



# The fiscal role of conscription in the U.S. World War II effort<sup>☆</sup>

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## ABSTRACT

An often overlooked role of conscription is as a method of lump sum taxation in times of war. Conscription of military personnel allows the fiscal authority to minimize wartime government expenditure, and hence, minimize tax distortions associated with war finance. This paper presents a simple dynamic general equilibrium model to articulate this view, and calibrates the model to the U.S. World War II experience. Analysis of the calibrated model indicates that the welfare value of conscription as a fiscal policy tool is quantitatively large: despite the fact that the American involvement lasted only four years, conscription is worth approximately 2% of annual aggregate consumption in perpetuity.

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## 1. Introduction

Conscription, or the “military draft,” allows the government to bypass the labor market in meeting its military staffing needs. The government is thereby able to pay soldiers below-market wages, thus minimizing tax distortions associated with financing military expenditures. In many countries, conscription has been used primarily during times of major war. It was instituted during the American Civil War by both the Union and the Confederacy, and during the U.S. involvement in World Wars I and II, and the Korean and Vietnam Wars. Given historical practice, conscription can be viewed as a *fiscal shock absorber*: a lump sum tax enacted in periods of unusual wartime spending.

The literature on optimal policy stresses the value of fiscal instruments that have this shock absorbing ability (see Lucas and Stokey, 1983; Chari et al., 1991). For instance, state-contingency in capital income tax rates or in returns on government liabilities act as *ex post* lump sum taxes that allow tax distortions to be smoothed in the face of budgetary shocks. Inspection of the U.S. experience during WWII indicates that such instruments were not used to the full extent prescribed by theoretical analysis. The clearest indication of this is the accumulation of government debt throughout the war that was

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**Table 1**  
Military statistics from selected U.S. Wars

Conflict	Enrollment		Casualties			Cost	
	Total (thousands)	Per capita (%)	Total per enrolled (%)	Combat deaths per enrolled (%)	Combat deaths per month	Average annual GDP share (%)	Per capita (2002\$)
Civil War	3713	15.2	23.9	5.8	4478	17	2532
World War I	4735	6.8	6.8	1.1	2811	14	2718
World War II	16 113	15.6	6.7	1.8	6626	41	27 957
Korean War	5720	5.1	2.8	0.6	912	5	2985
Vietnam War	8744	5.9	2.8	0.5	354	2	3340
Persian Gulf War	2322	1.2	0.1	0.01	147	4	384

Note: For data sources and detailed description of statistics, see Appendix A of the supplementary material to this paper, available online via ScienceDirect.

only gradually paid down through persistently higher postwar taxation (see Barro, 1979; Ohanian, 1997). The optimal state-contingent policy response would have involved something akin to a sharp capital income tax levy or a repudiation of real debt (either explicitly, or in the form of a spike in inflation) enacted at the outset of the American involvement in 1941.

This observation leads to two natural questions. If not these, what policy instruments did the government use to help absorb the WWII shock? And given the magnitude of the war, was the welfare value of this policy instrument large or small? This paper argues that military conscription played such a role, and that its value was quantitatively large.<sup>1</sup>

A simple, dynamic general equilibrium model is formulated to articulate this view. Conscription is part of an optimal policy when the model economy is subject to episodes of war. The model is calibrated to the U.S. WWII experience and two counterfactual experiments are performed. One replicates the war, but with the government hiring an all-volunteer armed forces. The other has the government instituting an *optimal* conscription. Together, these experiments quantify the welfare value of conscription as a fiscal policy tool during WWII.

The U.S. experience represents a unique episode to address this question. Table 1 presents a comparison of selected statistics across major U.S. wars. It is clear that while some wars were truly massive endeavors, others were not. By virtually any measure, WWII was the largest war or military conflict in U.S. history. In the peak year of 1945, over 12 million men served on active duty in the armed forces<sup>2</sup>. This represented nearly 12% of the adult population and over a quarter of prime-aged American men. The vast majority were conscripted. The first Selective Service Act was passed in August of 1940, and inductions began in earnest in 1941. By December of 1942, conscription became the sole means of military recruitment. Of the 16 million men who served in WWII, approximately 10 million were conscripted, with a large proportion of the remaining men “draft-induced.”<sup>3</sup>

Table 1 indicates that WWII was also the most costly war in American history. In 1944, government spending made up 48% of GDP; this represented an increase of approximately 500% in real spending relative to that of 1940. This necessitated drastic changes in the means and extent of government revenue collection. In 1939, federal personal and corporate income taxes totalled approximately 2.1 billion (current) dollars, or 33% of total federal tax receipts. By 1945, these figures had increased to 34.4 billion and 76%, respectively. Over the same period, the share of the labor force required to pay income taxes increased from 7% to 81%. Given these circumstances, it is interesting to determine the effect of concurrent wartime policies on fiscal policy. This is particularly true, given the massive nature of WWII. Of obvious importance is the fiscal consequences of conscription.

This is not the first paper to consider the economics of conscription. In the late 1960s and early 1970s, a series of important papers addressed the use of peacetime conscription relative to voluntary recruitment.<sup>4</sup> In addition to the obvious issues regarding equity and infringement on individual freedom, these papers focused on the distortions and inefficiencies associated with mandatory service. For example, these include the misallocation of labor skill across civilian and military uses, and the distortion on education, marriage and child-bearing incentives induced by the system of deferments and exceptions that were in place. Since these could be eliminated by employing a volunteer military, these papers argued strenuously for the termination of conscription as a means of peacetime recruitment.<sup>5</sup>

<sup>1</sup> See also Siu (2004), who shows that the welfare value of a *complete markets* outcome (as implemented through state-contingent policy) is quantitatively large relative to an *incomplete markets* outcome (as implemented via persistent innovations in debt and taxes), in an economy subject to war-and-peace shocks.

<sup>2</sup> Sources and details of all data used in this paper are contained in Appendix A of the supplementary material available online via ScienceDirect.

<sup>3</sup> Though no estimates for draft-induced volunteers exist for WWII, it is clear that this is the case. Volunteering presented clear benefits over being drafted, including the ability to go through basic training and serve in action with friends once enrolled. Department of Defense estimates from later periods corroborate this view. In 1964, 38% of volunteers reported being draft-induced, while in 1970, near the height of the Vietnam War recruitment, 50% reported similarly. See also Altman and Barro (1971) who estimate a draft-induced fraction of 41% for military officers in 1970.

