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Government Consumption Expenditures and the Current Account

Michele Cavallo
Federal Reserve Bank of San Francisco

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ABSTRACT

This paper distinguishes between two components of government consumption, expenditure on final goods and expenditure on hours, and compares the effects of changes in these two on the current account. I find that changes in government expenditure on hours do not directly affect the current account and that their impact is considerably smaller than the impact produced by changes in government expenditure on final goods. These findings indicate that considering government consumption as entirely expenditure on final goods leads to overestimating its role in accounting for movements in the current account balance.

KEYWORDS: Government expenditure; Government hours; Current account

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*Economic Research Department, 101 Market Street, Mail Stop 1130, San Francisco, CA 94105; Tel.: 415-974-3244; Fax: 415-974.2168. I thank Darrel Cohen for encouragement to work on this topic; Fabio Ghironi, Reuven Glick, Nouriel Roubini, Mark Spiegel and Diego Valderrama for helpful conversations; Judith Goff and Anita Todd for editorial assistance; and Greg Snyders for excellent research assistance. All remaining errors are my own. The views in this paper are solely my responsibility and should not be interpreted as reflecting the views of the Federal Reserve Bank of San Francisco or the Federal Reserve System.

1 Introduction

The current account balance is the difference between a country's exports and its imports of goods, services, and income. It also measures the difference between a country's national income and its domestic expenditure on consumption and investment. A considerable share of domestic expenditure in industrialized countries consists of government consumption expenditure. For example, in the United States, government consumption expenditure after World War II has accounted, on average, for roughly 20 percent of total domestic expenditure. Previous studies have therefore examined the relation between changes in government consumption expenditure and movements in the trade balance on goods and services, whose short-run fluctuations, as highlighted in Baxter (1995), track closely those of the current account balance. Among those studies, Ahmed (1987) found some evidence of a negative relationship between temporary increases in government expenditure and the trade balance for the United Kingdom during the 18th and the 19th centuries. Likewise, Yi (1993) showed that higher government purchases played at least a partial role in the deterioration of the U.S. trade balance during the 1970s and 1980s.

Government consumption expenditure consists of two main components: expenditure on final goods, and wage and salary accruals, which, essentially, correspond to expenditure on hours worked. Figures 1A and 1B indicate that the latter component has represented a quantitatively relevant share of both GDP and government consumption expenditure for the United States during the post-World War II period. Moreover, within a model economy, as shown by Finn (1998), government expenditure on hours has a negative impact on domestic output and investment expenditure in the private sector, whereas government expenditure on final goods has a positive impact (see, e.g., Baxter and King, 1993).

This paper, therefore, explores the dynamic effects of unanticipated increases in government expenditure on both final goods and hours, using a two-country model economy. In particular, it compares the consequences for the current account of a shock to government hours with those produced by a shock to government expenditure on final goods. The main results are as follows. An increase in government expenditure on final goods corresponding to 1 percent of GDP produces on impact a deterioration in the current account balance of nearly 0.5 percent of GDP, as in Baxter (1995). More notably, this paper also shows that an equivalent increase in government expenditure on hours produces a considerably smaller deterioration in the current account balance, corresponding to barely 0.05 percent of GDP.

While an increase in government expenditure of final goods is accommodated through higher imports, an increase in government hours is accommodated by an expansion in domestic labor supply. In the former case, there is a corresponding deterioration in the trade and current account balances, whereas, in the latter, there are no direct consequences on net exports of goods, services, and income. Similarly, since hours worked are nontraded, an increase in government hours does not directly affect the excess of domestic expenditure over national income. As a result, it does not lead directly to a deterioration in the current account. However, it still has an indirect effect, though quantitatively smaller, on the current account through its impact on domestic private output and expenditure on consumption and investment.

These results indicate that it is important to consider the composition of changes in government consumption expenditure to understand their impact on the current account balance. In addition, they hint that a fiscal deficit generated by an increase in government expenditure on hours has a substantially smaller impact on the current account than a fiscal deficit generated by an increase in government expenditure on final goods. Instead, most theoretical models, like the two-country model in Baxter (1995), predict that a fiscal deficit generated by an increase in government consumption expenditure produces a sizeable deterioration in the current account balance. In the United States, government expenditure on hours has accounted for a substantial share of government consumption expenditure, as illustrated in Figure 1B. Taking this into account, the results of this paper bring the predictions of a model economy about the association between fiscal and current account deficits closer to the recent findings of Kim and Roubini (2004). Their evidence, in fact, show that increases in the fiscal deficit actually improve the current account to some extent.

In a related paper, Erceg, Guerrieri and Gust (2005) have used a two-country model—calibrated to the U.S. economy and to the rest of the world—with nominal and real rigidities and with financial imperfections. They have found that fiscal deficits have only a fairly small effect on the U.S. trade balance. For example, a fiscal deficit generated by an increase in government expenditure on final goods which is equivalent to 1 percent of GDP induces a trade balance deterioration that is smaller than 0.2 percent of GDP.

The structure of the paper is as follows: Section 2 presents the model economy. Section 3 describes the solution of the model. Section 4 illustrates and discusses the dynamic responses to unanticipated increases in government consumption expenditures. Section 5 briefly concludes.

2 The model economy

The model economy consists of two countries, home and foreign, of size π and $(1-\pi)$, respectively. In each country there is a household sector, a private sector, and a government. In the household sector there is a large number of households. In the private sector there is a large number of identical firms. Both domestic and foreign firms produce a single final good that can be used for either consumption or investment purposes and that can be freely traded between the two countries. The set of financial claims includes a single noncontingent bond, denominated in units of the final good, and equity claims on the dividend stream of private sector firms. The first type of claims can be traded internationally, while the latter cannot.

As in Ghironi (2003), I use an overlapping-generations (OLG) version of the two-country general equilibrium model, rather than the representative agent version. In the representative agent framework, when the set of internationally traded financial claims includes only noncontingent bonds, insurance against country-specific shocks is incomplete. This implies that these shocks, even when temporary, produce permanent changes in the distribution of wealth across countries and in the levels of the other endogenous variables, thereby modifying the long-run equilibrium of the model economy. It is therefore problematic to analyze the dynamic effects of temporary country-specific shocks through solution techniques that are valid only around an equilibrium to which variables eventually return. In contrast, in the OLG framework, temporary country-specific shocks do not alter the long-run equilibrium of the model economy. After these disturbances, as newly born households with zero financial wealth enter the economy at the beginning of each period, aggregate per capita levels of wealth and of the other endogenous variables eventually return to their preshock equilibrium values.

Finally, time is divided into periods and each period is indexed by the subscript t.

Households

Households consume final goods and supply labor services in the form of hours worked both to private sector firms and to the government. These labor services are perfectly mobile across sectors within the same country but immobile across countries. For simplicity, I normalize the households' endowment of hours to one. As in Blanchard (1985), Frenkel, Razin, and Yuen (1996, Ch. 9) and Cardia (1991), in each period households face a constant probability of death, denoted by $(1-\varphi)$. As a consequence, the probability of survival from one period to the next is φ. The representative household in the home country born on date v has preferences over consumption $C_{t,v}$ and hours worked $N_{t,v}$. These preferences are represented by the following utility function:[1]

$$\text{(1)} \qquad \sum_{i=0}^{\infty} (\varphi\beta)^i \, U(C_{t+i,v}, N_{t+i,v}),$$

where β is the subjective discount factor. The momentary utility function is

$$\text{(2)} \qquad U(C_{t,v}, N_{t,v}) = \theta \log C_{t,v} + (1-\theta) \log (1 - N_{t,v}), \quad 0 < \theta < 1.$$

Households supply labor hours in a perfectly competitive labor markets. The real wage per hour unit is W_t. Households also pay lump-sum taxes, T_t. They hold equity claims on the profit stream of private sector firms. I denote these claims by $S_{t,v}$, their price by V_t, and the profits paid out in period t by D_t. They also hold a noncontingent real bond, $B_{t,v}$, that earns a gross real interest rate of R_t.

