The Macroeconomic Effects of War Finance in the United States: World War II and the Korean War

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During World War II, government expenditures were financed primarily by issuing debt. During the Korean War, expenditures were financed almost exclusively by higher taxes, reflecting President Truman's preference for balanced budgets. This paper evaluates quantitatively the economic effects of the different policies used to finance these two wars. Counterfactual experiments are used to explore the implications of financing World War II like the Korean War, and financing the Korean War like World War II. I find that using a Korean War policy during World War II would have resulted in much lower output and welfare relative to the actual policy. (*JEL* E62, E65, H30, N10)

Since organized societies have waged war, policy makers and economists have studied the problem of how best to finance war expenditures. Adam Smith (1776) and Alexander J. Hamilton (1787), for example, both recognized the benefit of issuing debt to finance emergency government spending, while A. C. Pigou (1916) considered debt and purely tax-financed policies for war expenditures to be equivalent. At the outbreak of World War II, John M. Keynes (1972) constructed a detailed policy to finance British war expenditures. The "radical" Keynes plan, submitted to the chancellor of the exchequer, recommended against the use of debt financing, and included the use of rationing and price controls, a sharply progressive surtax on private incomes, and a capital levy following the war. It is clear from these proposals that an important element of the Keynes policy was to generate significant revenue from contemporaneous taxation of factor incomes, in addition to shifting as much of the financial burden of the war as possible to wealthy citizens. The topic of war finance also has been a central issue in recent research, including theoretical studies by Robert J. Barro (1979), Robert E. Lucas, Jr. and Nancy L. Stokey (1983), and others who have analyzed dynamic optimal taxation.[1]

Despite the long-standing interest in the economic effects of war finance, however, there has not been much quantitative work done on this problem. The purpose of this paper is to evaluate quantitatively the macroeconomic effects of the different policies used to finance World War II and the Korean War. These episodes are of particular interest to contrast, because policies were strikingly different across these two wars. During World War II, U.S. war expenditures were financed primarily by issuing debt that allowed the government to smooth tax distortions over time, which is consistent with the Barro model. In addition, fairly high wartime inflation resulted in war debt bearing a low *ex post* rate of return. A similar pattern of government policy is

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[1] In addition to Barro, and Lucas and Stokey, the optimal taxation literature includes papers by Christophe Chamley (1981), Robert G. King (1990), Lucas (1990), and V. V. Chari et al. (1994). Most of this work draws on the early analysis of Frank Ramsey (1927). Empirical investigations of optimal taxation include Barro (1981) and Chaipat Sahasakul (1986). An important difference between Barro's work and that of Lucas and Stokey is the extent to which state-contingent policies are available. With complete contingent claims markets, as in Lucas and Stokey, the efficient policy is to tax capital heavily or adjust returns on government debt immediately upon the outbreak of war, rather than tax smooth as in Barro.

evident during the Revolutionary War, the War of 1812, the Civil War, World War I and, to some extent, the Vietnam War. Government policy, however, was very different during the Korean War. Expenditures were financed almost exclusively by higher capital and labor income taxes. Inflation was very low during this period, and for much of the Korean War the federal government recorded budget surpluses, rather than deficits.

The purpose of this paper is to evaluate quantitatively the macroeconomic effects of the different fiscal policies used by the United States to finance World War II, which was financed with tax-smoothing policies, and the Korean War, which was financed with balanced-budget-type policies. Given the sharp differences in the financing of government expenditures in these two wars, the focus of this paper is on the effects of the different fiscal policies adopted during these episodes. Both positive and normative issues are examined. I use a general equilibrium model with capital and labor income taxation to analyze the welfare costs associated with these different policies, and study their effect on aggregate variables such as output and the capital stock. Taking expenditures of specific war episodes as exogenous, the model economy is first used to estimate the effects of the actual government policies that were in place during these periods. The consequences of financing wars with different fiscal policies also are analyzed. Given the substantial policy differences between World War II and the Korean War, counterfactual experiments are used to explore the implications of financing World War II like the Korean War and, similarly, financing the Korean War like World War II.

I conclude from these experiments that historical differences in wartime government policies have important positive and normative implications. I find that using a Korean War (balanced-budget) policy during World War II would have resulted in much lower output and welfare. In particular, a permanent 3-percent increase in consumption would be required to compensate households under this policy. The use of a World War II policy during the Korean War would have resulted in a modest welfare gain relative to the policy that was used.

Section I provides a brief overview of these war episodes, highlighting differences in economic policy across war periods. Section II describes the model economy used in this paper. Section III discusses model parameterization and the procedure for calculating welfare costs. Section IV presents the welfare calculations and analyzes other economic effects for different experiments in war financing. A summary and conclusions are presented in Section V.

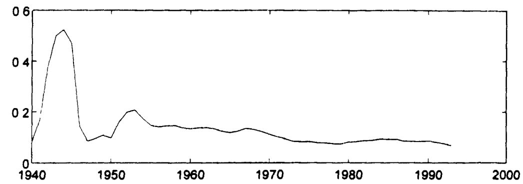

FIGURE 1. RATIO OF REAL FEDERAL GOVERNMENT PURCHASES TO REAL OUTPUT

I. Historical War Episodes

The most significant difference between the fiscal policies used to finance U.S. wars were those of World War II and the Korean War. This section summarizes the behavior of the U.S. economy during these two wars and, in particular, highlights differences in economic policy across the two periods. The data summarizing these differences are presented in Tables 1 and 2.

Growth in real output was considerable during both wars. Real GNP advanced 40 percent between 1941 and 1945, which represents an average annual growth rate of 8.4 percent. Compared to the natural rate series of output constructed by Nathan S. Balke and Robert J. Gordon (1986), GNP was 27 percent above trend at the peak of the war in 1944. Real output grew at a 5.1-percent annual rate during the Korean War, rising from nearly 4 percent below trend just prior to the war, to 5.5 percent above the Balke-Gordon natural rate index in 1952. The considerable increase in output during World War II reflected the enormous rise in military spending.[2] Figure 1 presents the ra-

[2] Using a real business cycle model, Mark Wynne (1989) finds that output rises significantly in response to temporary, large increases in government purchases, such as those that occurred during World War II.

TABLE 1—DESCRIPTIVE STATISTICS—WORLD WAR II AND THE KOREAN WAR

	Korean War (1950–53)	World War II (1941–45)
Output growth	5.1%	8.4%
Inflation rate (W.P.I.)	0.4%	9.6%
Money growth (M1)	4.0%	18.0%
Standard deviation of money growth	0.3%	2.5%
Government spending: Deviation from least-squares trend	29.0%	124.0%
Average capital tax rate: During war	62.6%	60.2%
Average capital tax rate: Prior to war	51.5%	43.8%
Average labor tax rate: During war	19.8%	17.5%
Average labor tax rate: Prior to war	16.2%	8.7%

Notes: All growth rates are annualized. Average taxes prior to war are the two-year average immediately preceding the war.
Sources: Lines 1–4, Balke and Gordon (1986) and Claudia Goldin (1980). Line 5, basic data: Kendrick (1961). Lines 6–9, Joines (1981).