<sup>4</sup> See, for instance, Friedman (1967), Hansen and Weisbrod (1967), Oi (1967), Fisher (1969), Altman and Barro (1971), and Amacher et al. (1973). Many of these were written in association with the Marshall Commission's review of the Universal Military Service and Training Act of 1951 (which was due to expire in 1967) and the Gates Commission's inquiry of an all-volunteer military.

<sup>5</sup> Conscription was abandoned in the U.S. in 1973. Selective Service registration was terminated in 1975, and then reinstated in 1980.

These costs and inefficiencies present a trade-off to the fiscal benefits of conscription in determining the optimal system of military recruitment. However, as the size of the required force increases, tax distortions associated with financing a volunteer military are exacerbated, while some of the costs of conscription decrease. As an obvious example, if all eligible individuals are required to serve, issues regarding the misallocation of labor across civilian and military uses become irrelevant. Hence, conscription may be the preferred option when the demand for military personnel is large. This observation was expounded by Friedman (1967) who was, in fact, a leading advocate for the volunteer system:

If a very large fraction ... of the relevant age groups are required ... in the military services, the advantages of a voluntary army become very small ... [T]o rely on volunteers under such conditions would then require very high pay in the armed services, and very high burdens on those who do not serve, in order to attract a sufficient number into the armed services. ... [I]t might turn out that the implicit tax of forced service is less bad than the alternative taxes that would have to be used to finance a voluntary army. Hence for a major war, a strong case can be made for compulsory service.<sup>6</sup>

A number of recent papers provide empirical evidence in support of this as a positive theory of conscription. Ross (1994) presents cross-country evidence linking larger armed forces to increased reliance on conscription, while Garfinkel (1990) shows in U.S. time series data that average marginal tax rates are negatively related to the use of conscription (after controlling for government spending).<sup>7</sup>

This paper differs from the recent literature in that it does not attempt to provide a positive theory of conscription. Instead, the central objective is to quantify the welfare value of conscription in its fiscal policy role for the U.S. WWII effort. Indeed, if conscription was to be justified on fiscal grounds for any event in American history, WWII represents the obvious episode to consider. In the context of Friedman's discussion, the goal is to determine "how strong a case can be made" for conscription during a major war.

The next section presents the analytical framework. The model is a standard neoclassical growth model augmented with a government sector. The government levies distortionary taxes in order to finance spending, and has the ability to conscript labor resources in times of war. As will become clear, the model abstracts from issues such as inequality, misallocation of labor skill, and distortions to education incentives. This allows me to focus on the paper's stated objective, namely, isolating the value of the military draft as a lump sum tax. Section 3 presents data and details relevant for the calibration of the model to the U.S. WWII experience. Simulation results indicate that the benchmark model is able to match key U.S. macroeconomic data during the wartime era (see also McGrattan and Ohanian, 2006). This verifies that the current framework represents a good laboratory to study the fiscal role of conscription.

To this end, Sections 4 and 5 analyze the counterfactual experiments performed in the model. Section 4 provides characterization results for the case of voluntary military recruitment, as well as the case of an "optimal" conscription. Section 5 presents quantitative results for the counterfactuals. Despite the fact that the American involvement in WWII lasted only four years, the case for conscription is indeed strong. For conservative estimates of the cost of voluntary recruitment, the fiscal value of conscription during WWII is worth approximately 1–2% of annual aggregate consumption *in perpetuity*. When the model is calibrated to match mid-century estimates of the military-to-civilian wage premium, the welfare value of conscription *doubles* to approximately 2–4% of consumption in perpetuity. Section 6 provides concluding remarks.

## 2. The model

Let  $s_t$  denote the event realization at any date  $t$ , where  $t = 0, 1, \dots$ . The history of date-events realized up to date  $t$  is given by the history, or *state*,  $s^t = (s_0, s_1, \dots, s_t)$ . The unconditional probability of observing state  $s^t$  is denoted  $\pi(s^t)$ , while the probability of observing  $s^t$  given state  $s^{t-1}$  is denoted  $\pi(s^t | s^{t-1}) \equiv \pi(s^t) / \pi(s^{t-1})$ . The initial state,  $s^0$ , is given so that  $\pi(s^0) = 1$ . In the case of a deterministic economy,  $s^t$  is degenerate, and  $\pi(s^t) = 1$  for all  $s^t$ .

Periods of war and peace differ along two dimensions: (i) the government's demand for privately produced goods,  $g(s^t)$ ; and (ii) the fraction of the population it requires serving in the armed forces,  $d(s^t)$ . For simplicity, the government's demand for military personnel during peacetime is assumed to be zero ( $d = 0$ ).<sup>8</sup> This amounts to assuming that the production technology for the government's peacetime defense services is identical to that of privately produced goods. Further, the per-period time a soldier spends in military service is given exogenously. Hence, variation in military labor needs is met solely through variation in the number of service members,  $d(s^t)$ .

<sup>6</sup> An earlier discussion was provided by the British political economist, Sidgwick (1887): "Where, indeed, the number ... is not large ... voluntary enlistment seems clearly the most economical system; since it tends to select the persons most likely to be efficient soldiers and those to whom military functions are least distasteful; ... But a nation may unfortunately require an army so large that its ranks could not be kept full by voluntary enlistment, except at a rate of remuneration much above that which would be paid in other industries ... in this case the burden of the taxation requisite ... may easily be less endurable than the burden of compulsory service."

<sup>7</sup> See also Mulligan and Schleifer (2004), who present an alternative positive theory of conscription based on the fixed costs associated with its administration and enforcement.

<sup>8</sup> As will be discussed in Section 3, this is a good approximation for the U.S. prior to 1941.

The government does not have the ability to levy lump sum taxes. Instead, it finances spending through proportional taxes on labor and capital income. The government does have the ability to conscript labor into military service during times of war. The case in which all military personnel are conscripted is presented next. The discussion in Section 1 indicates that this simplification is not far from actual experience for the U.S. during WWII. The case of a volunteer military, which is considered as a counterfactual, is presented in Section 4.