Households stipulate contracts with insurance companies contingent on survival. These contracts establish that, in the event of death, holdings of financial claims—bonds and equity claims—are transferred to insurance companies. Alternatively, in the event of survival, insurance companies pay households an extra return on their assets. With free entry into the insurance market, a zero profit condition determines the extra return. This condition implies that insurance companies allocate to those who remain alive the assets of those who do not survive. As the number of households that are born each period is large, the fraction of households who survive is equal to the probability of survival, φ. This also means that the fraction of households who do not survive is equal to $(1-\varphi)$. Therefore each household that survives receives a share $(1-\varphi)/\varphi$ of the assets of those who do not survive, so that the return on one unit of assets is equal to $1/\varphi$.

The period t flow budget constraint for the representative household born on date v is then

$$\text{(3)} \qquad B_{t+1,v} + V_t S_{t+1,v} = \frac{R_t}{\varphi} B_{t,v} + \frac{V_t + D_t}{\varphi} S_{t,v} + W_t N_{t,v} - C_{t,v} - T_t.$$

The representative household born on date v chooses sequences of end-of-period bond and equity claim holdings, $B_{t+1,v}$ and $S_{t+1,v}$, and hours worked, $N_{t,v}$, to maximize its intertemporal utility (1) subject to (3). The first-order conditions with respect to $B_{t+1,v}$, $S_{t+1,v}$ and $N_{t,v}$ give the consumption Euler equation for real bonds, the consumption Euler equation for stocks, and individual supply of hours, respectively:

$$\text{(4)} \qquad \frac{C_{t+1,v}}{C_{t,v}} = \beta R_{t+1};$$

[1] I focus on the home country for simplicity. A similar economic structure is present in the foreign country. In what follows, I will denote foreign variables with an asterisk.

$$(5) \qquad \frac{C_{t+1,v}}{C_{t,v}} = \beta \frac{V_{t+1} + D_{t+1}}{V_t};$$

$$(6) \qquad N_{t,v} = 1 - \frac{1-\theta}{\theta} \frac{C_{t,v}}{W_t}.$$

From (4) and (5) one can get a no-arbitrage condition between bonds and stocks:

$$(7) \qquad R_{t+1} = \frac{V_{t+1} + D_{t+1}}{V_t}.$$

Using this no-arbitrage condition, one can rewrite the budget constraint (3) as:

$$(8) \qquad A_{t+1,v} = \frac{R_t}{\varphi} A_{t,v} + W_t N_{t,v} - C_{t,v} - T_t,$$

where $A_{t,v}$ denotes individual financial wealth, defined as:

$$(9) \qquad A_{t,v} = B_{t,v} + V_{t-1} S_{t,v}.$$

Iterating forward the flow budget constraint (8), imposing a transversality condition, and using both the consumption Euler equation on bonds (4) and the first-order condition on hours worked (6), one can get an individual consumption function:

$$(10) \qquad C_{t,v} = (1 - \varphi\beta)\, \theta \left(\frac{R_t}{\varphi} A_{t,v} + H_{t,v} \right),$$

where $H_{t,v}$ denotes individual human wealth defined as the after-tax present discounted value of hours' endowment of the representative household born on date v:[2]

$$H_{t,v} = \sum_{i=0}^{\infty} \varphi^i R_{t,t+i} \left(W_{t+i} - T_{t+i} \right), \quad R_{t,t+i} = \prod_{j=0}^{i-1} R_{t+j}^{-1}, \quad R_{t,t} = 1.$$

Aggregation

Each period, in both home and foreign countries, a new generation of households is born; its measure is $(1-\varphi)$. This measure is distributed in the two countries according to their respective size. The size of each generation, due to death, declines nonstochastically over time. In any period t the size of a generation born on date v, thus of age $t-v$, is $(1-\varphi)\varphi^{t-v}$. Therefore, the size of the total population in the two-country model economy is:

$$(1-\varphi) \sum_{v=-\infty}^{t} \varphi^{t-v} = 1.$$

[2] As in Cavallo and Ghironi (2002), this definition of human wealth as the after-tax present discounted value of the household's exogenous endowment of hours is analogous to those of Blanchard (1985) and Weil (1989) for the case of inelastic labor supply and exogenous nonfinancial income. Blanchard (1985) defines human wealth as the present discounted value of exogenous non-interest income, while Weil (1989) defines human wealth as the present discounted value of after-tax endowment income.

As the size of population is equal to one, in what follows I will refer to aggregate variables and aggregate per capita variables interchangeably. As in Blanchard (1985), the relation between any aggregate variable X_t and its individual counterparts in the home country is:

$$X_t = (1-\varphi) \sum_{v=-\infty}^{t} \varphi^{t-v} X_{t,v}.$$

Newly born households own no assets. Therefore, period t aggregate bond and stock holdings are given by:

$$B_t = (1-\varphi) \sum_{v=-\infty}^{t} \varphi^{t-v} B_{t,v-1},$$

$$S_t = (1-\varphi) \sum_{v=-\infty}^{t} \varphi^{t-v} S_{t,v-1} = 1.$$

As a consequence:

$$(11) \quad (1-\varphi) \sum_{v=-\infty}^{t} \varphi^{t-v} B_{t,v} = \varphi (1-\varphi) \sum_{v=-\infty}^{t} \varphi^{t-v} B_{t,v-1} = \varphi B_t,$$

$$(12) \quad (1-\varphi) \sum_{v=-\infty}^{t} \varphi^{t-v} S_{t,v} = \varphi (1-\varphi) \sum_{v=-\infty}^{t} \varphi^{t-v} S_{t,v-1} = \varphi.$$

Keeping relations (11) and (12) in mind, aggregation of the household's flow budget constraint (8) gives:

$$(13) \quad A_{t+1} = R_t A_t + W_t N_t - C_t - T_t,$$

where aggregate financial wealth is

$$(14) \quad A_t = B_t + V_{t-1}.$$

Aggregation of the individual consumption function (10) then gives

$$(15) \quad C_t = (1-\varphi\beta)\, \theta \,(R_t A_t + H_t)\,,$$

where H_t is aggregate human wealth

$$H_t = (1-\varphi) \sum_{v=-\infty}^{t} \varphi^{t-v} H_{t,v},$$

with

$$(16) \quad H_t = W_t - T_t + \frac{\varphi}{R_{t+1}} H_{t+1}.$$

Aggregating the individual consumption Euler equations for bonds (4) gives

$$(1-\varphi)\sum_{v=-\infty}^{t}\varphi^{t-v}C_{t+1,v}=\beta R_{t+1}C_t.$$

Noting that

$$(1-\varphi)\sum_{v=-\infty}^{t}\varphi^{t-v}C_{t+1,v}=\frac{C_{t+1}}{\varphi}-\frac{1-\varphi}{\varphi}C_{t+1,t+1},$$

one can write

$$(17)\quad C_{t+1}=\beta R_{t+1}C_t-\frac{1-\varphi}{\varphi}\left(C_{t+1}-C_{t+1,t+1}\right).$$

Using the aggregate consumption function (15) and the period $t+1$ consumption function of the generation born in the same period one can get an aggregate version of the consumption Euler equation:

$$(18)\quad C_{t+1}=\beta R_{t+1}C_t-\frac{1-\varphi}{\varphi}\left(1-\varphi\beta\right)\theta R_{t+1}A_{t+1}.$$

Aggregate per capita consumption growth depends negatively on the level of aggregate per capita financial wealth. Specifically, the second term in the right-hand side of the aggregate Euler equation (18) indicates the reduction in aggregate per capita consumption in period $t+1$ resulting from the entry into the economy of newly born households owning zero financial wealth. This term creates a wedge between the real interest rate on internationally traded bonds and the aggregate marginal rate of intertemporal substitution in consumption. As pointed out in Cardia (1991), this wedge is a function of aggregate financial wealth, where aggregate financial wealth is the sum of aggregate bond and equity holdings (see equation 14). This implies that when a country has accumulated a positive bond position, it experiences slower consumption growth. Conversely, a country that has accumulated a negative bond position will be characterized by faster consumption growth. With $\varphi=1$, one obtains the representative agent setup with a standard consumption Euler equation. Finally, aggregation of individual labor supplies yields

$$(19)\quad N_t=1-\frac{1-\theta}{\theta}\frac{C_t}{W_t}.$$

Firms

Private sector firms in the home country produce final goods $Y_{P,t}$, combining capital and hours supplied from the household. The production function is

$$(20)\quad Y_{P,t}=K_t^{\alpha_P}N_{P,t}^{\alpha_P},\quad 0<\alpha_P<1,$$

where K_t is the capital stock in the economy available as of the beginning of period t, $N_{P,t}$ is the number of hours used as a labor input in the private sector, and α_P is the labor income share in the private sector. Firms own capital and make investment decisions, incurring convex adjustment costs. The capital stock evolves according to the following law of motion:

$$(21) \quad K_{t+1} = (1-\delta) K_t + \phi \left(\frac{I_t}{K_t} \right) K_t, \quad \phi(\cdot) > 0, \quad \phi'(\cdot) > 0, \quad \phi''(\cdot) < 0.$$