TABLE 2—WAR FINANCING IN THE UNITED STATES

	Estimated percentage of expenditures financed by:	
	Direct taxes	Debt and seignorage
Revolutionary War	13.1	86.9
War of 1812	21.0	79.0
Mexican War	41.8	58.2
Civil War Union	9.3	90.7
Civil War Confederacy	13.0	87.0
Spanish-American War	66.0	34.0
World War I	24.0	76.0
World War II	41.0	59.0
Korean War	100.0	0.0

Source: Goldin (1980 pp. 938–40).

tio of federal government expenditures to output. At the peak of the war, government spending absorbed over 50 percent of GNP. Federal spending during the Korean War also was substantial, accounting for over 20 percent of GNP.

Labor income tax rates and, to a lesser extent, capital taxes rose during World War II. All tax rates are taken from Douglas H. Joines (1981). Prior to World War II, the average marginal tax rate on capital was about 44 percent, and the average marginal labor tax rate was just 9 percent. During World War II, labor tax rates rose to about 18 percent, and capital tax rates averaged about 60 percent. While these higher tax rates generated significant revenues, they were not nearly sufficient to finance war spending. The U.S. government issued considerable debt during the war at nominal interest rates ranging between 0.375 and 2.5 percent, and the debt-GNP ratio at the end of the war was at a record 1.2 percent. After the war, labor tax rates fell to 16 percent, and capital tax rates fell to 49 percent.

Taxes rose again during the Korean War, with capital tax rates rising to an average of about 62 percent. This represents the highest rate of capital income taxation in the history of the United States (see Joines, 1981; Ellen R. McGrattan, 1994). Labor tax rates rose from 16 percent to about 20 percent. It is important to note that the extra revenue generated by these tax increases was nearly sufficient to finance the Korean War effort. The average tax rates during the two wars are presented in rows 6 and 8 of Table 1. During the Korean War, the federal government did not rely much on deficit financing. The market value of the national debt, which was \$1.5 billion just prior to the start of the war in 1949, stood at \$1.47 billion in 1952 (see John Seater, 1981).

Perhaps the most striking indicator of the difference in government policy in U.S. wars can be seen in Table 2, which is taken from Goldin (1980). These data show that the United States has typically financed wars using a mix of direct contemporaneous taxes, debt, and money creation, with contemporaneous taxation financing a fairly small fraction of expenditures. (The unweighted average of war expenditures financed by direct taxes over all U.S. wars through World War II is 29 percent.) During the Korean War, however, Goldin estimates that virtually all war expenditures were financed by contemporaneous distorting taxes.[3]

[3] Goldin's estimate that the Korean War was financed completely by contemporaneous taxation was obtained by comparing the cost of the Korean War to the difference

Although the focus of this paper is on fiscal policy, it is interesting to note the sharp differences in monetary policy between these war periods. Row 2 of Table 1 displays the behavior of aggregate prices during these wars. Inflation is substantially lower during the Korean War than during World War II. Wholesale prices between 1951 and 1953 rose about 2 percent, compared to an increase of about 70 percent during World War II.

Milton Friedman and Anna J. Schwartz (1963) attribute the striking difference in inflation performance during the Korean War to monetary policy. Rows 3 and 4 of Table 1 present data on the money stock during World War II and the Korean War. Money growth was very rapid and volatile during World War II. The average growth rate of money growth (M1) between 1940 and 1946 was 18 percent, with a maximum increase of 30 percent in 1943. The standard deviation of money growth was 2.5 percent. During the Korean War, M1 grew at an average rate of 4 percent. Maximum growth occurred in 1952, with an increase of only 4.9 percent. The standard deviation of M1 during the Korean War was just 0.3 percent, which is reported by Friedman and Schwartz (1963) to be the least variable in the post-Civil War United States.

These data illustrate clearly the significant differences in economic policy that accompanied World War II and the Korean War. Korean War expenditures were financed principally by contemporaneously higher distorting taxes, in particular, higher capital taxes. Very little government debt was issued, and inflation was very low, even by peacetime standards.

This policy mix was not arrived at by accident: Paul Studenski and Herman E. Kroos (1963 p. 490) report that President Harry S. Truman continuously urged Congress "... to finance the greatest possible amount by taxation," and that he "... hoped to maintain a balanced budget, even if military costs doubled." In fact, Truman viewed the U.S. debt finance policy of World War II as a fiscal policy mistake: "During World War II, we borrowed too much and did not tax enough" (p. 490). With an emphasis on balanced budgets, the Korean War policy did not provide for any substantial smoothing of tax distortions. In contrast, government policies during World War II allowed for significant tax smoothing. The differences in war financing during these two episodes represent an important regime shift in the history of U.S. economic policy.

The focus of this paper is on the financing of temporary government spending shocks (war expenditures), so it is worth noting that there likely was a permanent component associated with Korean War expenditures. However, it is also important to recognize that the transitory component of expenditures during the Korean War was substantial (see Figure 1). Federal purchases rose sharply during the Korean War, and declined immediately after the war. Real federal purchases at the end of the Korean War in 1953 were nearly 40 percent higher than they were in 1956, and in fact returned to the level attained during the Korean War only twice (1967–1968) until 1985. (Real military purchases are not available before 1972.) In addition, tax rates also fell after the Korean War. These observations, and Truman's unconditional emphasis on maintaining a balanced budget, help motivate the interest in this episode and the abstraction from future conflicts such as the Vietnam War. In the experiments that are conducted, it is the transitory component of expenditures that will be examined. The identification of permanent and temporary components of expenditures is discussed further in Section IV.

II. The Model Economy

I use the neoclassical growth model with capital and labor income taxation to evaluate the economic effects of the different wartime fiscal policies adopted during World War II and the Korean War. This strategy provides a tractable way to estimate the welfare costs of different policies and analyze quantitatively the effects of these policies on aggregate variables such as output and the capital stock.

between tax revenue collected during the Korean War and peacetime (normal) government expenditures. She assumed peacetime expenditure was equal to average government expenditures between 1948 and 1950. The difference between wartime tax revenue and peacetime expenditure actually exceeds the cost of the war, which yields the 100-percent figure that she reported.

The economy consists of a large number of identical, infinitely lived consumers endowed initially with $\bar{k}$ units of capital and one unit of time each period. Individuals have perfect foresight. Consumers receive income from labor and capital services, matured government debt, and government transfers, and they use income to purchase consumption goods, finance new investment, and purchase government bonds. During wartime in the model, some individuals will be drafted into military service.

Output is produced from a constant returns to scale technology by a competitive firm using capital and labor. The government faces a sequence of spending requirements that are financed by taxing labor and capital income, and issuing noncontingent debt. I assume that lump-sum taxes are not available.

Individuals maximize the following lifetime utility function:

$$(1) \quad \sum_{t=0}^{\infty} \beta^t[\log(c_t) + v(l_t)], \qquad 0 < \beta < 1,$$

where c_t is date—t consumption, l_t is date—t leisure (nonmarket time), and β is the household's subjective discount factor. Since there is no consensus in the literature regarding the functional form of $v(l)$, the analysis is conducted under two different specifications for this function:

$$v(l) = \begin{cases} A(l_t) \\ B(\log(l_t)). \end{cases}$$

Following Gary D. Hansen (1985), the first specification for the function $v(l)$ is that leisure for the representative household enters utility linearly. This specification is often interpreted using Richard Rogerson's (1988) indivisible labor construct with lotteries.[4] With this linear specification, Hansen has shown that the variability of labor input in a business cycle version of this model is comparable to the cyclical variability of aggregate hours in U.S. data. In the second specification, leisure enters utility logarithmically, which results in lower intertemporal elasticity of leisure. Both of these preference specifications are consistent with the existence of a steady-state growth path in this model.