### 2.1. Households

There is a large number of identical households. The representative household is composed of a unit measure of family members. All family members have identical preferences over consumption and labor, with current utility given by

$$U(c, h) = u(c) + v(h),$$

where  $u$  is increasing and concave,  $v$  is decreasing and convex, and  $h \in [0, 1]$ . At each state, a fraction,  $d(s^t)$ , of family members is drafted for military service. In the military, individuals work a prespecified number of hours per period,  $\bar{h}$ . Given additive separability in preferences, the household allocates the same amount of consumption to “draftees” and “civilians.”<sup>9</sup>

Hence, the representative household’s problem is to maximize:

$$\sum_{t=0}^{\infty} \sum_{s^t} \beta^t \pi(s^t) [u(c(s^t)) + (1 - d(s^t))v(h(s^t)) + d(s^t)v(\bar{h})], \quad \beta \in (0, 1),$$

subject to

$$c(s^t) + i(s^t) + p(s^t)b(s^t) \leq b(s^{t-1}) + [(1 - \theta(s^t))r(s^t) + \theta(s^t)\delta]k(s^{t-1}) + (1 - \tau(s^t))w(s^t)[(1 - d(s^t))h(s^t) + \phi d(s^t)\bar{h}], \quad (1)$$

and  $c(s^t), i(s^t) > 0$ , for all  $s^t$ . The initial values,  $k(s^{-1}) \equiv k_{-1} > 0$  and  $b(s^{-1}) \equiv b_{-1}$  are taken as given. The right-hand side of the equation is total income earned at state  $s^t$ . Here,  $b(s^{t-1})$  denotes units of real, one-period bonds purchased at  $s^{t-1}$  which mature at date  $t$ ; each bond returns one unit of consumption, irrespective of the state realized at date  $t$ . The second term represents after-tax income earned on capital holdings chosen at  $s^{t-1}$ . Here,  $\theta(s^t)$  is the state-contingent capital income tax rate,  $r(s^t)$  is the real rental rate, and  $\delta \in (0, 1)$  is the depreciation rate, so that  $\theta(s^t)\delta$  is a depreciation allowance in the tax code. The third term represents after-tax labor income earned at state  $s^t$ , where  $\tau(s^t)$  is the state-contingent labor income tax rate,  $w(s^t)$  is the civilian wage rate, and  $h(s^t)$  is the number of hours worked by civilians. For the purposes of the benchmark economy, the military wage rate earned by draftees is modeled as equaling a fraction,  $\phi \geq 0$ , of the civilian wage. This fraction is a policy variable for the government.

Income is used to finance purchases of consumption,  $c(s^t)$ , investment,  $i(s^t)$ , and non-contingent bonds. The consumption price of a bond which pays one unit of consumption at all  $s^{t+1}$  following  $s^t$  is denoted  $p(s^t)$ . Investment augments capital holdings according to

$$k(s^t) = i(s^t) + (1 - \delta)k(s^{t-1}), \quad \forall s^t.$$

The first-order necessary conditions (FONCs) are standard:

$$-\frac{v'(h(s^t))}{u'(c(s^t))} = (1 - \tau(s^t))w(s^t), \quad (2)$$

$$u'(c(s^t)) = \beta \sum_{s^{t+1}|s^t} \pi(s^{t+1}|s^t) u'(c(s^{t+1})) [(1 - \theta(s^{t+1}))r(s^{t+1}) + \theta(s^{t+1})\delta + 1 - \delta], \quad (3)$$

$$u'(c(s^t))p(s^t) = \beta \sum_{s^{t+1}|s^t} \pi(s^{t+1}|s^t) u'(c(s^{t+1})). \quad (4)$$

The first FONC indicates that the presence of a proportional labor tax drives a wedge between the marginal rate of substitution in the (civilian) leisure/consumption valuation and the real wage. The second states that (future) capital taxation drives a wedge between the current marginal value of consumption and the expected marginal utility weighted return to capital. The third states the standard pricing formula for a risk-free, one-period bond.

<sup>9</sup> See Bergstrom (1986) who considers the role of conscription in providing consumption insurance, given the inherently indivisible nature of time across military and civilian uses. Implicit in Bergstrom’s analysis is the government’s ability to finance military pay through lump sum taxation. Here, insurance against military service is provided through the large family construct. Instead, the role of conscription is to minimize tax distortions associated with financing military pay.

## 2.2. Firms

Firms transform factor inputs into private sector output according to the constant returns to scale technology:

$$y(s^t) = z(s^t)\tilde{k}(s^t)^\alpha[(1 + \gamma)^t\tilde{h}(s^t)]^{1-\alpha}, \quad \alpha \in (0, 1). \quad (5)$$

Here,  $\tilde{k}(s^t)$  and  $\tilde{h}(s^t)$  denote capital and labor hired at  $s^t$ ,  $\gamma$  is the deterministic growth rate of labor-augmenting technology, and  $z(s^t)$  is the level of productivity.

The representative firm's problem is static:

$$\max[y(s^t) - r(s^t)\tilde{k}(s^t) - w(s^t)\tilde{h}(s^t)],$$

and results in the standard FONCs relating factor prices to marginal revenue products:

$$r(s^t) = \alpha z(s^t) \left[ \frac{(1 + \gamma)^t \tilde{h}(s^t)}{\tilde{k}(s^t)} \right]^{1-\alpha}, \quad (6)$$

$$w(s^t) = (1 - \alpha) z(s^t) \left[ \frac{(1 + \gamma)^t \tilde{h}(s^t)}{\tilde{k}(s^t)} \right]^{-\alpha} (1 + \gamma)^t. \quad (7)$$

## 2.3. Government

The government's payment for privately produced output,  $g(s^t)$ , and conscripted labor services,  $d(s^t)\bar{h}$ , must satisfy the following budget constraint:

$$g(s^t) + (1 - \tau(s^t))\phi w(s^t)d(s^t)\bar{h} + b(s^{t-1}) \leq p(s^t)b(s^t) + \tau(s^t)w(s^t)(1 - d(s^t))h(s^t) + \theta(s^t)(r(s^t) - \delta)k(s^{t-1}),$$

for all  $s^t$ . Note that the government's expenditures include only the after-tax value of military wages; this is in keeping with U.S. policy during WWII.<sup>10</sup>

## 2.4. Equilibrium

A competitive equilibrium is defined in the usual way.