For a given level of the capital stock, K_t, an investment expenditure equal to I_t generates $\phi(I_t/K_t) K_t$ units of new capital, where $\phi(\cdot)$ is a concave function. In contrast, in the absence of adjustment costs, $\phi(I_t/K_t) = I_t/K_t$, so that one unit of investment expenditure I_t would generate one unit of new capital K_{t+1}. As in Baxter (1995), I incorporate convex costs of adjusting the capital stock so that, following country-specific shocks, the two-country model economy does not deliver an excessive volatility of investment relative to what is observed in the data.

Period t profits for the firm are then

$$(22) \quad D_t = Y_{P,t} - W_t N_{P,t} - I_t.$$

As the marginal rate of intertemporal substitution in consumption for individual households is equal to the gross real interest rate on bonds, R_t (see equation 4), firms discount future profits using the real interest rate R_t. The present discounted value of profits is then:

$$(23) \quad V_t = \sum_{i=1}^{\infty} R_{t,t+i} D_{t+i}.$$

Firms choose sequences of labor demand $N_{P,t}$, end-of-period capital K_{t+1}, and investment I_t, to maximize (23) subject to (20) through (22).

I denote with Q_t the Lagrange multiplier on the capital accumulation equation, i.e., Tobin's Q, which indicates the marginal cost of new capital K_{t+1} in terms of foregone output of final goods $Y_{P,t}$. I also denote by $R_{K,t}$ the marginal product of capital:

$$(24) \quad R_{K,t} = (1-\alpha_P) \left(\frac{N_{P,t}}{K_t} \right)^{\alpha_P}.$$

The first-order conditions with respect to $N_{P,t}^P$, K_{t+1}, and I_t are, respectively:

$$(25) \quad W_t = \alpha_P \left(\frac{K_t}{N_{P,t}} \right)^{1-\alpha_P};$$

$$(26) \quad Q_t R_{t+1} = R_{K,t+1} + Q_{t+1} \left[(1-\delta) - \phi' \left(\frac{I_{t+1}}{K_{t+1}} \right) \frac{I_{t+1}}{K_{t+1}} + \phi \left(\frac{I_{t+1}}{K_{t+1}} \right) \right];$$

$$(27) \quad 1 = Q_t \phi' \left(\frac{I_t}{K_t} \right);$$

As both the production function (20) and the adjustment cost function $\phi(\cdot)$ are linearly homogeneous in K and N, and in I and K, respectively, it is well known that average Q and marginal Q coincide, so that:

$$(28) \quad V_t = Q_t K_{t+1}.$$

Government

I denote government consumption expenditure with G_t. It is equal to the sum of government expenditure on final goods, $C_{G,t}$, and government expenditure on hours, $W_t N_{G,t}$, where $N_{G,t}$ is the amount of hours of labor supplied by the households to the government.[3] The government collects lump-sum taxes from households, T_t. It also keeps a period-by-period balanced budget. The budget constraint of the government is

$$(29) \quad G_t = C_{G,t} + W_t N_{G,t} = T_t.$$

I assume that government expenditure on final goods does not have any effect on households' marginal utility of consumption. By the same token, I assume also that the production of final goods by private sector firms is affected neither by government expenditure on final goods nor by government hours. Therefore, both types of government expenditures are pure waste.

The real wage per hour paid by the government to households is the same that households receive from private sector firms. This assertion follows from two assumptions. One, hours can be costlessly moved across sectors. And, two, $N_{P,t}$ and $N_{G,t}$ enter the utility function in a perfectly substitutable manner, so that working for either the private sector or for the government brings households the same marginal disutility.

Government expenditure on final goods and on hours are the two exogenous fiscal policy variables. They are taken as given by households and firms. I describe the evolution of these two fiscal policy variables, $C_{G,t}$ and $N_{G,t}$, as follows:

$$(30) \quad C_{G,t} = (C_{G,t-1})^{\rho_G} \varepsilon_t^G, \quad N_{G,t} = (N_{G,t-1})^{\rho_N} \varepsilon_t^N,$$

where ε_t^G and ε_t^N are two zero-mean innovations to government expenditure on final goods and government hours, respectively.

[3] Government consumption expenditure, G_t, and government expenditure on hours, $W_t N_{G,t}$, correspond to the National Income and Product Account (NIPA) definitions of government consumption expenditures and general government wage and salary accruals, respectively. Government expenditure on final goods, $C_{G,t}$, corresponds to the NIPA definition of government consumption expenditures net of government wage and salary accruals.

Equilibrium

An equilibrium for this two-country economy, as of period t, is a collection of allocations for home and foreign households, $C_{t,v}$, $N_{t,v}$, and $B_{t,v}$, and $C^*_{t,v}$, $N^*_{t,v}$, and $B^*_{t,v}$; for home and foreign private firms, $N_{P,t}$, K_t, and I_t, and $N^*_{P,t}$, K^*_t, and I^*_t; and sequences of prices, W_t, W^*_t, R_t, R^*_t, V_t, and V^*_t such that (i) taking prices, firms' profits, and exogenous processes (30) for $C_{G,t}$ and $N_{G,t}$ as given, households in the home country maximize (1) subject to (3); (ii) foreign households solve their analogous problem; (iii) taking prices as given, private firms in the home country maximize (23) subject to (20) and (21); (iv) foreign private firms solve their analogous problem; and (v) labor, goods and bond markets all clear, as follows:

$$N_t = N_{P,t} + N_{G,t}, \tag{31}$$

$$N^*_t = N^*_{P,t} + N^*_{G,t}, \tag{32}$$

$$Y_{P,t} = C_t + I_t + C_{G,t} - B_{t+1} - R_t B_t, \tag{33}$$

$$Y^*_{P,t} = C^*_t + I^*_t + C^*_{G,t} - B^*_{t+1} - R_t B^*_t, \tag{34}$$

$$\pi B + (1-\pi) B^* = 0. \tag{35}$$

Equations (33) and (34) are the resource constraints in the home and foreign countries. They can be obtained by integrating the aggregate versions of the household budget constraint (13), the definitions of period t profits of private firms (22) and the government budget constraints (29), along with the prices of the competitive equilibrium, in particular the no-arbitrage condition (7), and the market-clearing conditions. Equation (35) indicates that real noncontingent bonds are in zero net supply.

3 Model solution

In this section I look for an approximate analytical solution of the model. First, I describe the deterministic steady state of the model defined as the equilibrium in which all variables are constant. Then, I log-linearize around the steady state the equations that define the equilibrium of the two-country economy, and I obtain a system of log-linear difference equations. Finally, in order to simulate the linearized version of the model economy, I assign numerical values to the parameters of the log-linear system.