Individuals maximize (1) subject to the following sequence of wealth constraints:

$$(2) \quad T_t + (1 + R_t)b_t + (1 - \delta)k_t^p + (1 - \tau_{kt})r_t k_t^p + \tau_{kt}\delta k_t^p + (1 - \tau_{nt})w_t n_t \geq k_{t+1}^p + b_{t+1} + c_t.$$

Each period, individuals purchase consumption and new government debt (b_{t+1}), and carry forward next period's private capital stock (k_{t+1}^p). Funding for these purchases includes after-tax labor and capital income, [$(1 - \tau_{nt})w_t n_t$, $(1 - \tau_{kt})r_t k_t^p$], where w_t is the wage rate, n_t is hours worked, and r_t is the rental rate of capital. Wealth also includes transfers from the government (T_t), principal and interest on matured, one-period government debt [$(1 + R_t)b_t$], and undepreciated capital [$(1 - \delta)k_t^p$]. The term $\tau_{kt}\delta k_t^p$ is included to capture the depreciation allowance in the tax code.

Private investment is defined as:

$$(3a) \quad i_t^p = k_{t+1}^p - (1 - \delta)k_t^p.$$

Gross private investment is constrained to be nonnegative:

$$(3b) \quad i_t^p \geq 0.$$

[4] The linear-leisure specification has been used in a number of other studies, including Thomas F. Cooley and Hansen (1989) and Lawrence Christiano and Martin Eichenbaum (1992). In this paper, I will assume that individual households have linear preferences over leisure, rather than use the Rogerson-Hansen interpretation of the linear specification. I make this choice for two reasons. First, the explicit interpretation of the linear specification is not central for the main questions examined in this paper. Second, if lotteries were explicitly considered, the budget constraint would be more complicated, and individuals would maximize *expected* utility in equation (1) since there would be uncertainty over who would work. The use of an expectations operator in equation (1) would tend to be confusing in this otherwise perfect foresight environment.

The time constraint for the individual is:

$$1 = n_t + l_t. \tag{4}$$

This constraint restricts time spent in work and leisure to not exceed the time endowment, which is normalized to unity.

The sequences of government expenditures $\{G_t\}_{t=0}^{\infty}$, tax rates $\{\tau_{kt}\}_{t=0}^{\infty}$, $\{\tau_{nt}\}_{t=0}^{\infty}$, and transfers $\{T_t\}_{t=0}^{\infty}$ are viewed parametrically by individuals. To simplify the analysis, I have assumed that individuals have perfect foresight.[5]

Government exists to finance nonnegative sequences of expenditures $\{G_t\}_{t=0}^{\infty}$ and transfers $\{T_t\}_{t=0}^{\infty}$. Government purchases consist of government consumption (G_t^c) and government-financed capital investment (G_t^i):

$$G_t = G_t^c + G_t^i. \tag{5a}$$

Government-financed investment also is constrained to be nonnegative:

$$G_t^i \geq 0. \tag{5b}$$

I include government-owned capital in the model since the government-financed additions to the country's capital stock during the war through government-owned, privately operated (GOPO) capital (see R. Anton Braun and McGrattan, 1993). I assume that private capital and government-owned capital are perfect substitutes in production and depreciate at the same rate. GOPO capital is viewed parametrically by individuals. Given the assumption of perfect substitutes, the aggregate capital stock is the sum of private capital and government-owned capital (K_t^g):

$$K_t = K_t^p + K_t^g. \tag{6}$$

Following Lucas and Stokey (1983), I assume that government consumption does not enter utility functions or enhance private sector productivity.[6] Government spending is satisfied by capital and labor tax revenues, revenue from government-owned capital, and by issuing one-period, noncontingent debt. The period government budget constraint is given by:

$$G_t + T_t + (1 + R_t)B_t = \tau_{nt}w_tN_t + \tau_{kt}(r_t - \delta)K_t^p + r_tK_t^G + B_{t+1}. \tag{7}$$

A balanced-budget government policy is defined as one in which the present value of government expenditures and transfers equals the present value of government revenue:

$$\sum_{t=0}^{\infty} \left\{ \left(\prod_{t=0}^{\infty} [1/(1 + R_t)] \right) \times [G_t + T_t - \tau_{nt}w_tN_t - \tau_{kt}(r_t - \delta)K_t^p - r_tK_t^G] \right\} = 0. \tag{8}$$

A competitive, profit-maximizing firm produces output from the Cobb-Douglas production function:

$$Y_t = AK_t^{\theta}N_t^{1-\theta}, \; 0 < \theta < 1. \tag{9}$$

Capital letters indicate per capita quantities. Although this model abstracts from growth, it can be shown to be equivalent (up to a scale factor) to one with steady-state growth (see King et al., 1988).

The aggregate resource constraint for this economy is:

$$Y_t \geq C_t + I_t + G_t. \tag{10}$$

The last issue I wish to address in the model is the draft. During World War II, an average

[5] An alternative would be to work with a stochastic environment in which households do not know when wars occur, how long they may last, and how many resources are required to fight the war. I have conducted a stochastic analysis of this nature in Ohanian (1993), and found that for the specific environment I considered, many of the differences between the stochastic economy and the perfect foresight economy were modest.

[6] Barro (1981) discusses how public expenditures may affect utility by substituting for private spending. He notes that while expenditures such as school lunch programs may be almost perfect substitutes for private spending, deployment of national defense provides very little substitution.

of about 9 million individuals were in the armed forces, many of whom were conscripted. During the Korean War, the average number of military service personnel was about 3.5 million. The draft has potentially important implications, since it reduces the labor force and thus may affect aggregate labor input.[7] To incorporate the key feature that the draft reduced the U.S. labor force, the draft is modeled by removing a fraction of agents from the labor force in the model economy during wars. The number of hours spent in military activities by drafted agents is determined by the government, so leisure is not a choice variable for drafted individuals. Individuals in the military do not produce output.

To maintain the tractability of the representative agent construct, I assume that draftees are paid (given transfers) by the government such that their choices for consumption and investment would coincide with those of individuals who have not been drafted. Since utility is separable between consumption and leisure, the marginal utility of consumption is independent of leisure, which implies that the transfer required to maintain the representative agent construct is equal to the net wage income of those who are in the private labor force.[8] This seems to be a reasonable approximation to U.S. data, in that average compensation of military personnel during World War II was about 82 percent of the average compensation of nonmilitary employees (see Bureau of the Census, 1960 p. 735). Since the representative agent construct is maintained, distinctions between draftees and civilians is not important. Therefore, to conserve space and keep notation to a minimum, I do not distinguish between these types in the text.

