically, reflecting the increase in the capital–labor ratio in period 11. It continues to rise thereafter, however, reflecting the increasing marginal productivity of capital, as the capital stock continues to shrink while hours worked expand. In the new long-run steady state, the capital stock is lower by 25.2 percent, and output is reduced by 7.3 percent. This crowding-out effect is much larger than the effect of the balanced-budget increase in government expenditure considered earlier. It reflects the greater distortionary effect of the higher tax rates under deficit financing that are imposed on young and future generations to pay for the redistribution toward the initial older generations.

FIGURE 1

The Effects of Permanent Balanced-Budget Increases in Government Consumption



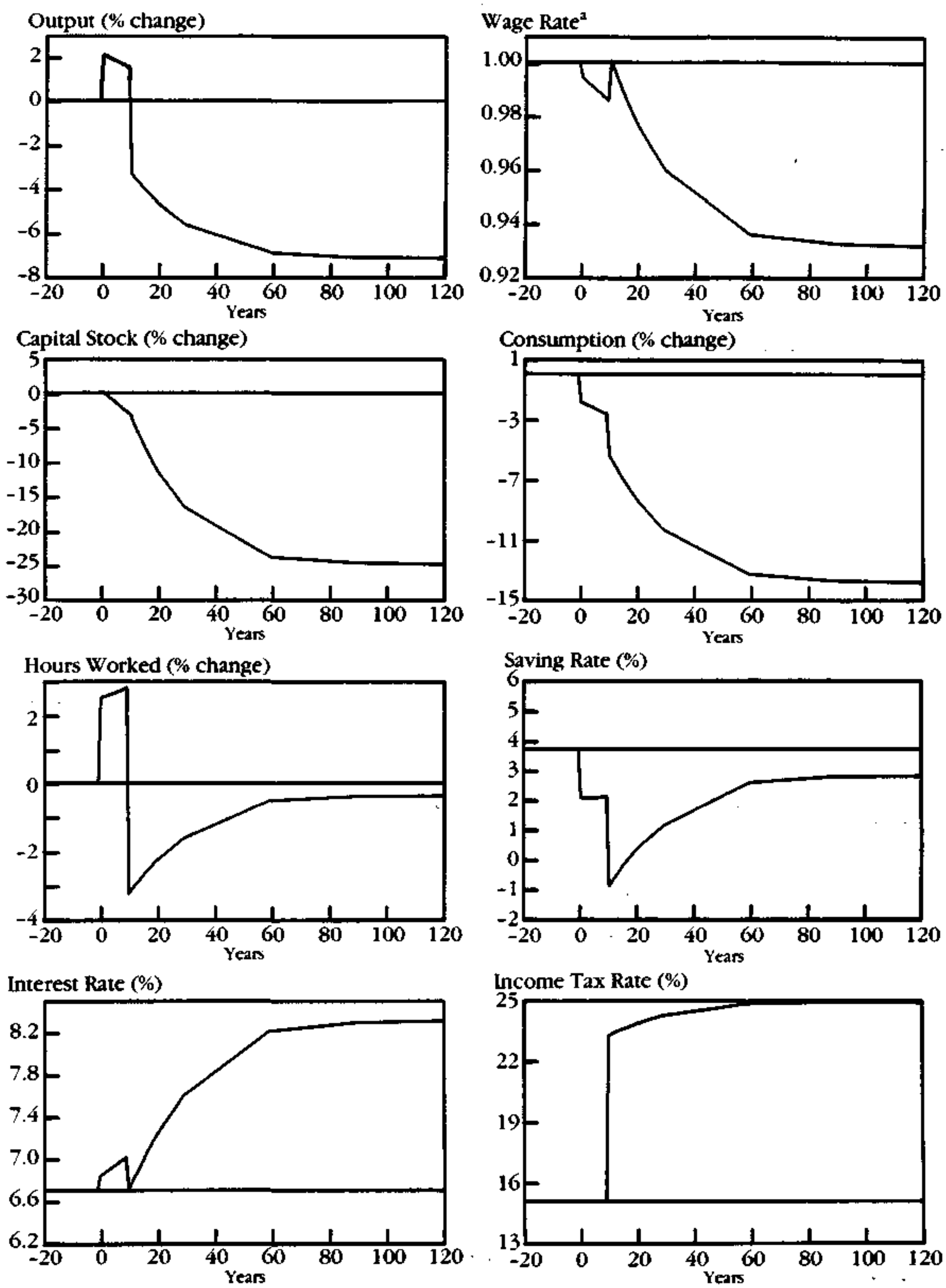
a. The wage rate in the initial steady state is normalized to unity.

NOTE: Horizontal lines represent values in the initial steady state. Percent changes are calculated from the initial steady state.

SOURCE: Authors' calculations.