Steady state

In this subsection I describe the deterministic steady state of the model economy. In what follows, variables without the time subscript denote steady-state values. First, I determine the labor income share in private sector output, α_P. To this purpose, I denote by α the labor income share in total output, where total output, Y_t, is the sum of output in the private sector, $Y_{P,t}$, and of government expenditure on hours, $W_t N_{G,t}$. I also denote by $\theta_G = N_G/N$ the share of hours allocated to the government over total hours worked. The labor income share in private output is then related to α and to θ_G as follows:

$$\alpha_P = \frac{\alpha(1-\theta_G)}{1-\alpha\theta_G}. \tag{36}$$

With no government hours $(\theta_G = 0)$, private output is equal to total output and $\alpha_P = \alpha$. The steady-state shares of private output and of government expenditure on hours in total output are, respectively:

$$\frac{Y_P}{Y} = 1 - \alpha\theta_G, \quad \frac{WN_G}{Y} = \alpha\theta_G.$$

Also, the steady-state shares of government expenditure on final goods in total output and in private output are, respectively:

$$\frac{C_G}{Y} = \frac{G}{Y} - \alpha\theta_G, \quad \frac{C_G}{Y_P} = \frac{G/Y - \alpha\theta_G}{1-\alpha\theta_G}.$$

Next, I determine the steady-state distribution of noncontingent bonds between the home and the foreign countries. As this is the only type of financial claim that is traded internationally, I refer to B and B^* as the net foreign asset positions of the home and of the foreign country, respectively. I assume here that both countries are similar in every respect. Households have the same preferences over consumption of final goods and labor supply. Firms in the private sector generate final goods combining capital and hours according to the same production function. Capital depreciates at the same rate, and the government purchases the same amount of final goods and hours, thereby taxing households by the same amount in a lump-sum fashion. Furthermore, as in Baxter (1995), firms incur no cost of adjusting the capital stock in the steady state, so that $\phi(I/K) = I/K$ and $\phi'(I/K) = 1$. Then, by the law of motion for capital (21), the ratio of investment to the capital stock is equal to the depreciation rate, $I/K = \delta$, and by (27), $Q = 1$. When investment in new capital goods is just enough to replace depreciated capital and to keep the capital stock constant, then adjustment costs are zero.

With international trade in bonds and a common real interest rate, R, by (26), both countries have the same marginal product of capital, $R_K = R - (1-\delta)$, by (24), the same capital-hours ratio in the private sector, K/N_P, and by (25), the same wage rate, W. Given that taxes, T, are the same in both countries as well, then by (16) aggregate human wealth, H, defined as the after-tax present discounted value of the households' endowment of hours, is also the same in the home and in the foreign countries. This implies that steady-state aggregate consumption, C, is also the same in both countries.[4] By (18) and (19), financial wealth, A, and hours supplied, N, are also the same in both countries. With hours allocated to the government, N_G, the same in both countries, hours in the private sector, N_P, are also the same. Given that the capital-hours ratio in the private sector, K/N_P, is the same in the two countries, then the steady-state capital stock, K, will also be the same. On one hand, this means that both countries produce the same amount of final goods, Y_P, and have the same level of investment expenditure, $I = \delta K$. On the other hand, with the same level of financial wealth, A, and Tobin's Q equal to 1, it also implies that both countries hold an identical amount of the noncontingent real bond, B. As $B = B^*$, the market-clearing condition for bonds (35) implies that in the steady state $B = B^* = 0$. Seen from another viewpoint, when both countries in equilibrium produce and consume the same amount of final goods and have the same level of investment and government expenditure on final goods, their net exports will be zero. With no international trade in final goods occurring in equilibrium, there will also be no trade in bonds between the home and the foreign countries, so that $B = B^* = 0$.

Finally, I determine the steady-state real interest rate, R. Given similar economic structures in both countries, I describe its determination with reference to the home country. I use the steady-state counterpart of the consumption Euler equation (18) normalized by output in the private sector Y_P after noting that in the steady state $Q = 1$ and $B = 0$:

$$(37) \quad \frac{C}{Y_P} = \beta R \frac{C}{Y_P} - \frac{1-\varphi}{\varphi} (1 - \varphi\beta)\, \theta R \frac{K}{Y_P}.$$

To solve (37) for R, I use two equations to substitute for K/Y_P and C/Y_P:

$$\begin{aligned}
(38) \quad \frac{K}{Y_P} &= \frac{1-\alpha_P}{R-(1-\delta)}, \\
(39) \quad \frac{C}{Y_P} &= 1 - \delta \frac{K}{Y_P} - \frac{C_G}{Y_P}.
\end{aligned}$$

The first equation is the steady-state counterpart of the marginal product of capital (24) after using the steady-state versions of the production function (20) and of private firms' first-order condition for capital (26). The second equation is the steady-state counterpart of the resource constraint (33)

[4] For brevity, I do not report here the algebra, which is, however, available upon request.

normalized by Y_P. The second term in the right-hand side, $\delta \cdot (K/Y_P)$, is steady-state investment relative to private output. Once the equilibrium real interest rate is computed, then K/Y_P and C/Y_P can be recovered using (38) and (39).

The log-linear system

This subsection presents the log-linear equations that describe the behavior of the model economy around the deterministic steady state. In what follows I use "hat" variables to denote log deviations from steady-state values.[5] I report here only the log-linear equations relative to the home country. Similar equations describe the behavior of the foreign country.

Household behavior is approximated by the log-linear versions of the aggregate consumption Euler equation (18) and the aggregate labor supply equation (19):

$$(40) \quad \hat{C}_{t+1} = \hat{R}_{t+1} + \beta R \hat{C}_t - \frac{1-\varphi}{\varphi} (1-\varphi\beta) \theta R \left(\frac{C}{Y_P} \right)^{-1} \hat{A}_{t+1},$$

$$(41) \quad \hat{N}_t = \frac{1-N}{N} \left(\hat{W}_t - \hat{C}_t \right).$$

The log-linear version (40) of the aggregate consumption Euler equation is analytically similar to the log-linear consumption Euler equation in Schmitt-Grohé and Uribe (2003), where the interest rate on internationally traded bonds is increasing in the size of a country's net foreign debt.

As for private sector firms, the log-linear counterparts of the production function (20), the law of motion for capital (21), and the marginal product of capital (24) are, respectively:

$$(42) \quad \hat{Y}_{P,t} = (1-\alpha) \hat{K}_t + \alpha_P \hat{N}_{P,t},$$

$$(43) \quad \hat{K}_{t+1} = (1-\delta) \hat{K}_t + \delta \hat{I}_t,$$

$$(44) \quad \hat{R}_{K,t} = \alpha_P \left(\hat{N}_{P,t} - \hat{K}_t \right).$$

The first-order conditions of the problem of the firm (25) through (27), in log-linear terms are:

$$(45) \quad \hat{W}_t = (1-\alpha_P) \left(\hat{K}_t - \hat{N}_{P,t} \right),$$

[5]For variables such as financial wealth, net foreign assets, current account, and net exports, log deviations are defined respectively as

$$\hat{A}_t = \frac{A_t - A}{Y_P}, \quad \hat{B}_t = \frac{B_t - B}{Y_P}, \quad \hat{CA}_t = \frac{CA_t - CA}{Y_P}, \quad N\hat{X}_t = \frac{NX_t - NX}{Y_P}.$$

$$(46)\quad \hat{R}_{t+1} = \frac{R_K}{R}\hat{R}_{K,t+1} + \frac{\delta}{R\eta}\left(\hat{I}_{t+1} - \hat{K}_{t+1}\right) + \frac{1-\delta}{R}\hat{Q}_{t+1} - \hat{Q}_t,$$

$$(47)\quad \hat{I}_t - \hat{K}_t = \eta\hat{Q}_t, \quad \eta = -\left[\frac{(I/K)\,\phi''}{\phi'}\right]^{-1}.$$

Combining the definition of aggregate financial wealth (14) with equation (28) and taking a log-linear approximation yields:

$$(48)\quad \hat{A}_{t+1} = \hat{B}_{t+1} + \frac{K}{Y_P}\left(\hat{Q}_t + \hat{K}_{t+1}\right).$$