Given initial endowments of capital, bonds, a balanced-budget government policy, sequences of tax rates, transfers, and government purchases, a *competitive equilibrium* for this economy consists of sequences for interest rates $\{R_t\}_{t=0}^{\infty}$, factor prices $\{w_t, r_t\}_{t=0}^{\infty}$, and allocations $\{k_{t+1}^p, b_{t+1}, l_t, c_t, n_t\}_{t=0}^{\infty}$, such that: (i) given the sequence of interest rates, tax rates, factor prices, and transfers, the sequence of allocations maximizes equation (1) subject to the wealth constraint [equation (2)]; (ii) factor prices equal marginal products:

$$w_t = A(1-\theta)(K_t/N_t)^{\theta} \tag{11}$$

$$r_t = A\theta(N_t/K_t)^{1-\theta}; \text{ and} \tag{12}$$

(iii) the net rate of return on government debt and capital is equated:

$$R_{t+1} = [(1-\tau_{kt+1})r_{t+1} + (1-\delta) + \delta\tau_{kt+1}] - 1.$$

This implies that the outstanding stock of government debt will be held in equilibrium. (iv) Allocations are feasible, and choices of bonds (b_{t+1}), capital (k_{t+1}^p), effort (n_t), and consumption (c_t) coincide with B_{t+1}, K_{t+1}^p, N_t, and C_t; and (v) the aggregate capital stock is the sum of private and government-owned capital: $K_t = K_t^p + K_t^G$.

Assuming an interior solution, the competitive equilibrium can be computed using the following set of efficiency conditions.

$$\partial v/\partial l = 1/c_t(1-\tau_{nt})w_t \text{ (leisure)}. \tag{13a}$$

$$c_{t+1}/c_t = \beta([1-\delta(1-\tau_{k,t+1}) + (1-\tau_{k,t+1})r_{t+1}]) \text{ (capital)}. \tag{13b}$$

$$c_{t+1}/c_t = \beta(1+R_{t+1}) \text{ (government bond holdings)}. \tag{13c}$$

$$T_t + (1+R_t)b_t + (1-\delta)k_t^p + (1-\tau_{kt})r_tk_t^p + \tau_{kt}\delta k_t^p + (1-\tau_{nt})w_tn_t - k_{t+1}^p - b_{t+1} - c_t = 0 \text{ (budget constraint)}. \tag{13d}$$

[7] The draft had other economic effects which I do not incorporate in this paper. In particular, the draft changed the composition of the labor force by pulling labor out of household production and into market production.

[8] See the Appendix for further discussion of the draft and the representative age construct.

These first-order conditions, with equations (4) and (8)–(12), the conditions $b_{t+1} = B_{t+1}$, $k^p_{t+1} = K^p_{t+1}$, $n_t = N_t$, $c_t = C_t$, and a present-value, balanced-budget policy, characterize the competitive equilibrium of this economy.

To compute the perfect foresight competitive equilibrium, I solve numerically the system of nonlinear equations that consists of the first-order conditions and resource constraints in the model economy. This involves feeding in government purchases, transfers, and tax rates, and solving for the allocations that satisfy the first-order conditions. After the Korean War, government purchases, taxes, and transfers all are constant. A nonlinear equation solver is used over T periods, where T is chosen such that the economy is in the neighborhood of the steady state. In some cases, the nonnegative constraint on investment was binding. If this occurred, gross investment was set to zero for that specific date. After period T, I use a version of Albert Marcet's (1989) method to compute the equilibrium. This procedure is very accurate in that the Euler equation errors were virtually zero.

III. Model Calibration and Welfare Cost Calculation

Prior to conducting the experiments of interest, values are assigned to the parameters describing preferences, technology, and government policy variables. The calibration of the model for World War II is based on data from 1942–1945, and the calibration for the Korean War is based on data from 1950–1953. The postwar calibration is based on data from 1954–1993.

The length of a period in the model is a quarter. The quarterly discount factor, β, is set equal to 0.99, which delivers a steady-state, annualized real interest rate of about 4 percent. The leisure preference parameter A (for the linear specification) is set to 2.25, and B (for the log specification) is set to 1.50. These values imply that the representative household spends about one-third of its discretionary time working in the steady states of the respective economies. A similar restriction has been used by Hansen (1985).

The average number of individuals in military service during World War II was about 9 million, and during the Korean War about 3.5 million. These data are used to determine the fraction of agents taken from the labor force in the model during the two wars. The fractions are defined as the ratio of individuals in the military to the total labor force, and average about 14 percent during World War II and 4 percent during the Korean War. During other periods, I assume that there are no military personnel. Payments to military personnel are treated as transfers to those individuals. These payments amounted to about $1,900 per individual during World War II, and to about $2,900 during the Korean War (Bureau of the Census, 1960 p. 735). Across the different experiments, the number of drafted agents is identical.

Joines (1981) has constructed a time series of average marginal rates for both capital and labor income taxes. This data has been updated by McGrattan (1994). Since the Korean War, the average marginal peacetime capital tax rate is 50 percent, and the average marginal peacetime labor tax rate is 23 percent. The difference between peacetime steady-state tax revenue and peacetime steady-state government spending, given these average marginal rates calculated by Joines (1981), equals peacetime transfers. During World War II and through the Korean War, transfers (other than payments to military personnel) are set to zero.

For the period beginning with World War II through the Korean War, I set the labor and capital income tax rates for this period equal to the average values calculated by Joines (1981) for the United States between 1942 and 1953. Specifically, the tax rates I use for the baseline model are based on Joines' series "MTRL1" (p. 203) and "MTRK1" (p. 204). This period includes U.S. participation in World War II through the end of the Korean War. The marginal labor tax rate averages about 0.2 during both World War II and the Korean War. The marginal capital tax rate averages 0.6 during World War II, and 0.62 during the Korean War. Based on the estimates of Joines (1981) and McGrattan (1994), it is interesting to note that the Korean War represents the highest level of capital taxation in the history of the United States. For the interwar period, tax rates equal the average values over the 1946–1949 period. Following the Korean

War, the average postwar tax rates of 23 percent on labor income and 50 percent on capital income are adjusted proportionally such that present-value budget balance is attained at the end of 1,000 quarters. Increased taxes are required for the postwar period, given that government debt will be issued during war episodes.

The parameter θ is capital's share of total output, and is fixed at 0.36, which is the value used by Finn E. Kydland and Edward C. Prescott (1982). The depreciation rate, δ, is chosen so that the steady-state, capital-output ratio for the model economy is consistent with the average value for the postwar U.S. economy. This implies a value of .0175, or an annual depreciation rate of 7.0 percent.

Postwar government spending on goods and services has averaged about 20 percent of GNP. For the model economy, this implies that steady-state government purchases are 20 percent of steady-state output, with the average marginal tax rates of 23 percent on labor and 50 percent on capital described above. During the two wars, steady-state deviations of government purchases are identified by calculating deviations from trend in the data over the war years. Government spending deviations from the steady-state value during this period are specified by subtracting the actual government spending time series between 1942 and 1953 from the estimated least-squares trend. Deviations from trend range between −18 percent (1948), and over 300 percent (1944).[9] The trend is estimated using John W. Kendrick's (1961) government spending data, spliced with data from the 1992 national income and product accounts (NIPA). Following the Korean War, government expenditures are constant, and equal to the steady-state value described above. Government expenditures and transfers are identical across all the economies considered. Government spending that is not satisfied by capital or labor tax revenue is financed by issuing competitively priced, one-period debt, with interest rates satisfying equation (13c).