FIGURE 2

The Effects of Permanent Deficit-Financed Increases in Government Consumption



a. The wage rate in the initial steady state is normalized to unity.
NOTE: Horizontal lines represent values in the initial steady state. Percent changes are calculated from the initial steady state.
SOURCE: Authors' calculations.

III. Temporary Increases in Government Expenditure

Balanced-Budget Increases

The next set of simulations examines the effects of a five-year increase in government expenditure financed by a contemporaneous increase in taxes. One can think of these experiments as being caused by a five-year war, during which taxes are raised to pay for military operations. In the long run, years after the war ends, all variables return to the values they held prior to the expansion of government spending. The reason is that tax rates and the share of government expenditure in output are both identical to their pre-war levels.

The charts in figure 3 show the effects of these policies on capital, labor, and output. Taxes are higher during the war years. Substitution effects dominate income effects, since a five-year tax increase does not reduce lifetime income by much. Because of the intertemporal substitution effect, people choose to work less during the war years when taxes are high, and to work more in later periods when taxes are lower. Labor supply is also reduced due to the within-period substitution effect that operates on the labor–leisure choice.

Labor supply falls by 2.6 percent, causing output to decline 2.0 percent in the first period of the five-year war. Because capital is fixed at the initial steady-state level in the first year, the large negative effect on output in the first period is solely due to the substitution effects on labor supply.

If government expenditure were high for only one year (instead of five), labor supply would fall by 4.0 percent (versus 2.6 percent for the five-year war). The larger decline in labor supply is due to the stronger intertemporal substitution effect in the case of a one-year war. There are two reasons for this. First, unlike the five-year case, lower labor supply during periods of high taxation cannot be spread over time in the one-year case. Second, a greater number of generations will face lower future taxes in a one-year war than in a five-year war. Hence, the first-period effects on labor supply and thus on output are larger in the one-year war.

Given the desire of individuals to smooth their consumption over time in the face of temporarily higher taxes, saving initially falls from 3.7 percent of output to –0.8 percent of output. Thus, although the income-tax rate rises from 15 percent to 20.4 percent in the first year, consumption falls by only 3.0 percent. The dramatic decline in saving shows up in period two, as capital falls by nearly 1.2 percent. Labor supply, consumption, output, and saving continue to be depressed during the second through the fifth years of the war, when taxes are still high. Thus, the capital stock continues to decline until year six. After the war is over and government expenditure returns to its original level, all variables gradually return to their pre-war levels.

Deficit-Financed Increases

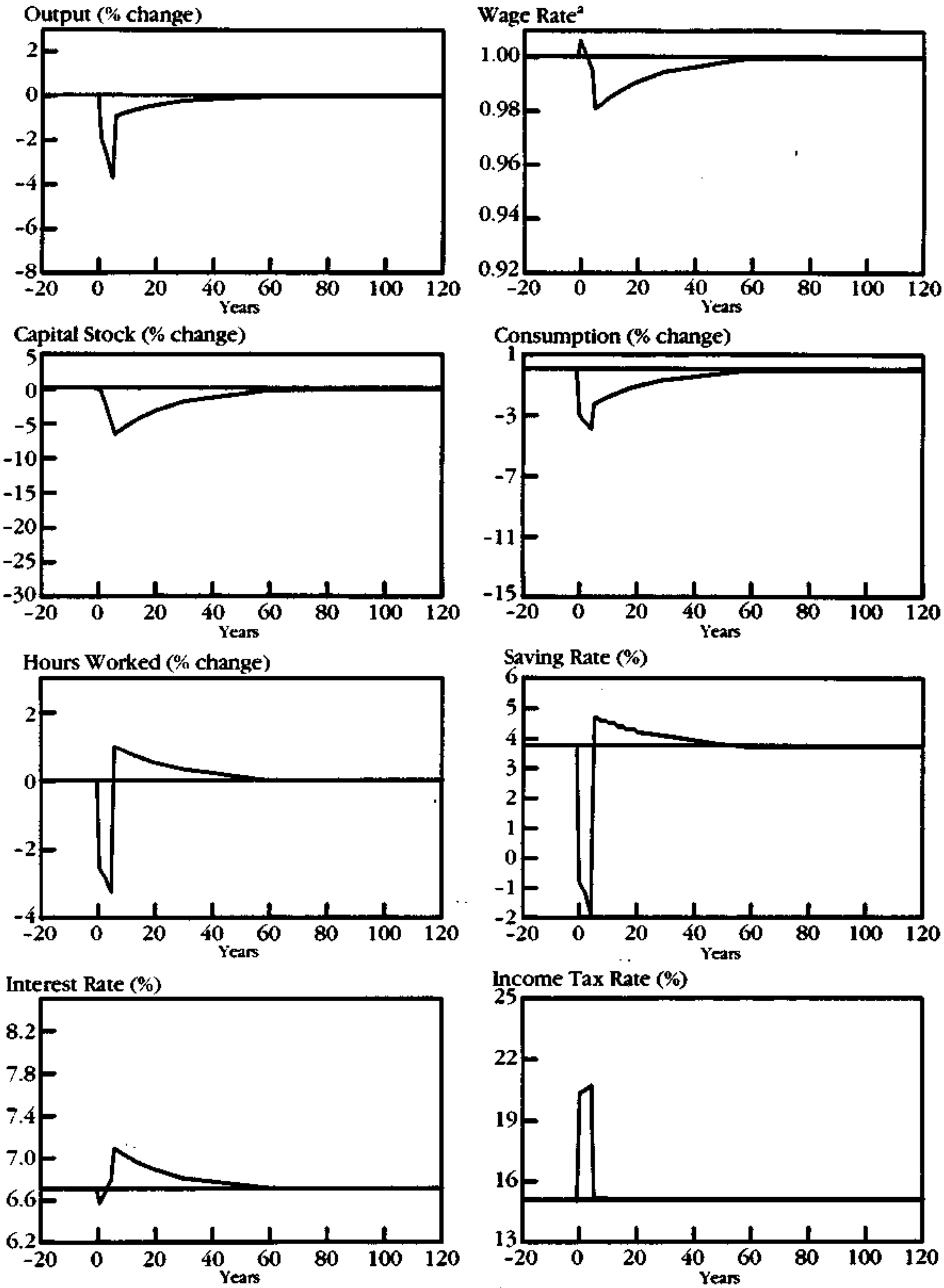
Most temporary increases in government spending are the result of wars, and most wars are deficit financed. That is, taxes are not raised during the war, but only at some time after the war has ended. The final simulation shows the effects of a five-year war when taxes are not increased until the year after the war concludes. Thus, taxes are slightly higher from year six on, rising by just enough to cover the additional interest expense on the war debt.