The log-linearized process for government expenditure on final goods and government hours in (30) are, respectively:

$$(49)\quad \hat{C}_{G,t} = \rho_G\hat{C}_{G,t-1} + \hat{\varepsilon}_t^G,$$

$$(50)\quad \hat{N}_{G,t} = \rho_N\hat{N}_{G,t-1} + \hat{\varepsilon}_t^N.$$

The labor market clearing condition (31), the resource constraint (33), and the bond market clearing condition are:

$$(51)\quad \hat{N}_t = (1-\theta_G)\,\hat{N}_{P,t} + \theta_G\hat{N}_{G,t},$$

$$(52)\quad \hat{B}_{t+1} = R\hat{B}_t + \hat{Y}_{P,t} - \frac{C}{Y_P}\hat{C}_t - \delta\frac{K}{Y_P}\hat{I}_t - \frac{C_G}{Y_P}\hat{G}_t,$$

$$(53)\quad \pi\hat{B}_t + (1-\pi)\,\hat{B}_t^* = 0.$$

Finally, I also include in the system the log-linear versions of the definitions of total output, net exports, and the current account balance:

$$(54)\quad \hat{Y}_t = (1-\alpha\theta_G)\,\hat{Y}_{P,t} + \alpha\theta_G\left(\hat{W}_t + \hat{N}_{G,t}\right),$$

$$(55)\quad N\hat{X}_t = \hat{Y}_{P,t} - \frac{C}{Y_P}\hat{C}_t - \delta\frac{K}{Y_P}\hat{I}_t - \frac{C_G}{Y_P}\hat{G}_t,$$

$$(56)\quad C\hat{A}_t = N\hat{X}_t + (R-1)\,\hat{B}_t = \hat{B}_{t+1} - \hat{B}_t.$$

In (55), net exports are the difference between domestic production by private sector firms and domestic expenditure on final goods consumption—by both households and government—and on investment. In (56), the current account balance is the sum of net exports of goods and services and net income receipts from foreigners, $(R-1)\,\hat{B}_t$. Combining (56) with (52), the current account balance is also the difference between national income, $\hat{Y}_{P,t} + (R-1)\,\hat{B}_t$, and domestic expenditure on consumption and investment, both net of government expenditure on hours. Additionally, it is also equal to the balance on the financial account, $\hat{B}_{t+1} - \hat{B}_t$, which measures the change in the stock of net financial claims on foreigners.

Given the symmetry between the home country and the foreign country in the model, it is convenient to follow the approach of Aoki (1981). Therefore, I solve the system that includes both log-linear equations (40) through (55) for the home country and similar log-linear equations for the foreign country, in terms of differences between corresponding country variables.

Parameter Values

This subsection presents the numerical values assigned to the parameters of the linearized model economy. These parameters are such that the steady state of the model is consistent with the post-World War II experience of the U.S. economy. The model period is one quarter.

I set the subjective discount factor β equal to $1.04^{-1/4}$ to get a 4 percent annual real interest rate in the steady state. Next, I choose φ, the probability of survival, so that the average number of periods that household members spend in the labor force, $1/(1-\varphi)$, is equal to 200 (50 years). Therefore φ corresponds to 0.995. I set the labor income share in total output, α, equal to 0.58, and the quarterly depreciation rate to 2.5 percent. As in Baxter (1995) and Finn (1998), the steady-state share of time devoted to labor, N, is 0.2. As in Finn (1998) and Schmitt-Grohé and Uribe (2003), the preference parameter θ is set equal to 0.23, a value consistent with the steady-state value for N. As for the value of η, the elasticity of (I/K) with respect to Q, there is no direct empirical measure available. Baxter and Crucini (1995) selected a value for this parameter so that a two-country model economy subject to country-specific productivity shocks would produce a relative volatility of investment equivalent to its empirical counterpart; therefore, I use their parameter value and set $\eta = 15$. The shares of government consumption expenditure in total output, G/Y, and of government hours in total hours, θ_G, are equal, respectively to 0.2, and to 0.16, the average values for the U.S. economy from 1948 to 2000. I set country size π equal to 0.5, so that both countries have equal size. This allows one to abstract from effects stemming from relative country size, per se. Finally, I set the persistence of the government expenditure shocks, ρ_G and ρ_N, equal to 0.9.

4 Dynamic responses to government expenditures shocks

In this section I study the dynamic responses of the endogenous variables in the model to temporary and unanticipated balanced-budget increases to two different components of government consumption expenditure in the home country only. In particular, I assess whether these two shocks lead to different consequences for the current account balance in the model economy.

First, I consider an increase in government expenditure on final goods and I choose the size of this first shock to be equal to 1 percent of steady-state total output (GDP), which corresponds to what Baxter and King (1993) refer to as "one commodity unit." Second, I consider an increase in government hours. To help the comparison between the dynamic effects of these two shocks, I calibrate the size of the second shock so that government expenditure on hours ($W_t N_{G,t}$) also increases by 1 percent of steady-state GDP. Therefore, under both scenarios, government consumption expenditure increases by the same amount in terms of GDP.

As the focus of this paper is on the current account, which is determined by country differences in this setup, I report only the dynamic responses for the differences between home and foreign variables. Therefore, when I describe the impulse responses in the following two subsections, I refer to them in terms of home variables relative to their foreign counterparts.

Figures 2 and 4 show the impulse responses to the government expenditure shocks of private output, private consumption, investment, government expenditure on final goods, net exports, current account, total output and government expenditure on hours; I report the responses of these variables in terms of percentages of steady-state GDP. Figures 3 and 5 illustrate the impulse responses of private hours, total hours, real return to capital, real wage, Tobin's Q, capital stock, net foreign assets and government hours; in these figures I present the responses of capital stock and net foreign assets in terms of percentages of steady-state GDP, while I report those of private hours and total hours in terms of percentages of total hours in the steady state.

Shock to government expenditure on final goods

This subsection studies the dynamic responses to an unanticipated balanced-budget increase in government expenditure on final goods in the home country, as illustrated in Figures 2 and 3. When government expenditure on final goods in the home country increases, by the budget constraint (29), lump-sum taxes also increase by the same magnitude. As a consequence, domestic households observe a decrease in their after-tax labor income. They react by doing two things: they reduce consumption as shown in Figure 2B (by about 0.03 percent of GDP) and they increase their supply of labor hours by 0.07 percent (see Figure 3B). The increase in labor supply produces various effects. Given a decreasing marginal product of labor in the private sector (see equation 25), the increase in the supply of domestic hours relative to foreign leads to a decrease in the real wage in relative terms (see Figure 3D) and, with government hours unchanged, also a decrease in the government expenditure on hours (see Figure 2H). The increase in domestic total hours produces an increase in hours allocated to private sector firms of exactly the same magnitude (0.07 percent, see Figure 3A) and in private and total output by approximately 0.05 percent (see Figures 2A and 2G). Moreover, as an increased number of hours are combined with each unit of capital into the production of final goods, the domestic marginal product of capital in the home country increases relative to the foreign country in response to the shock (see Figure 3C). Correspondingly, as the marginal product of capital increases, the replacement cost of capital decreases relative to the value of existing capital, so that Tobin's Q increases domestically relative to the foreign country (see Figure 3E). The increase in Tobin's Q prompts an increase in domestic investment relative to foreign by 0.1 percent of GDP on impact (see Figure 2C) and a protracted increase in the capital stock (see Figure 3F).

Overall, the relative responses of private output, private consumption, and investment, on impact, sum approximately to zero. However, government expenditure increases in relative terms by 1 percent of GDP. As one can derive from equations (52), (56), and (55), this leads to a relative deterioration of net exports and current account balances of similar magnitude (see Figures 2E and 2F). Given equal country sizes, this amounts to a current account deterioration in the home country of about 0.5 percent of GDP, like in Baxter (1985), and a corresponding improvement in the current account balance in the foreign country. The impulse responses described in this subsection are also similar to those already obtained within two-country frameworks by Kollmann (1998) and by Betts and Devereux (2001). Over time, as domestic government expenditure on final goods returns to its preshock level, the deficits in the home country become smaller in size and eventually turn into surpluses. Conditional on the positive shock to domestic government expenditure on final goods, the sequence of current account deficits in the home country leads to a protracted accumulation of external debt. Relative external indebtedness, after approximately 40 periods, reaches 10 percent of GDP and then very slowly reverts back to its preshock level (see Figure 3G).

I conclude that, within this framework, an increase in government expenditure on final goods in the home country leads to offsetting effects on relative domestic private output, consumption, and investment. Moreover, the expansion in the final goods component of government consumption expenditure produces a sizeable worsening in the current account balance of the home country and corresponding increases in net foreign indebtedness. Therefore, conditional on a positive shock to domestic government expenditure on final goods, the current account deterioration in the home country appears noticeably linked to the increase in government consumption expenditure.