**Definition 1.** Given initial values,  $k_{-1}$  and  $b_{-1}$ , and the process,  $\{z(s^t), g(s^t), d(s^t)\}$ , a *competitive equilibrium* is an allocation,  $\{c(s^t), h(s^t), k(s^t), b(s^t); y(s^t), \tilde{k}(s^t), \tilde{h}(s^t)\}$ , price system,  $\{p(s^t), r(s^t), w(s^t)\}$ , and government policy,  $\{\phi, \theta(s^t), \tau(s^t)\}$ , such that:

- $\{c(s^t), h(s^t), k(s^t), b(s^t)\}$  solves the household's problem subject to the sequence of household budget constraints;
- $\{y(s^t), \tilde{k}(s^t), \tilde{h}(s^t)\}$  solves the final good firm's problem;
- the sequence of government budget constraints is satisfied;
- and factor markets clear:

$$\tilde{k}(s^t) = k(s^{t-1}), \quad \tilde{h}(s^t) = (1 - d(s^t))h(s^t), \quad \forall s^t.$$

Bond market clearing has been implicitly imposed, as both issues and holdings are denoted by the single variable,  $b(s^t)$ . By Walras' law, the market for private sector output clears:

$$c(s^t) + k(s^t) + g(s^t) = y(s^t) + (1 - \delta)k(s^{t-1}), \quad \forall s^t.$$

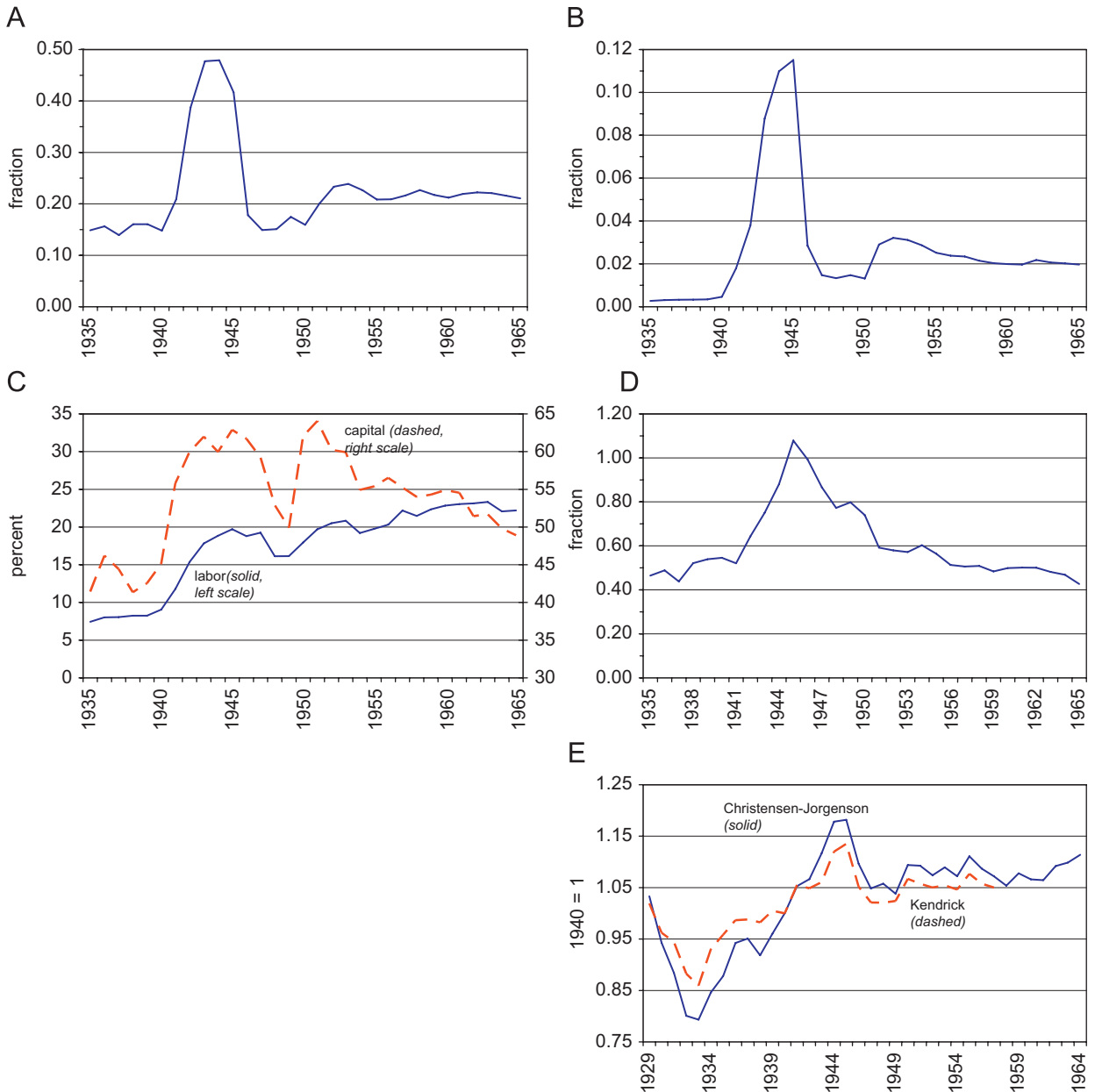
## 3. Quantitative specification and model fit

This section calibrates the model to the U.S. WWII experience. Among other things, this requires specifying the process governing wartime spending and military staffing,  $\{g(s^t), d(s^t)\}$ , and fiscal policy rules,  $\{\phi, \theta(s^t), \tau(s^t)\}$ , to match historical observation.

### 3.1. Data description

To begin, a description of the data relevant for the exercise is presented. Further detail and source information is contained in Appendix A; all appendices are available online via ScienceDirect as supplementary material to this paper.

<sup>10</sup> Beginning with the Korean War, military pay earned in combat zones by members of the armed forces was exempted from taxation. See the U.S. Internal Revenue Code, Section 112.



**Fig. 1.** U.S. data, 1929–1965. (A) Government spending to GDP ratio. (B) Active duty military personnel (per capita). (C) Factor income tax rates. (D) Outstanding government debt to GDP ratio. (E) Detrended private sector TFP.

Fig. 1, panel A plots the ratio of total (i.e., federal, state, and local) government spending to GDP, 1935–1965. In addition to WWII, this period is marked by a shift in the size of government coinciding with the onset of the Cold War. Excluding the war years, government spending averaged 15.5% of GDP between 1932 and 1950. With respect to WWII, the government’s share increased to 21% in the build-up year of 1941, when real total spending increased 66%—and military equipment spending increased 16-fold—over 1940. This was due to the passing of the Lend-Lease Act and overall military mobilization. With the onset of the war, government spending increased each year until it peaked in 1944 at 48% of GDP.

Panel B displays similar dynamics for the number of active duty military personnel, normalized by the adult population. When Germany invaded Poland in September 1939, the U.S. military employed 330,000 men, roughly the same size as the forces of Portugal or Romania, and  $\frac{1}{10}$  that of Germany (see [Cardozier, 1995](#)). At that time, approximately 0.3% of the U.S. population served in active duty. With the passing of the Selective Service Act of 1940, inductions began in earnest so that by 1941, 1.8 million men were serving in the military. Conscription became the sole means of recruitment in December 1942, and by 1945 the armed forces peaked at 12.1 million men or 11.5% of the population. In 1946 conscription was

terminated, military strength dropped, and leading up to the Korean War active duty personnel numbered approximately 1.5 million annually.