The government invested substantially in capital equipment and structures during World War II. As in Braun and McGrattan (1993), data on GOPO capital are specified in the model by including additions to the capital stock in the model that are financed by the government during World War II. During peacetime, investment in GOPO capital was negligible, so I assume that it is zero in the model. GOPO capital is identical across all experiments.

The welfare analysis is based on allocations beginning with the start of the war in 1942, and continues over the 1,000 quarters following the end of the Korean War. Government expenditures and transfers are identical across all experiments. Following the Korean War, government expenditures, transfers, and tax rates are constant. As a result, the model converges to its steady state. Steady states will differ across the three experiments, since postwar tax rates will differ.

Choice of the initial privately owned capital stock in the model merits discussion, since the size of the capital stock can affect the welfare consequences of balanced-budget policies relative to tax-smoothing policies. The choice of the initial private capital stock in the model is based on an estimate of the U.S. capital stock relative to its estimated steady-state growth path at the start of World War II.

Between 1929 and 1941, the private capital stock in the United States fell in absolute terms about 16 percent,[10] reflecting the extraordinarily low rate of physical investment in the 1930's. For example, average real fixed investment over the entire decade of the 1930's was only *half* of its level in 1929, and was even below the level of the early 1900's, when population and output were both about 60 percent lower. To get an *initial* estimate of the private

[9] An alternative approach is to use a model-based procedure to identify permanent components, as in Barro (1979). Wynne (1989) has used Barro's approach, and computed estimates for permanent and transitory components that are similar to those reported in this paper.

[10] See Bureau of Economic Analysis (BEA) (1993 p. 213). Alternate measures of capital during this period are similar to the BEA data. Laurits R. Christensen and Dale W. Jorgensen (1995) have constructed times series of capital input using procedures that differ considerably from those of the BEA, including depreciation schedules that tend to suffer less from the type of potential bias discussed below. They also report a considerable decline in private capital input during this period.

capital stock in 1941 relative to the steady-state growth path, I assume that in 1929 the capital stock is on the steady-state growth path, and that trend growth (including population growth) is a relatively modest 2 percent. This procedure implies that in 1941 the capital stock would be more than 40 percent below the steady-state growth path.[11]

However, the official capital stock data may be too low, because capital may have been retired at a slower rate in the 1930's than was reported by the U.S. Department of Commerce.[12] One way to account for this possibility is to adjust depreciation rates during the 1930's. It seems reasonable to make an adjustment along these lines in calculating an initial capital stock for use in these experiments, but unfortunately lack of data makes it unclear as to how large the adjustment should be. With this in mind, I have used an initial private capital stock of 25 percent below the steady state at the start of the war. This choice tries to strike a balance between the fact that: (1) the very low level of investment in the 1930's led to a low capital stock before the war; and (2) depreciation likely was overstated during the 1930's. The choice of a private capital stock that is 25 percent below the steady-state growth path implies a downward adjustment to the depreciation rate during the 1930's of about 40 percent, and in absolute terms, implies a modest *increase* in the capital stock during the 1930's, rather than the 16-percent decline reported by the U.S. Department of Commerce. Since depreciation includes wear and tear, accidental damage, aging, and obsolescence, this seems like a fairly generous adjustment. It should be noted, however, that the *total* capital stock in the model during the war is significantly larger than the 25-percent deviation in the private capital stock because of GOPO capital, which was about 10 percent of total capital during the war.

Use of a larger initial capital stock at the start of the war tends to reduce the welfare cost of balanced-budget policies relative to tax-smoothing policies, while a smaller capital stock tends to increase the relative cost of balanced-budget policies. To understand how important this issue might be for the welfare costs of these different policies, I conduct a sensitivity analysis. In addition to the initial capital stock specified here, I evaluate the welfare costs of the different policies under two other initial conditions. The first initial condition on capital for the sensitivity analysis is that initial capital is 42 percent below trend, which is my estimate based solely on the official capital stock data. The other initial condition for the sensitivity analysis is that capital is at the steady-state value. The results of this sensitivity analysis are presented in Section V.

The final issue regarding the capital stock is the specification of the initial stock across *different* policies. The analysis begins at the outbreak of World War II. Within the deterministic environment that I use, it is fairly standard practice to start the analysis when the exogenous event of interest takes place, and this also facilitates comparison of my findings to other results in the literature. Given that the analysis begins at the start of World War II, I use the same initial capital stock across all three experiments. This has important implications, since if the initial date of this deterministic economy was *prior* to the start of the war, prewar capital accumulation would differ across the three policies I consider. In particular, households would accumulate less capital if they knew in advance that capital tax rates would be raised to maximize tax revenue during World War II. This implies that if the starting date of the analysis was prior to World War II, then under the balanced-budget policy the capital stock (the tax base) would be low relative to the baseline policy. The low capital stock would reduce maximum tax revenue that could be generated during the war, and the

[11] It does not seem unreasonable to assume that the capital stock is in the neighborhood of the steady-state growth path in 1929. According to Kendrick (1961), the average growth rate of capital during the 1920's was about 2.6 percent, about 2.1 percent per year in the 1910's, and about 3 percent per year between 1900 and 1909. Assuming a different year for the capital stock to be on the steady-state growth path in the 1920's (rather than 1929) does not change significantly the calculated deviation in 1941. An alternative approach is to fit a least-squares time trend to the data. This procedure gives a similar deviation from trend for 1941, but because of the sensitivity of ordinary least squares (OLS) to outliers (those observations in the 1930's), implies that the capital stock in the 1980's is about 30 percent above trend.

[12] The possible underestimate of the capital stock during the 1930's was suggested to me by Jack Triplett of the U.S. Department of Commerce.

transition from the low capital stock to the new postwar steady-state capital stock would take longer. All of these effects would tend to increase the welfare costs of the balanced-budget policy. Thus, starting the analysis at the beginning of the war and using identical initial capital stocks in all the experiments tends to reduce the distortions associated with the balanced-budget policy.

To obtain the welfare cost of a specific policy, I calculate the additional level of consumption to give to households such that their utility level achieved under a specific policy is equal to utility achieved under the baseline policy. The welfare analysis is based on allocations beginning with the start of the war in 1942, and continues over the 1,000 periods (quarters) following the end of the Korean War. Specifically, for both utility-function specifications (linear and log leisure), I find the value x that satisfies the following equation:

$$(14) \qquad \sum_{t=0}^{J} \beta^t [\log[c_t^*(1+x)] - v(l_t^*) - \bar{U}_t] = 0,$$

where $\bar{U}_t$ is defined as the utility level under the baseline policy: $\log(\bar{c}_t) - v(\bar{l})_t$, c_t^* and l_t^* are allocations under the alternative policy, and $J = 1{,}000$.[13]

IV. Economic Analysis of Government Policies

This section presents quantitative estimates of the economic effects of the different fiscal policies that were used to finance World War II and the Korean War. I consider the following counterfactual experiments: what would be the consequences if World War II had been financed like the Korean War under Truman, or like Britain's World War II efforts under the Keynes plan, in which emphasis was placed on high contemporaneous taxation and balanced budgets? Similarly, what if the Korean War had been financed with tax-smoothing policies?