Shock to government expenditure on hours

In this subsection I analyze the dynamic responses to an unanticipated balanced-budget increase in government hours in the home country, as shown in Figures 4 and 5. When domestic government hours increase, less of this resource is available for production in the private sector. Domestic private hours and private output decrease in the home country relative to the foreign by 0.5 of total hours and by 0.33 percent of GDP, respectively (see Figure 5A and Figure 4A). As fewer final goods are available for consumption and investment, the expanded government use of resources produces a negative wealth effect in the home country. Domestic households react by decreasing consumption by approximately 0.01 percent of steady-state GDP (see Figure 4B) and by increasing labor supply. With fewer hours allocated to the domestic private sector, the marginal product of labor, hence the real wage, in the home country increases relative to the foreign (see Figure 5D). In addition, with a higher real wage, the supply of domestic labor hours relative to foreign further increases, as a consequence of a substitution effect. All together, as a result of both the wealth and the substitution effects, total hours in the home country increase in relative terms by 1 percent (see Figure 5B). Moreover, as the private sector employs fewer hours, the domestic marginal product of capital and Tobin's Q decrease on impact after the shock (see Figures 5C and 5E). As replacing existing capital goods becomes more costly relative to their market value, investment declines by approximately 0.23 percent of GDP (see Figure 4C). This leads to a hump-shaped decline in the capital stock (see Figure 5F).

Overall, in relative terms, private output decreases by 0.33 percent of GDP, while government expenditure on hours increases by 1 percent of GDP. Therefore, total output $(Y_{P,t} + W_t N_{G,t})$ increases by 0.67 percent in relative terms as a result of the shock considered in this subsection. The consequences on the current account are now different from those examined in the previous subsection. While relative supply of final goods from the private sector declines by 0.33 percent of GDP, relative private consumption and investment decline by 0.01 percent and 0.23 percent of GDP, respectively. Therefore, net exports and the current account deteriorate in relative terms by approximately 0.09 percent of GDP (see Figures 4E and 4F). Again, given equal country sizes, this means that the current account balance deteriorates by nearly 0.05 percent of GDP in the home country, while improving by a corresponding amount in the foreign country. The deterioration in the home country produces a worsening in the relative net foreign debt position ratio to GDP, which reaches a magnitude of 4.53 percent of GDP after approximately 60 periods (see Figure 5.G). As one can see from the log-linear versions of the resource constraint (52) and the current account definition (56), an increase in the government expenditure on hours ($W_t N_{G,t}$) does not lead directly to a deterioration in the current account. When the government spends more on hours, it increases both national income and domestic expenditure, thereby not directly affecting the excess of domestic expenditure over national income. Furthermore, while final goods are traded internationally, hours are not. Therefore, an increase in government expenditure on final goods leads to a decrease in net exports of goods, services, and income. In contrast, government expenditure on hours does not produce any direct effect on net domestic absorption of traded resources, and, hence, on the current account. The effects on the current account take place, rather, through the changes in output in the private sector and in consumption and investment produced by the shock to government hours. These effects are one order of magnitude smaller than the direct current account effects of an increase in government expenditure on final goods. On the whole, the simulations of the model economy indicate that, when considering increases in government expenditure on hours, the link between increases in government consumption expenditure and current account deficits is weakened quite substantially.

5 Conclusions

This paper has distinguished between two components of government consumption, expenditure on final goods and expenditure on hours, and has explored the dynamic effects of increases in these two, using a two-country model economy. In particular, it has compared the consequences on the current account of a shock to government hours with those produced by a shock to government expenditure on final goods. While an increase in government expenditure on final goods produces a sizeable deterioration in the current account balance, an increase in government hours has a considerably smaller impact. Specifically, an increase in government expenditure on hours equivalent to 1 percent of GDP produces a deterioration in the current account balance corresponding to barely 0.05 percent of GDP. Positive shocks to government hours are accommodated domestically through an expansion in labor supply and, therefore, do not directly affect the current account balance, which measures the difference between national income and domestic expenditure. Overall, the results in this paper indicate that considering government consumption as entirely expenditure on final goods leads to overestimating its role in accounting for movements in the current account balance.

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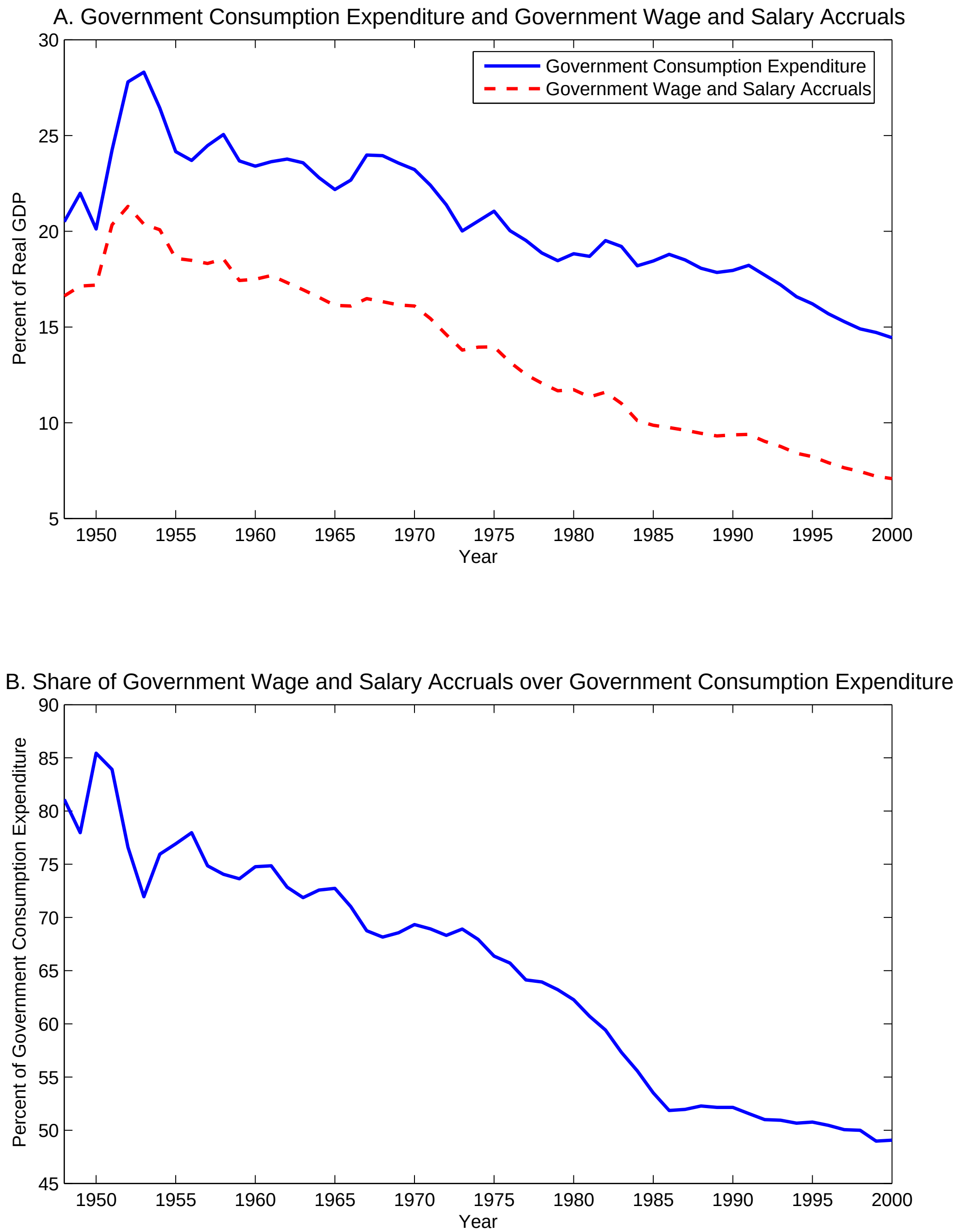
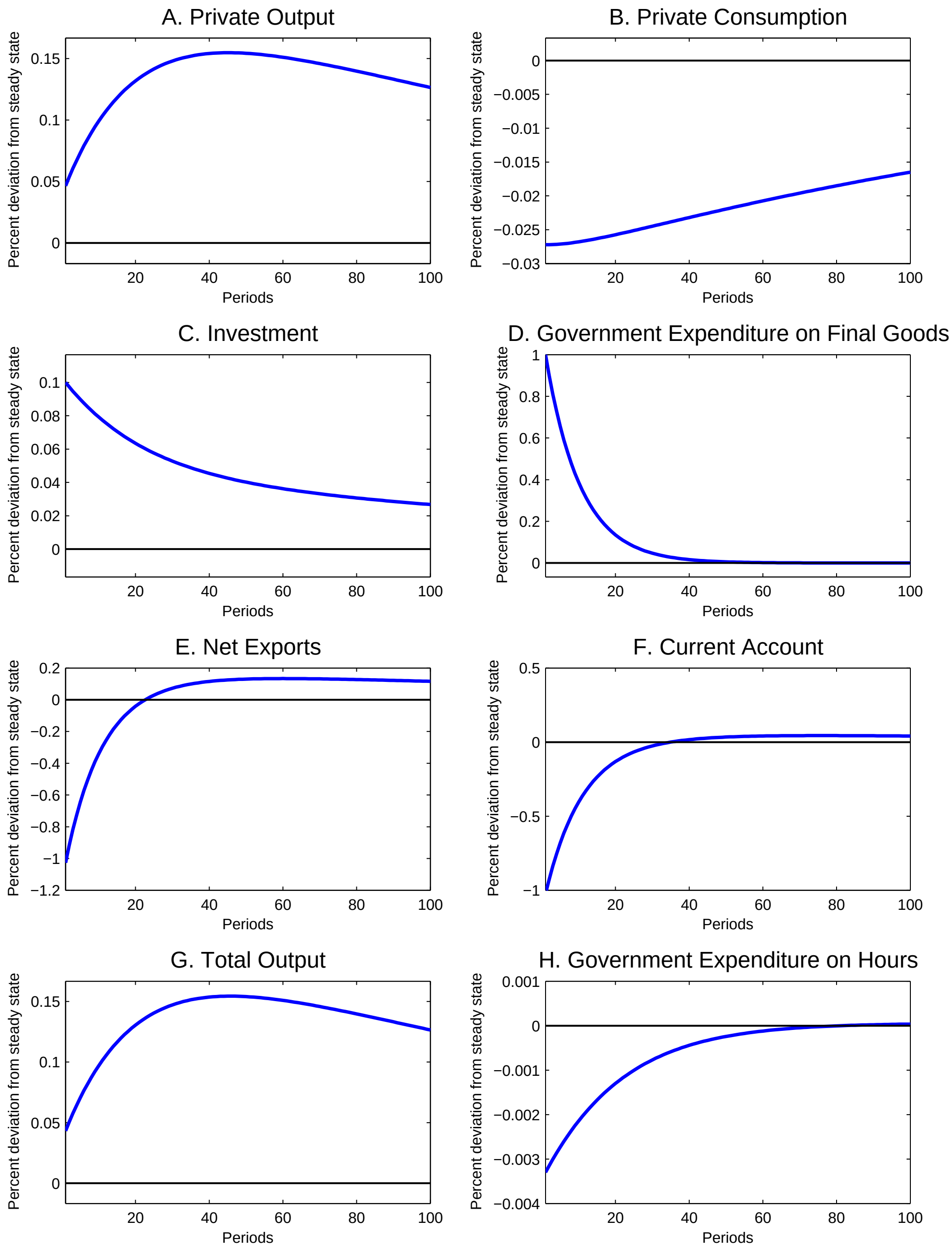
Figure 1: U.S. government expenditures (1948 - 2000)