The charts in figure 4 show the effects that a five-year deficit-financed war can be expected to have on the economy. The tax profile facing private individuals has income and substitution effects, and again, income effects are small and substitution effects dominate. During the war years, taxes are lower than their level in later periods. Hence, individuals choose to work longer hours during the war years and to curtail labor supply in later periods. During the first year of the war, labor supply increases by 1.2 percent. Since capital is fixed during the first period, the higher labor supply causes output to rise by 0.9 percent and leads to a slight increase in the interest rate. Private consumption drops by 0.9 percent as individuals save more for future consumption.

This decrease, however, is insufficient to offset the increase in government consumption. Although private saving rises, aggregate saving is depressed because of the larger decline in government saving (that is, the government saves nothing in the initial steady state and is a net borrower during the war years). This leads to a decline in the capital stock over subsequent years. A lower capital stock, coupled with lower hours worked because of higher taxes, causes output to fall even further. In the long-run steady state, the capital stock is 7.6 percent lower, labor supply is 0.6 percent lower, and output is 2.4 percent lower compared with the initial steady state.

FIGURE 3

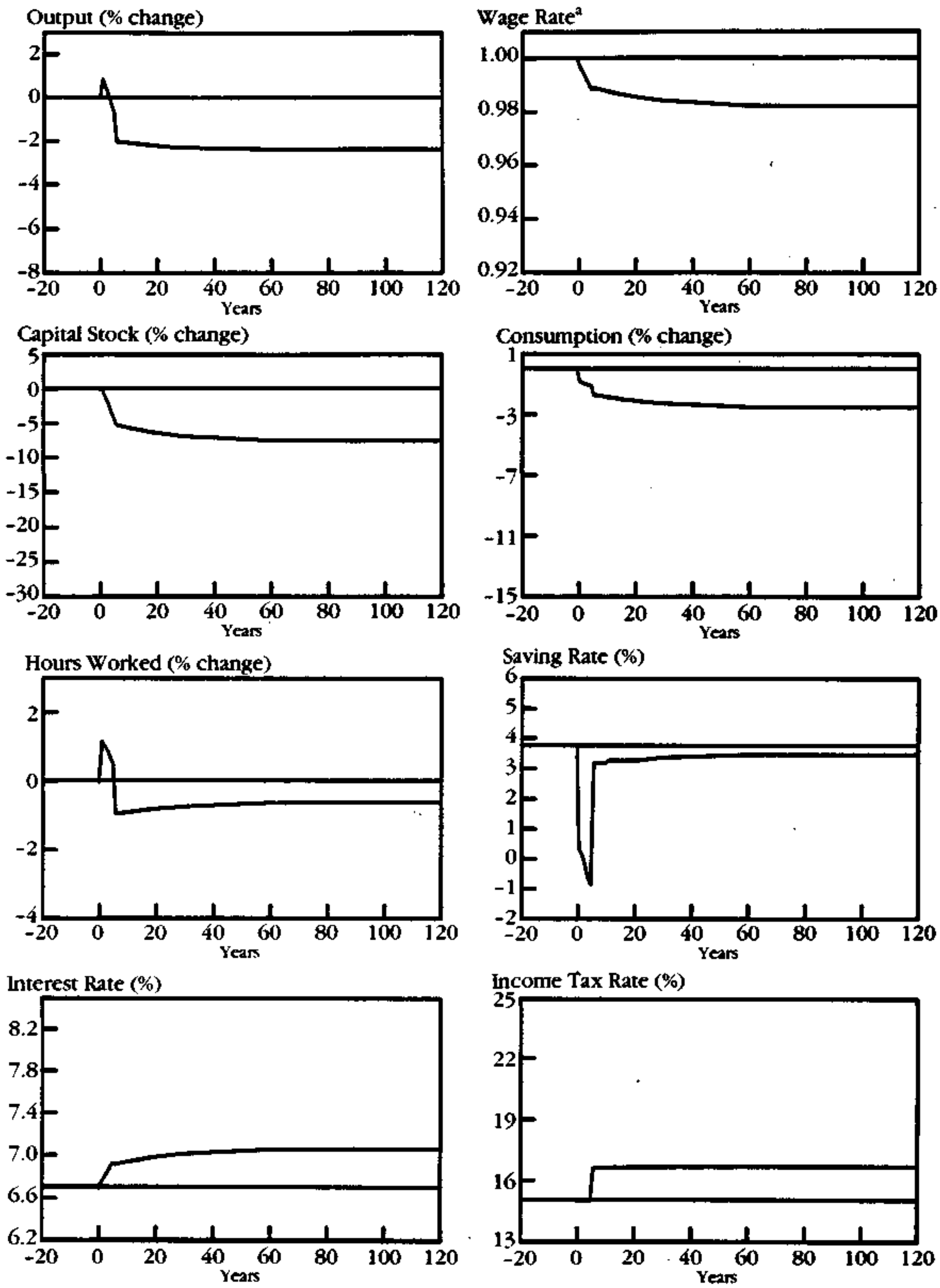
The Effects of Temporary Balanced-Budget Increases in Government Consumption



a. The wage rate in the initial steady state is normalized to unity.
NOTE: Horizontal lines represent values in the initial steady state. Percent changes are calculated from the initial steady state.
SOURCE: Authors' calculations.

FIGURE 4

The Effects of Temporary Deficit-Financed Increases in Government Consumption



a. The wage rate in the initial steady state is normalized to unity.
NOTE: Horizontal lines represent values in the initial steady state. Percent changes are calculated from the initial steady state.
SOURCE: Authors' calculations.

IV. Conclusion

This paper has analyzed the effects of both permanent and temporary changes in government expenditure on labor supply, interest rates, output, and the capital stock. Both the short- and long-run effects depend critically on whether the higher expenditures are financed with higher taxes initially or with government budget deficits.