As described by [Ohanian \(1997\)](#) and many others, the war effort was largely deficit-financed allowing tax distortions to be smoothed forward in time. Panel C displays average marginal labor income and capital income tax rates as constructed by [Joines \(1981\)](#). Both tax rates increased noticeably during the war. Between 1940 and 1945, the labor tax rate (solid line) increased from 9.1% to 19.7%, and the capital tax rate (dashed line) from 45.1% to 62.9%. These increases did not nearly cover the increased spending. Panel D displays [Seater's \(1981\)](#) data for the market value of outstanding total government debt as a ratio of GDP. Government indebtedness rose throughout the war until it peaked at 108% of GDP in 1945. After the war, the debt was gradually paid off as taxes remained high.

Finally, panel E displays two measures of total factor productivity in the private sector (i.e., calculated net of the government sector). The dashed line is from [Kendrick's \(1961\)](#) treatment, and the solid line is from [Christensen and Jorgenson \(1995\)](#). Both series have been detrended by a constant annual growth rate and normalized to unity in 1940. These data reveal three notable features. First, in both series, the pre- and post-WWII periods can be characterized as displaying a common trend in TFP growth. In the 1946–1968 period TFP fluctuates around trend, while in the 1929–1941 period TFP falls precipitously at the onset of the Great Depression, but grows rapidly beginning in 1934 to return to the 1929 trend level. The second thing to note is that across the pre- and post-war periods, there is a marked break in levels, indicating a permanent TFP increase. Finally, during WWII productivity displays a pronounced hump relative to the pre- and post-war periods, peaking in 1945.

A number of recent papers address these productivity observations. Important considerations include the implementation of product and process innovations during the 1930s (see [Field, 2003](#)), the accumulation of road and highway infrastructure during the pre- and post-war periods ([Field, 2003](#)), and the provision of government-owned-privately-operated capital during the war (see [Gordon, 1969](#); [Braun and McGrattan, 1993](#); [McGrattan and Ohanian, 2006](#)). Following the war, the economy underwent conversion of plant and equipment from military to civilian purposes; this was particularly pronounced in manufacturing industries. This reallocation was partially responsible for the fall in productivity after 1945.

Finally, it should be noted that while the productivity series have been constructed to account for changes in factor input composition, changes in utilization have not been accounted for. Hence, variation in workweek and labor effort that were operative appear in these TFP series.<sup>11</sup> To keep the policy analysis tractable, variable factor utilization has been excluded from the model of Section 2. Variation in observed productivity is accounted for in the quantitative exercise via the exogenous process,  $\{z(s^t)\}$ .

### 3.2. Calibration and specification

For the numerical experiments, the period length is taken to be a year. Preferences are specified as  $u(c) = \log(c)$  and  $v(h) = \psi \log(1 - h)$ . The exogenous growth rate of technology is set to  $\gamma = 0.02$  (see [Kendrick, 1961](#); [Field, 2003](#); [Cole and Ohanian, 2004](#)). The discount factor and capital share parameter are  $\beta = 0.95$  and  $\alpha = 0.36$ . As in [McGrattan and Ohanian \(2006\)](#), the depreciation rate is set to  $\delta = 0.07$ . The peacetime steady state is specified such that  $d_{ss} = 0$ ,  $g_{ss}/y_{ss} = 0.155$ ,  $\tau_{ss} = 0.091$ , and  $\theta_{ss} = 0.451$ . The latter two values match those observed in the U.S. data in 1940, while the former two values match the observations discussed above. Steady state productivity is normalized to  $z_{ss} = 1$ . The value of  $\psi$  is set so that  $h_{ss} = 0.27$  in the peacetime steady state. The model produces predictions for government debt accumulation. Because of this, a lump sum tax/transfer is introduced into the household and government budget constraints. This is done solely for the purposes of calibrating the steady state. This tax is specified as a constant value (i.e., is non-time-varying and non-state-contingent) so that in the peacetime steady state, the ratio of the market value of outstanding debt to output is  $p_{ss}b_{ss}/y_{ss} = 0.505$ .

The history of date-events evolves as follows.<sup>12</sup> The economy begins in steady state in 1940. In 1941, agents learn that they are in a one year build-up phase, and will be involved in the war between 1942 and 1945. In 1946, the economy exits the war and begins its transition back to the peacetime steady state. Between 1941 and 1945, the values for taxes,  $\{\theta(s^t), \tau(s^t)\}$ , are set to their historical values. The values for  $d(s^t)$  are set to match the wartime active duty military personnel to population ratio displayed in [Fig. 1](#), panel B. The values for  $z(s^t)$  and  $g(s^t)$  are set to jointly match the observations for the government spending to GDP ratio of [Fig. 1](#), panel A and [Kendrick's \(1961\)](#) measure of civilian hours worked, which is displayed below. Starting in 1946, the values for  $g(s^t)$  and  $d(s^t)$  return to their steady-state values.

From the perspective of 1941, the evolution of exogenous variables just described is known with certainty. That is, the model is a perfect foresight economy, except in the following two features of the postwar period. First, from the perspective of 1941–1945, the postwar state of productivity is uncertain. There are two possible values of  $z(s^t)$  which may occur in all periods from 1946 onward. In one case,  $z(s^t) = 1.1$  to account for the break in productivity found in the data. In the other,

<sup>11</sup> Note also that the presence of time-varying monopoly mark-ups affects the interpretation of TFP measurement. See [Cole and Ohanian \(2004\)](#) for a discussion of cartelization and unionization and New Deal policies during the mid- to late-1930s.

<sup>12</sup> A visual presentation of the model elements described here are contained in [Fig. 2](#). A detailed description of [Fig. 2](#) is contained in the following subsection.

$z(s^t) = 0.90$ ; Gallup poll and survey data during the war indicated a widely held belief that once over, the economy would re-enter a depression or severe recession (see McGrattan and Ohanian, 2006). To accord with this evidence, each (permanent) productivity regime occurs with probability 0.5. However, *ex post*, only the high productivity regime is realized in the simulations reported below.