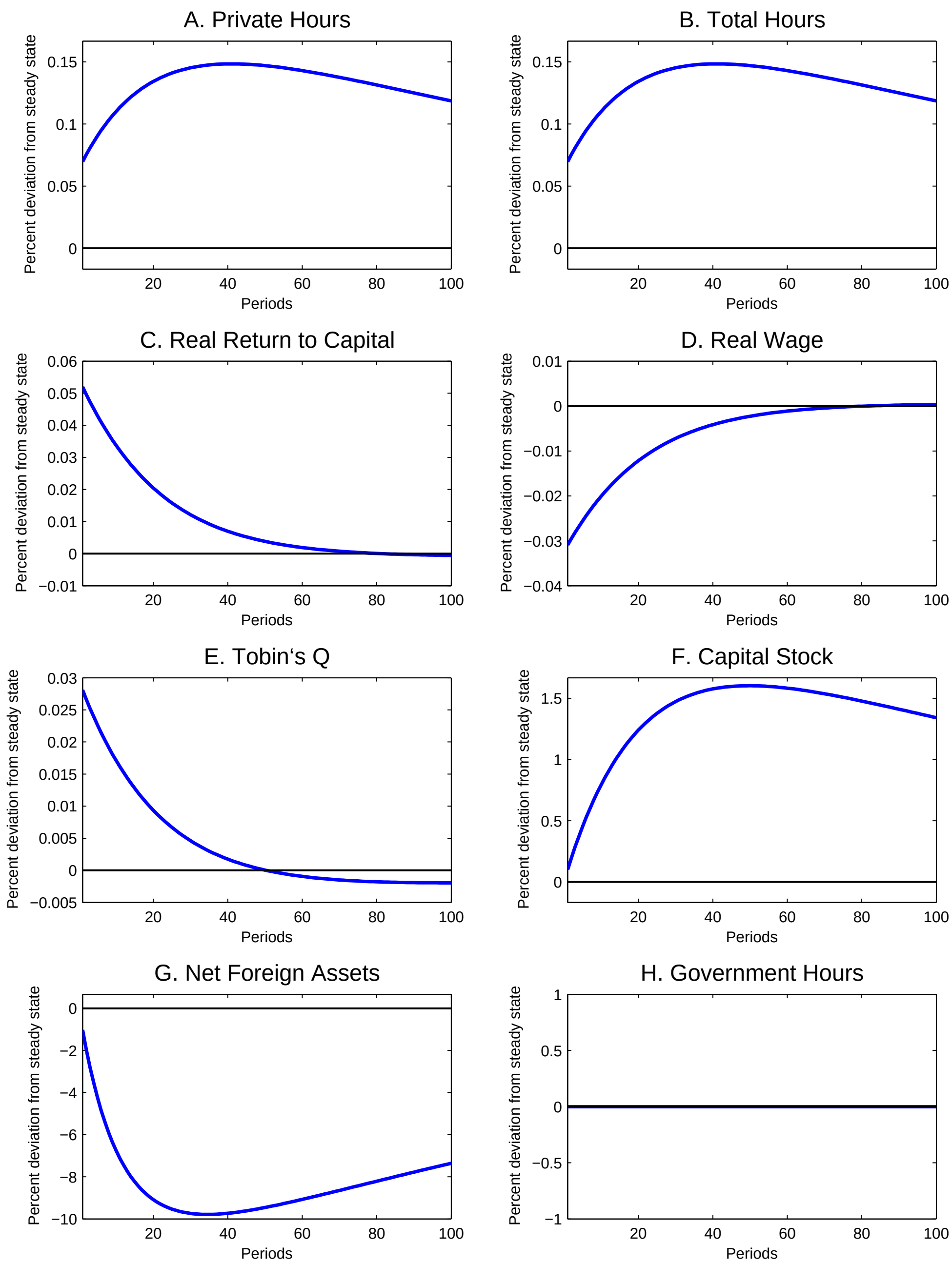
Note: Source: Bureau of Economic Analysis, NIPA Tables.