Figures 2–5 display the behavior of output, labor input, consumption, and the capital stock in the baseline model economy with linear leisure during the 1941–1953 period relative to the actual U.S. time series. The capital stock series for both the model and the data are private capital, and therefore do not include GOPO capital. The U.S. data are from Kendrick (1961) and NIPA, and are measured as percent deviations from a least-squares trend, with the exception of the capital stock, which is measured relative to trend as described in the previous section. Kendrick did not adjust his labor input series for the fact that the draft reduced the private labor force. To make the model labor input series comparable to the data, I follow Kendrick and do not adjust the labor input from the model for the draft. The measure of labor input from the model in Figure 3 is the percent deviation of total hours worked from steady-state (peacetime) total hours worked. In all other figures, the model equilibria also are measured as percent deviations from the peacetime steady state. The model equilibria are presented as annual averages of quarterly model data.

The distinctive features of the actual time series are the sharp increases in output and labor supply that occurred during World War II, and the more modest increases in these variables during the Korean War. Consumption and the capital stock fell during World War II, and rose significantly after the war. It is interesting that the simple baseline model economy is consistent with some of these wartime features. In particular, the model generates qualitatively similar paths for output and labor input during this period.

One difference between the model and the data is that model output deviations are lower than the actual data, while labor input and the capital stock are *higher* in the baseline model. This deviation between model and data likely reflects three issues. First, capital utilization increased substantially during the war (see Murray Foss, 1963), which will lead to higher output. I abstract from variation in capital utilization intensity in the model economy, however. Second, the use of price controls and

[13] Since the functional forms for preferences and technology are consistent with balanced growth, it is straightforward to add exogenous labor-augmenting technical progress to this model. This does not affect the welfare computations, since the benefit of a growing economy in eliminating debt is offset by higher real interest rates for the model specification that was chosen.

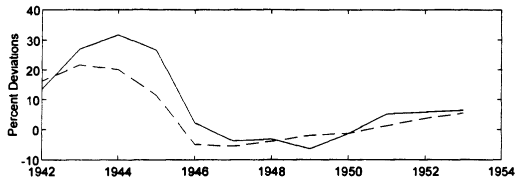

FIGURE 2. OUTPUT: U.S. DATA (SOLID) AND BASELINE MODEL (DASH)

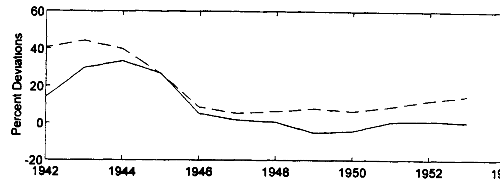

FIGURE 3. LABOR INPUT: U.S. DATA (SOLID) AND BASELINE MODEL (DASH)

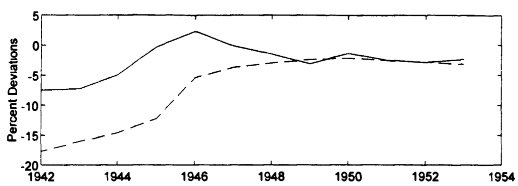

FIGURE 4. CONSUMPTION: U.S. DATA (SOLID) AND BASELINE MODEL (DASH)

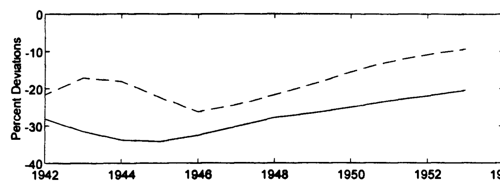

FIGURE 5. PRIVATE CAPITAL STOCK: U.S. DATA (SOLID) AND BASELINE MODEL (DASH)

changes in the composition of output during the war made measurement of output difficult during this period, so it is likely that measurement error is a problem during this period. Third, measured "productivity" rose considerably in the United States during the war, but there is no change in technology in the model. (Of course, as N. Gregory Mankiw [1989] has pointed out, the measured increase in productivity during the war may reflect imperfect measurement of factor intensity use.) Another notable difference between the model and the data is the time path of the capital stock. In the data, the capital stock falls gradually during World War II. In the model, the capital stock rises modestly during the early part of the war, and declines in the late stages of the war. I have found that this deviation is due to the perfect foresight nature of the model. Given the perfectly foreseen sharp increases in government expenditures during the war, the capital stock is increased in the early stages of the war to help smooth consumption.[14]

To achieve present-value budget balance for the baseline model, the average postwar tax rates on labor income of 23 percent and on capital income of 50 percent are increased proportionally to 27 percent and 58 percent, respectively.

The first experiment, which is summarized in panel B in Table 3, evaluates the implications of financing World War II with balanced-budget-type fiscal policies similar to those used during the Korean War. For this high-tax experiment, I choose the tax policy that maximizes the present value of tax revenues during World War II. To identify this policy, I search over different combinations of labor and capital income tax rates during the war. I find that maximum present-value tax revenue is obtained by setting labor income taxes during World War II to 64 percent, and capital income taxes to 100 percent (net of depreciation).[15] This policy generates nearly enough

[14] In experiments with the same model, but with uncertainty over government expenditures (the duration of the war), the time path of the capital stock in the model is fairly similar to that in the data.

[15] It turns out that 100-percent capital income taxation (net of depreciation) every period during the war generates maximum present-value tax revenue. This is because with nonnegative investment, capital is effectively a fixed factor and, therefore, is supplied inelastically. If gross investment was allowed to become negative, the revenue-maximizing tax rates on both capital and labor income would be lower, and the welfare costs of this policy would be higher.

TABLE 3—WELFARE COSTS OF ALTERNATIVE POLICIES—LINEAR-LEISURE SPECIFICATION

Policy	τ_n	τ_k	Welfare cost of alternative policy[a]
A. Baseline policy			
WWII	0.19	0.60	
Korea	0.20	0.62	
Postwar[b]	0.26	0.58	
B. Korean policy			3.0%
WWII	0.64	1.00	
Korea	0.20	0.62	
Postwar	0.20	0.45	
C. WWII policy			−0.4%
WWII	0.19	0.60	
Korea	0.23	0.50	
Postwar	0.26	0.58	

[a] The welfare cost of a policy is the permanent change in consumption required to equate lifetime utility under the counterfactual policy to lifetime utility under the baseline policy. See Section IV for additional discussion.

[b] Postwar tax rates are obtained by proportionately adjusting actual average postwar tax rates to achieve present-value budget balance.

revenue to finance the war as a balanced-budget item. Competitively priced, one-period debt is issued to satisfy remaining government spending requirements. Note that the baseline Korean tax policy is not changed for this experiment. Following the Korean War, government expenditures and transfers are constant and equal to those in the baseline model. Post-Korean War tax rates also are constant (although not equal to those in the baseline model), and this economy converges to its steady state.