Second, the specification includes a one-time debt repudiation in 1946. The U.S. experienced a sharp spike in inflation following the war. Inspection of nominal interest rates indicates that this was largely unanticipated. Since bond returns were set in nominal terms, this resulted in an unanticipated erosion of the real value of outstanding government debt. Ohanian (1998) estimates that the post-war inflation amounted to a repudiation of debt worth approximately one third of GDP. Since the model does not include this type inflationary taxation, a one-time, unanticipated debt repudiation worth 33% of 1946 GDP is introduced. This allows for a closer correspondence in debt dynamics between the model and data.

Unfortunately, data for total hours worked in the military during WWII does not exist.<sup>13</sup> During the initial months spent in basic training, enlisted personnel spent approximately 54 h per week in drills and exercises. Once in action, official estimates and documentation of hours worked are not available. Some information is available, however, from letters written by soldiers during the war. For instance, during a 19-day cycle, I estimate that a bomber pilot spent 7 days off, 8 days on-base/in briefings, 3 days flying bombing missions, and 1 day de-briefing, totalling approximately 145 h worked (see Parilo, 2002). Since pilots typically worked fewer hours (in a given time period) than ground and naval personnel, this is taken to be a reasonable lower bound for combat troops. Given this, per period military hours is set to  $\bar{h} = 0.64$  in the benchmark case, so that out of a possible 84 h per week, 54 are spent working.

Data on total wage and salary compensation for the armed forces is available from *Historical Statistics of the United States, Colonial Times to 1970* (U.S. Department of Commerce, 1976). From this and BLS employment data, it is determined that average annual earnings in the military was 76% of that earned in the civilian economy during WWII. This also corresponds with independent data available for 1945, in which basic pay plus allowances in the military equaled 77% of average earnings of non-military employees.<sup>14</sup> Given this, and the difference in annual hours worked per worker across military and civilian sectors,  $h(s^t)/\bar{h}$ , averaged over the war years,  $\phi$  is set to 0.63 so that in the benchmark calibration, the military wage is 63% of the civilian wage.

The final elements to be specified are the peacetime policy rules for capital and labor tax rates. These are specified as being non-linear functions of the deviation of inherited government debt from its peacetime steady-state value. These rules are specified in order to match the capital and labor tax rate series observed between 1946 and the onset of the Korean War.

### 3.3. Historical simulation

In this subsection, quantitative evidence of the model's ability to match the historical data is presented. Fig. 2 displays time series of key macroeconomic variables for the benchmark model and the U.S. The solid line corresponds to the U.S. data and the dashed line to the "historical simulation" of the model.<sup>15</sup> The model series are simulated by feeding through the exogenous variables corresponding to the observed WWII experience, as described above. Model variables are defined in an analogous manner to the U.S. data. Specifically, real GDP is defined as the sum of private sector output and government (i.e. military) wages,  $y(s^t) + \phi w(s^t)d(s^t)\bar{h}$ ; government spending as the sum,  $g(s^t) + \phi w(s^t)d(s^t)\bar{h}$ ; and civilian hours worked (normalized by the adult population) as  $(1 - d(s^t))h(s^t)$ . For all growing variables, the figure displays series that are detrended and normalized to unity in 1940.

Panels A and B display the government spending to GDP ratio and civilian hours worked, respectively. As discussed above, the wartime values for  $z(s^t)$  and  $g(s^t)$  have been specified so that between 1941 and 1945, the model matches U.S. observation along these dimensions. Panel C displays the time series for (detrended, normalized) real GDP. The model does a very good job of mimicking the output boom associated with the U.S. war effort.<sup>16</sup> However, the model is less successful at accounting for the U.S. economy's strong performance in the years following the war. This is mirrored by the historical simulation for civilian hours worked. This drop-off in hours worked is due principally to the post-war drop-off in productivity,  $z(s^t)$ , and the high labor tax rate which persisted after the war. Taken together, these simulation results suggest that the U.S. WWII "miracle" was not necessarily the economy's ability to mobilize during the war, but the economy's strong performance immediately afterward.

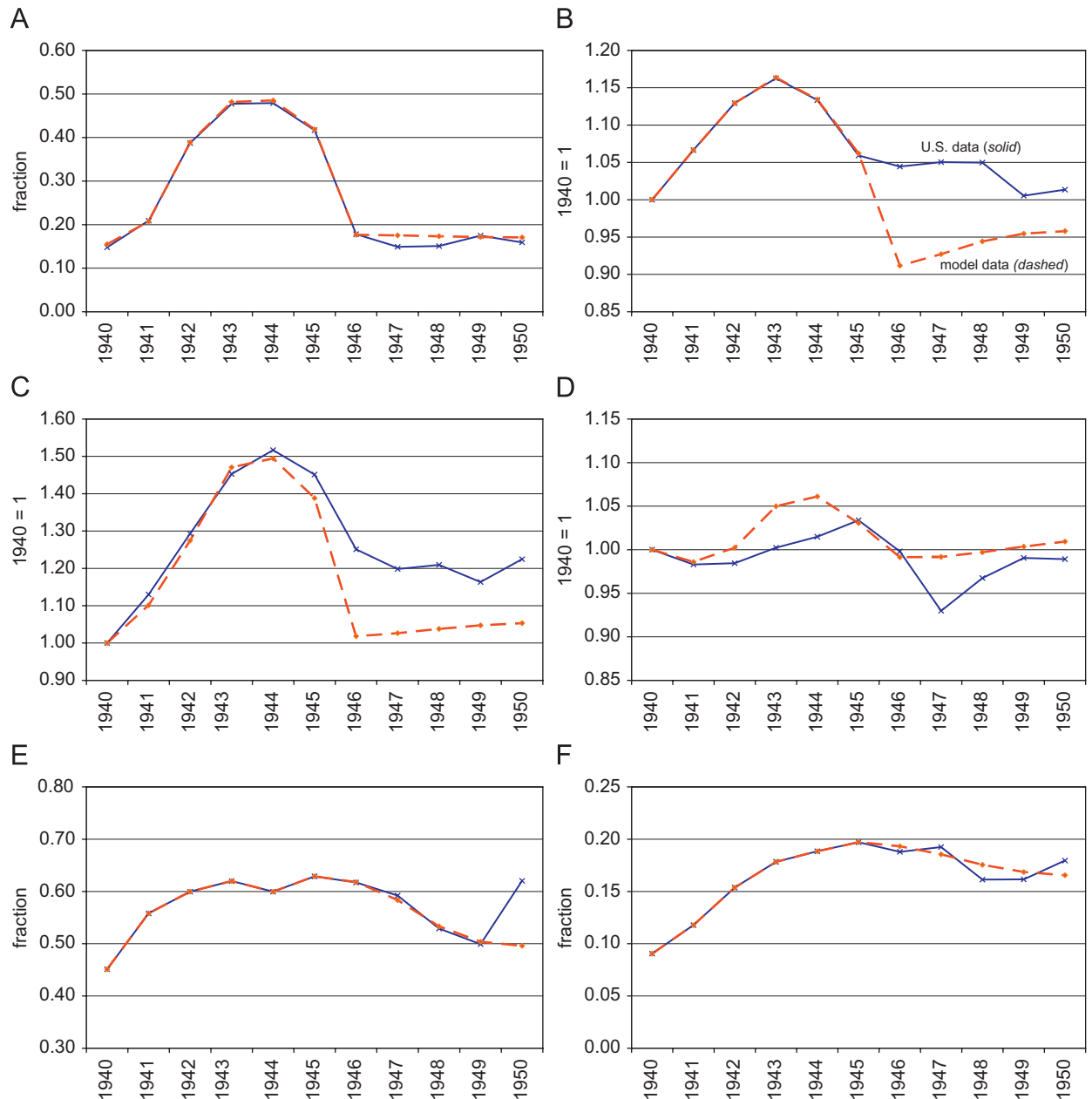
<sup>13</sup> In Kendrick's (1961) data, weekly hours worked by military personnel during the war was imputed as being identical to those of civilian government employees. This obviously represents a severe underestimate.