Figure 2: Shock to government expenditure on final goods in the home country



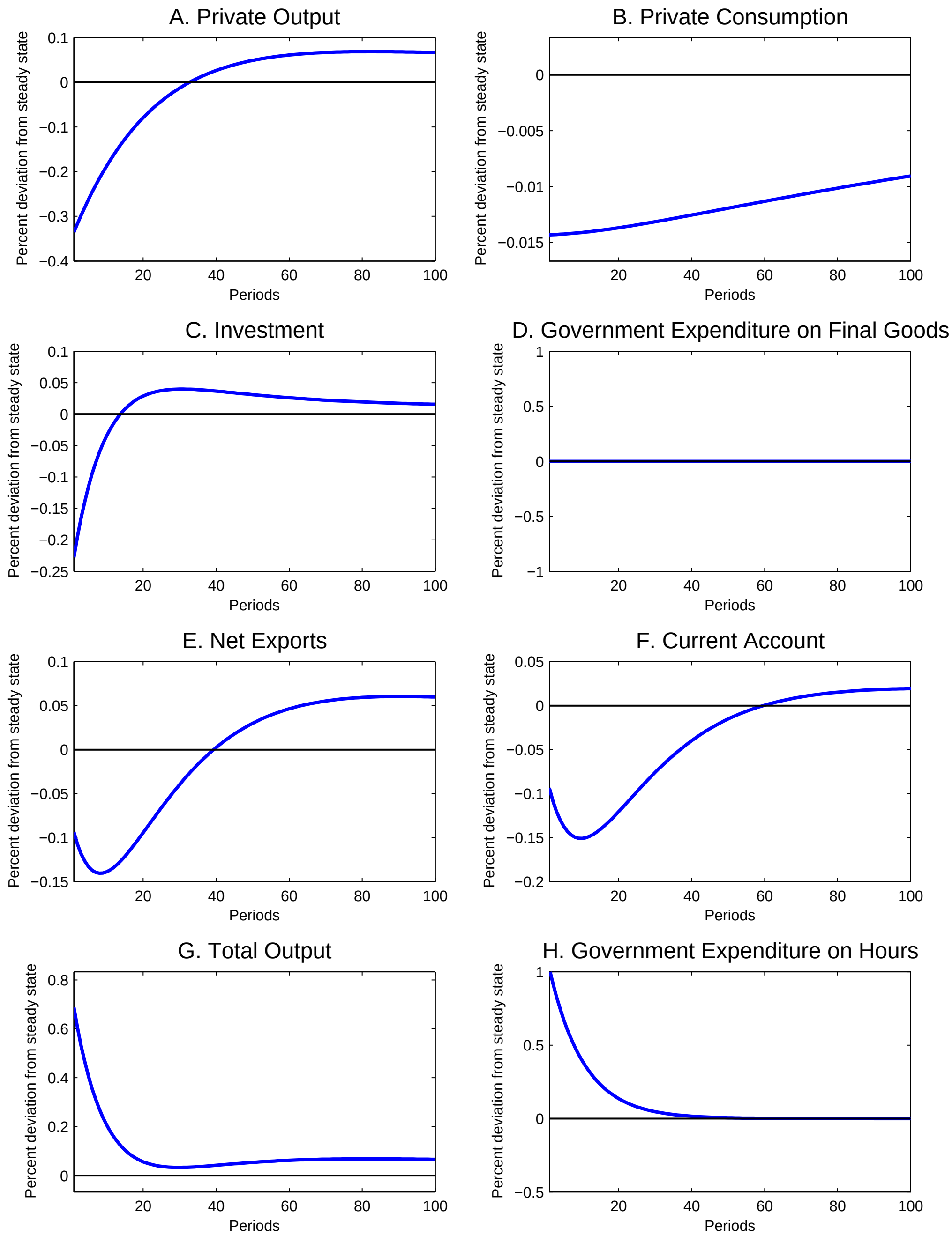
Note: This figure displays impulse responses of differences between home and foreign variables to a positive shock to government expenditure on final goods in the home country. The shock is equivalent to 1% of GDP. Responses are scaled in terms of percentages of steady-state total output (GDP).

Figure 3: Shock to government expenditure on final goods in the home country



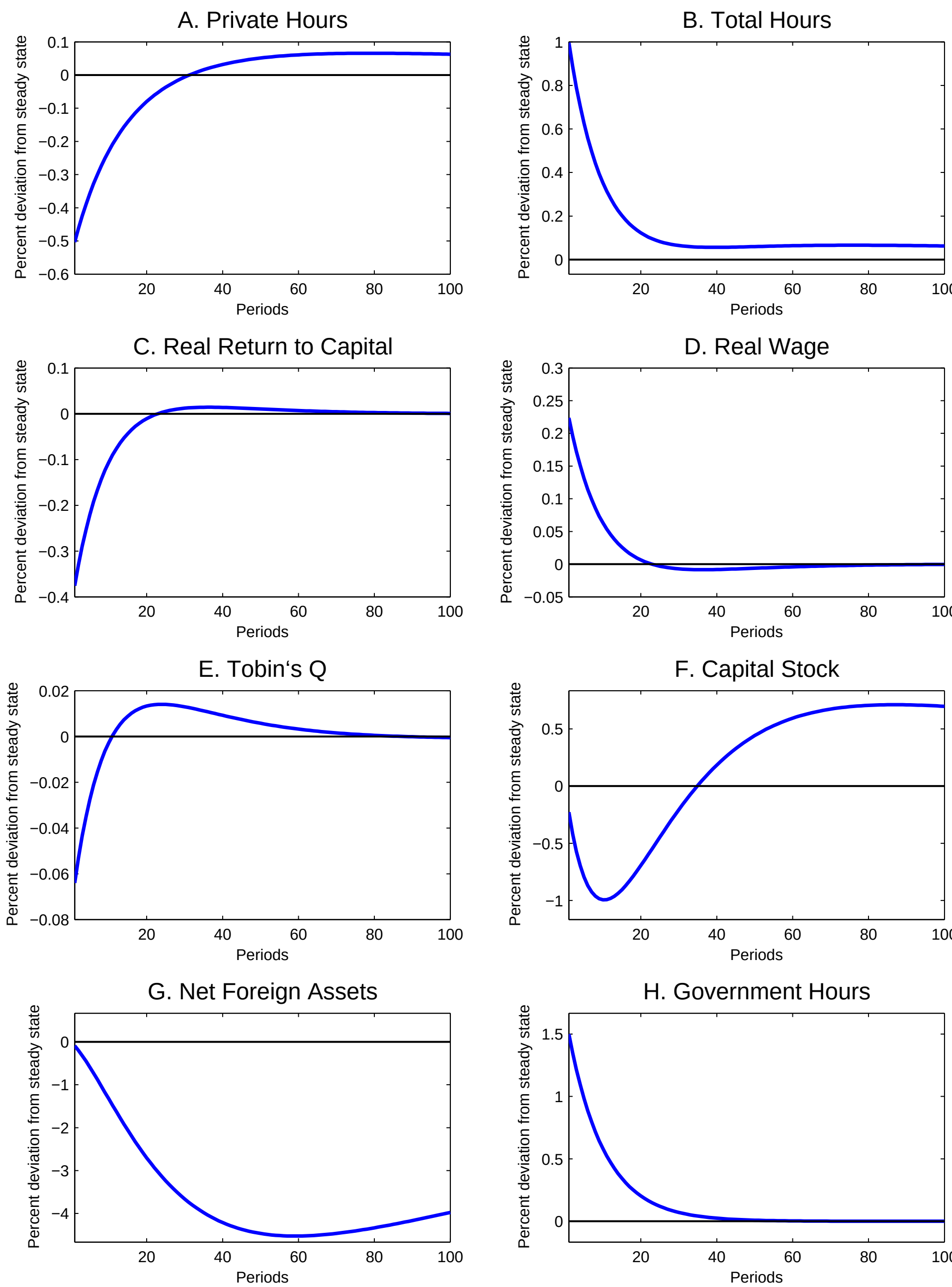
Note: This figure displays impulse responses of differences between home and foreign variables to a positive shock to government expenditure on final goods in the home country. The shock is equivalent to 1% of GDP. Responses for capital stock and net foreign assets are scaled in terms of percentages of steady-state total output (GDP). Responses for private hours and government hours are scaled in terms of percentages of steady-state total hours.

Figure 4: Shock to government hours in the home country



Note: This figure displays impulse responses of differences between home and foreign variables to a positive shock to government hours in the home country. The shock implies an increase in government expenditure on hours equivalent to 1% of GDP. Responses are scaled in terms of percentages of steady-state total output (GDP).

Figure 5: Shock to government hours in the home country



Note: This figure displays impulse responses of differences between home and foreign variables to a positive shock to government hours in the home country. The shock implies an increase in government expenditure on hours equivalent to 1% of GDP. Responses for capital stock and net foreign assets are scaled in terms of percentages of steady-state total output (GDP). Responses for private hours and government hours are scaled in terms of percentages of steady-state total hours.