A simulation in which government expenditures increased permanently from 13.7 to 22.1 percent of GNP (as they did over the last four decades) led to a long-run decline in output of 2.1 percent. This number is a benchmark estimate of the effect on output because of permanently higher government consumption. With deficit financing, output is higher in the short run because of the increase in labor supply induced by the intertemporal substitution effects of lower taxes earlier and higher taxes later. However, the long-run steady-state level of output is lower with deficit financing than without it. This occurs because of the higher tax rates necessary under deficit financing to service the accumulated debt.

Temporary increases in government expenditure, if financed by contemporaneous tax hikes, result in temporary declines in output because of the within-period substitution effect of the currently high taxes on the labor–leisure margin of choice. This effect is magnified by the intertemporal substitution effect. Individuals substitute current for future leisure because of the temporary increase in taxes. When a balanced budget is maintained during a temporary increase in government spending, all variables return to their initial steady-state levels in the long run. Under deficit financing, however, long-run output is slightly lower because of the adverse effects on labor supply caused by the higher taxes necessary to service the debt accumulated during the war years.

Unlike the case in the representative-agent model, output increases only in the presence of deficit-financed government expenditure. This is true for both permanent and temporary increases in government spending. When revenue is raised in a balanced-budget fashion, output declines. This is a result of the distortionary nature of taxation that induces intratemporal substitution in favor of working more hours, as well as intertemporal substitution in favor of working when taxes are low.

A further reason for the difference in results between this model and the representative-agent model is the intergenerational redistribution aspect of deficit financing. Some older generations escape higher future tax burdens and as a result consume more than they otherwise would. This leads to higher interest rates that again induce greater work effort on the part of the labor force.

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