<sup>14</sup> It should be noted that this difference in pay does not primarily reflect lower labor skill among members of the military relative to the civilian sector. Indeed, WWII draftees were positively selected. Using U.S. census data, Angrist and Krueger (1994) show that favorable post-war labor market outcomes of veterans relative to non-veterans is due to non-random selection into the military. Bedard and Deschenes (2002) present evidence from the 1973 *Occupational Change in a Generation* Survey for men born 1920–1929. Relative to non-veterans, WWII veterans were typically from higher income families with parents of higher educational attainment, were more likely to be urban, and less likely to be from the South. Moreover, veterans had higher educational attainment before the war relative to the 'ever-completed' education level of non-veterans.

<sup>15</sup> A non-linear solution algorithm was used to derive nearly exact solutions for the model economy. Details of the method are available from the author upon request.

<sup>16</sup> McGrattan and Ohanian (2006) demonstrate that reasonably specified variants of the neoclassical growth model are able to quantitatively account for the effects of large fiscal shocks. Though the features of my model differ from theirs, the close correspondence in output dynamics—as well as that for the consumption-output ratio, investment-output ratio, and after-tax real wages—to the U.S. data corroborates their view.

Panel D displays the after-tax real wage rate; the U.S. data corresponds to non-farm hourly compensation. Though the exact timing in the model is shifted forward by a period, this figure indicates that the benchmark model is able to successfully replicate the experience for hours worked during the war, without predicting counterfactually large gains in the return to work. In order to match the historical observations for civilian hours, the maximal wartime value for  $z(s^t)$  is 1.27, which is within 7.5% of the maximal value displayed in Fig. 1, panel E. In experiments not reported here, I find that through various changes to the benchmark specification, it is possible to generate the observed boom in civilian hours with smaller gains in wartime productivity. One such change involves accounting for the Great Depression by lowering the initial capital stock in 1940 below its steady-state value (see Ohanian, 1997). Another involves allowing for uncertainty in the transition across states with respect to the severity and duration of the war (see McGrattan and Ohanian, 2006).



**Fig. 2.** U.S. data and historical simulation of benchmark model, 1940–1950. (A) Government spending to GDP ratio. (B) Civilian hours worked. (C) Real GDP. (D) After-tax real wage. (E) Capital tax rate. (F) Labor tax rate. (G) Outstanding debt to GDP ratio. (H) Military pay to government spending ratio. (I) Consumption to GDP ratio. (J) Investment to GDP ratio.

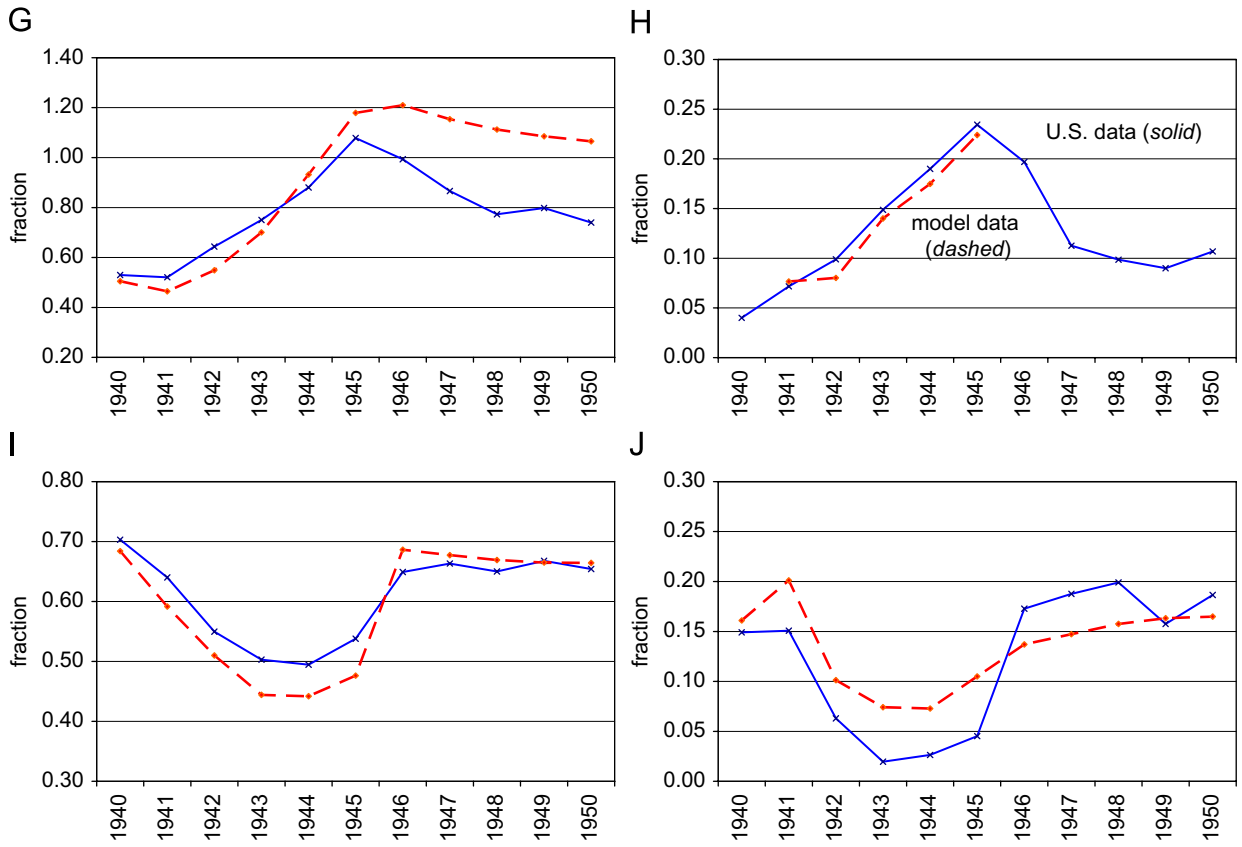


Fig. 2. (Continued)