I find that these temporary wartime increases in labor and capital income taxes have large positive and normative effects. Figures 6–9 present the paths of percent steady-state deviations in consumption, output, labor supply, and the capital stock for the baseline economy and the balanced-budget economy. Consumption falls over the course of the war, and the capital stock falls each period at the rate of depreciation, reflecting the binding nonnegative constraint on investment. The capital stock under the high-tax policy at the end of the war is about 25 percent lower than under the baseline policy. Labor input, which rises sharply in the baseline case, averages about 15 percent below the steady state in the high-tax economy during World War II. *Peak* output in the baseline economy is more than 20 percent above the steady state, but is about 13 percent *below* the steady state in the high-tax economy. Consumption averages about 14 percent below the steady state in the baseline economy, but is about 50 percent below the steady state in the high-tax economy.

While the marginal cost of this high-tax policy is the severe distortions imposed on households during World War II, the marginal benefit is that war debt in this high-tax economy is substantially lower than in the baseline policy. This allows postwar tax rates that are considerably lower than the tax rates that deliver present-value budget balance in the baseline experiment. These lower tax rates yield higher asymptotic labor input, capital stock, output, and consumption. The benefit of these lower postwar taxes, however, does not nearly offset the cost of temporary high taxes during World War II.

From a welfare perspective, an important effect of this policy is that consumption and leisure must fall significantly below their steady-state levels for some time as the capital stock converges to the steady state. The welfare compensation calculations of this policy are presented in panel B of Table 3. This table shows the permanent change in consumption required to equate lifetime utility under the counterfactual policy to lifetime utility under the baseline policy. To compensate individuals in this high-tax economy, consumers would require a permanent 3-percent increase in consumption, which corresponds to over 2 percent of steady-state GNP. The magnitude of this change is comparable to major tax reforms studied by Cooley and Hansen (1992). In particular, it is about 60 percent of the estimated utility change from *permanently* eliminating all labor income taxes in the United States.

The welfare cost of the balanced budget is somewhat sensitive to the choice of the initial private capital stock, which was 25 percent below the steady state for the experiment described above. If the raw deviation from trend in the published government data was used as the initial stock (recall that in the BEA data, the capital stock declined in absolute terms about 16 percent between 1929 and 1941, and over 40 percent relative to trend), the welfare cost of financing World War II using the

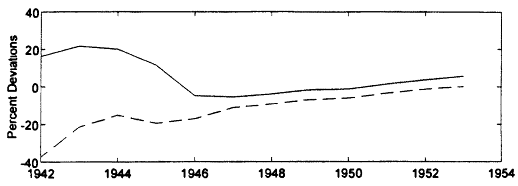

FIGURE 6. OUTPUT: BASELINE MODEL (SOLID) AND BALANCED-BUDGET MODEL (DASH)

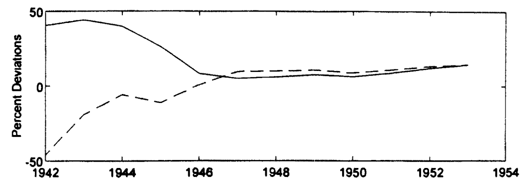

FIGURE 7. LABOR INPUT: BASELINE MODEL (SOLID) AND BALANCED-BUDGET MODEL (DASH)

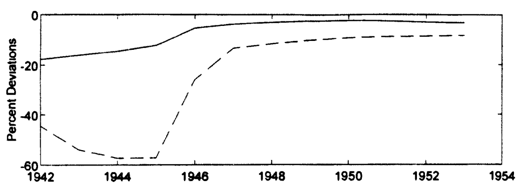

FIGURE 8. CONSUMPTION: BASELINE MODEL (SOLID) AND BALANCED-BUDGET MODEL (DASH)

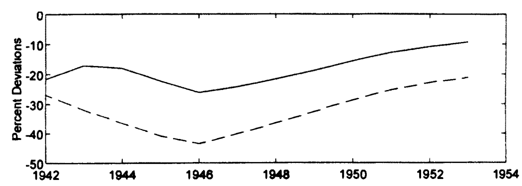

FIGURE 9. PRIVATE CAPITAL STOCK: BASELINE MODEL (SOLID) AND BALANCED-BUDGET MODEL (DASH)

high-tax policy would be 4.7 percent of consumption. On the other hand, if the initial capital stock was set to the steady-state value, which is surely much too high given the very low level of investment during the 1930's, the welfare cost of the high-tax policy would be about 1.6 percent of consumption.

The third experiment considers financing the Korean War with tax-smoothing policies. I consider a shift from the baseline policy used during the Korean War of high capital tax rates to a policy that sets tax rates equal to the average postwar tax rates calculated by Joines of 23 percent on labor income and 50 percent on capital income, respectively, relative to the baseline Korean War tax rates of about 20 percent, and 63 percent, respectively. Competitively priced debt is issued to satisfy the balance of government expenditures, and debt issue under this is about the same as under the baseline model. Following the Korean War, government expenditures and transfers are constant over time and equal to those in the baseline model. Post-Korean War tax rates also are constant over time, and this economy also converges to its steady state.

Figures 10–13 display percent steady-state deviations in output, labor input, consumption, and the capital stock in the baseline and World War II policy economies immediately after World War II until the mid-1960's. (The two economies have identical equilibria during World War II because tax policies are the same during this period, and because nonnegative investment is binding in both models at the end of the war. In the absence of this binding constraint, investment at the end of the war would differ in the two economies, reflecting differences in future tax policies.) The relatively high capital tax rates during the Korean War in the baseline model lead to lower labor input and output immediately after World War II as seen in Figures 10 and 11. Moreover, the capital stock is significantly lower in the baseline model after World War II (see Figure 13). It is interesting to note that both consumption and the capital stock under the tax-smoothing policy are higher than in the baseline model for nearly 20 years after the end of the Korean War.

Panel C of Table 3 presents the welfare difference between these two economies. Lifetime utility under the counterfactual policy is higher than under the actual policy. To equate lifetime utility in the counterfactual economy to the baseline economy would require a permanent 0.4-percent reduction in consumption under the counterfactual policy, which corresponds to about 20 billion current dollars. To put this in perspective, I have calculated the welfare difference between the baseline economy and the same economy that did not ex-

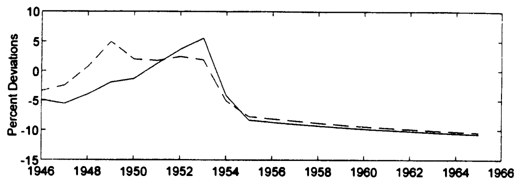

FIGURE 10. OUTPUT: BASELINE MODEL (SOLID) AND TAX-SMOOTHING MODEL (DASH)

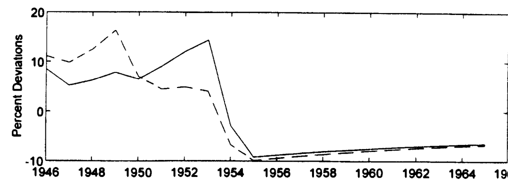

FIGURE 11. LABOR INPUT: BASELINE MODEL (SOLID) AND TAX-SMOOTHING MODEL (DASH)

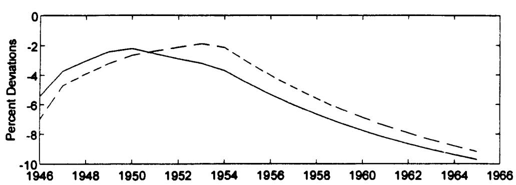

FIGURE 12. CONSUMPTION: BASELINE MODEL (SOLID) AND TAX-SMOOTHING MODEL (DASH)

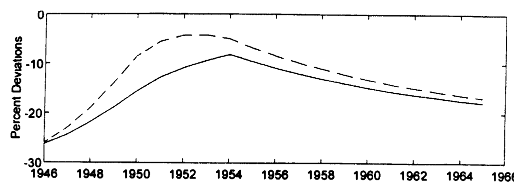

FIGURE 13. PRIVATE CAPITAL STOCK: BASELINE MODEL (SOLID) AND TAX-SMOOTHING MODEL (DASH)

perience the Korean War. I find that the welfare cost of this war is about 1.3 percent. This suggests that the relative cost of the Korean War could have been reduced by about 30 percent by adopting the alternate policy. While this utility difference is small relative to the estimates associated with financing World War II, it is important to recognize that this is a permanent change in consumption in response to a relatively modest policy shift over a three-year war.[16]

Both of the counterfactual experiments also were conducted with log leisure in utility, rather than linear leisure. Since the behavior of this economy over the 1942–1953 period is qualitatively similar to the linear case, (and is not as consistent with U.S. data over the period of interest), I do not present analogs of Figures 2–13. The main positive difference between the two economies is that labor input (and output) during the war are considerably lower in the log-leisure economy, which reflects the fact that intertemporal elasticity of leisure is lower with this preference specification. The main normative difference is that the welfare costs of the balanced-budget policy are somewhat smaller in the log-leisure economy, with a permanent increase in consumption of 2.3 percent to compensate households under the Korean War policy. The welfare benefit of using a tax-smoothing policy during the Korean War in the log-leisure model is roughly the same as in the linear-leisure model. These results are presented in Table 4.

V. Summary and Conclusions

The purpose of this paper was to evaluate quantitatively the economic effects associated with the different fiscal policies that were used during World War II and the Korean War. An intertemporal general equilibrium model was constructed and calibrated to match particular features of U.S. macroeconomic time series.

I first simulated the model economy under spending shocks and government policies that approximate the actual U.S. experience of 1941–1953. This baseline artificial economy was able to replicate several important features of the data, including the substantial increases in labor input and output that occurred during World War II. The first experiment analyzed the effects of financing World War II with balanced-budget policies in the spirit of those used during the Korean War. I find that a per-

[16] The welfare benefit of the alternate policy is also large relative to the calculations presented by Lucas (1987) for the benefit of eliminating business cycles.

TABLE 4—WELFARE COSTS OF ALTERNATIVE POLICIES—LOG-LEISURE SPECIFICATION

Policy	τ_n	τ_k	Welfare cost of alternative policy
A. Baseline policy			
WWII	0.19	0.60	
Korea	0.20	0.62	
Postwar	0.28	0.60	
B. Korean policy			2.3%
WWII	0.64	1.00	
Korea	0.20	0.62	
Postwar	0.22	0.49	
C. WWII policy			−0.3%
WWII	0.19	0.60	
Korea	0.23	0.50	
Postwar	0.28	0.60	

Note: This table differs from Table 3 by analyzing the utility-function $\log(c_t) + B \log(\ell_t)$.

manent, significant increase in consumption is required to compensate households under the Korean War policy for World War II. This compensating increase is 3 percent for the model with linear preferences over leisure, and is 2.3 percent with logarithmic preferences over leisure. This cost is high, and reflects the sharp increase in labor and capital income taxation associated with a policy that maximizes contemporaneous tax revenue from labor and capital income. The behavior of macroeconomic variables under this policy is very different. Labor input and output both fall considerably relative to the baseline model, and the capital stock declines about 30 percent. This significant drop in the capital stock results in persistent postwar declines in leisure and consumption as the capital stock converges to the steady state.

The second experiment examined the behavior of the economy if tax-smoothing policies in the spirit of World War II were used to finance the Korean War. A policy of lower capital taxes and somewhat higher labor taxes during the Korean episode is estimated to have provided a permanent benefit to households equal to 0.4 percent of consumption. While this calculation is small relative to the World War II experiment, it suggests that the costs of the Korean War could have been reduced about 30 percent by a relatively modest policy change.

Studenski and Kroos (1963 p. 493) reported that President Truman hoped to maintain a balanced budget during the Korean War "... even if military costs doubled." Moreover, he stated that "... our people understand that if we had paid higher taxes in World War II we would be better off today. During World War II, we borrowed too much and did not tax enough." The results presented here suggest that if the balanced-budget policy Truman advocated *was* welfare improving over actual World War II policy choices, it must be through some channels not specified within the growth model used in this paper.

There are a number of additional issues that could be studied within this type of framework. First, a stochastic version of this model could be used to analyze the Ramsey solution to the problem of financing these two wars. Second, given the substantial increase in capital utilization that occurred during the war, it may be of interest to amend the model so that capital utilization was a choice variable, and depreciation was a positive function of the utilization rate. In this type of environment, capital services would be very elastic, and the welfare costs of high-tax policies may be much higher than those reported in this paper. In addition, the representative agent construct could be changed, so that issues associated with how the finance burden is distributed across subgroups of the population could be studied.[17]

APPENDIX

A draft that reduces the labor force is constructed in the representative agent framework as follows. In the model, there are draftees and civilians, and these individuals are subscripted to indicate their status: $i \in \{d, c\}$. I assume that draftees cannot choose leisure. Prewar capital and bonds for the two types are identical, and the notation is the same as in the text.

Preferences are identical for the two types, and are given by:

$$\text{(A1)} \quad \text{Max} \sum_{t=0}^{\infty} \beta^t [\log(c_{it}) + v(l_{it})].$$

[17] These two suggestions are from a referee of this journal.

At the start of the war, the budget constraint is:

$$(A2)\quad T_{it} + (1 + R_t)b_t + (1 - \delta)k_t^p + (1 - \tau_{kt})r_t k_t^p + \delta\tau_{kt}k_t^p + (1 - \tau_{nt})w_t n_{it} \geq k_{it+1}^p + b_{it+1} + c_{it}.$$

Draftees are given transfers such that the wealth of the two types is identical:

$$(A3)\quad T_{dt} = T_{ct} + (1 - \tau_{nt})w_t n_{ct}.$$

The efficiency conditions for accumulating capital and bonds are:

$$(A4)\quad c_{it+1}/c_{it} = \beta[(1 - \tau_{kt+1})r_{t+1} + (1 - \delta) + \delta\tau_{kt+1}].$$

$$(A5)\quad c_{it+1}/c_{it} = \beta(1 + R_{t+1}).$$

Since the types have identical separable preferences across consumption and leisure and have identical wealth, they will allocate their wealth identically so that:

$$c_{dt} = c_{ct} \qquad k_{dt+1}^p = k_{ct+1}^p \qquad b_{dt+1} = b_{ct+1}.$$

Thus, the only difference between the two types is the amount of leisure they consume. Essentially the same result is found in Hansen (1985), who studied an economy with perfect unemployment insurance in which individuals differed in their employment status, but because of separable utility across consumption and leisure, all individuals receive identical consumption allocations.

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