Though these considerations allow for a closer match between the model’s productivity series and the estimates presented in Fig. 1, panel E, they do not significantly alter the results for the welfare value of conscription.

Fig. 2, panels E and F display the capital and labor tax rates, respectively. As discussed, the model has been specified to match the 1941–1949 data.<sup>17</sup> The model does a good job of matching the market value of outstanding debt to GDP ratio observed during the war, displayed in panel G. The correspondence in postwar dynamics of government indebtedness between model and data is also acceptable (recall that the model includes an unexpected debt repudiation in 1946); the primary reason for the discrepancy is the model’s underprediction for output following the war.

The final three panels display further successes of the model in its ability to match the U.S. experience. Panel H displays the ratio of military wage and salary compensation to government spending. Panels I and J display the ratios of private consumption and investment to GDP, respectively. Again, the historical simulation does a good job of matching the U.S. data, though it slightly underpredicts the relative fall in investment. Taken as a whole, these results indicate that the current quantitative model represents a good laboratory in which to study the fiscal role of conscription.

#### 4. Counterfactual experiments

In order to assess the fiscal value of conscription, two counterfactual experiments are considered. The first experiment supposes that the government does not have the ability to conscript, and must hire an all-volunteer military. The second supposes that the government institutes an optimal conscription. Analysis of each experiment is presented in turn.

##### 4.1. The case of an all-volunteer military

Without conscription the government must pay a market wage that induces the household to supply the required personnel in order to meet military demand. Given the fixity of hours each service member works in the military,  $\bar{h}$ , the

<sup>17</sup> The match breaks down in 1950, since the model does not account for the onset of the Korean War. As discussed in Ohanian (1997), tax rates were increased sharply in response to the Korean War, as U.S. policy aimed to finance war spending through current taxation.

household has one additional choice variable. Let  $e(s^t)$  denote the fraction of its family members the household chooses to allocate to military work.

The representative household's problem in this case is to maximize:

$$\sum_{t=0}^{\infty} \sum_{s^t} \beta^t \pi(s^t) [u(c(s^t)) + (1 - e(s^t))v(h(s^t)) + e(s^t)v(\bar{h})],$$

subject to

$$c(s^t) + i(s^t) + p(s^t)b(s^t) \leq b(s^{t-1}) + [(1 - \theta(s^t))r(s^t) + \theta(s^t)\delta]k(s^{t-1}) + (1 - \tau(s^t))[(1 - e(s^t))w(s^t)h(s^t) + e(s^t)\chi(s^t)\bar{h}],$$

for all  $s^t$ . Here,  $\chi(s^t)$  is the military wage, which differs from the civilian wage,  $w(s^t)$ . This is due to the fact that: (i)  $v$  is convex in hours worked, and; (ii) in general,  $h(s^t) \neq \bar{h}$ .

The firm's problem is identical to that presented in Section 2.2. The government's budget constraint is augmented in the obvious way to account for the fact that the military wage is now  $\chi(s^t)$  as opposed to  $\phi w(s^t)$ . Equilibrium without conscription is defined in an analogous manner to Section 2.4. In addition to the equilibrium conditions presented there, the condition  $e(s^t) = d(s^t)$  for all  $s^t$  must be satisfied.

The budgetary implications of an all-volunteer military are easy to derive. From the household's FONC with respect to  $e(s^t)$ , it is easy to show the following relationship between the military and civilian wage rates:

$$\chi(s^t) = \varphi(s^t)w(s^t),$$

where

$$\varphi(s^t) \equiv \frac{v(\bar{h}) - v(h(s^t)) + v'(h(s^t))h(s^t)}{v'(h(s^t))\bar{h}}. \quad (8)$$

Hence, the military wage is proportional to the civilian wage, and the factor of proportionality,  $\varphi(s^t)$ , is contingent on the value of  $h(s^t)$ .

From here it is straightforward to show the following result:

**Proposition 2.**  $\varphi(s^t) \geq 1$ ; that is, in the case of an all-volunteer military, the military wage rate is greater than the civilian wage rate.

See Appendix B for the proof, which follows directly from the convexity of  $v$ , and the fact that per-period hours worked in the military is greater than that in the civilian sector. Under conscription, the analogous factor of proportionality is given by  $\phi$ . Hence, for  $\phi < 1$ , conscription confers a cost saving to the government in terms of military wage expenditures.<sup>18</sup>

#### 4.2. Optimal conscription

The next result relates to the determination of optimal policy under commitment. The policy problem is to find the government policy that induces competitive equilibrium associated with the highest value of the household's expected lifetime utility. This equilibrium is called the *Ramsey equilibrium*. Specifically, the government commits to its announced policy at the beginning of time, and in all periods agents optimize taking this announcement as given.

For the economy presented in Section 2, optimal military recruitment is straightforward:

**Proposition 3.** If the government's intertemporal budget constraint (presented in Appendix C) is binding, then it is optimal to set  $\phi = 0$ ; that is, all military personnel are conscripted and paid nothing in the Ramsey equilibrium.

The proof is contained in Appendix C. The intuition for this result is obvious. Since in any equilibrium military service must be fulfilled, it is optimal to minimize military pay in order to minimize the tax distortions associated with financing it. In the model presented here, military service is required only in times of war. Hence, in the context of this model, conscription acts as a fiscal shock absorber, minimizing tax distortions associated with wartime spending.

It is important to note that actual tax policy during WWII was far from optimal, as characterized by the Ramsey equilibrium for this economy. Hence, in the quantitative analysis, the welfare value of conscription is also evaluated in the more realistic context of observed historical tax policy, in addition to the Ramsey context discussed here.

That is, the welfare gain in moving from volunteer military recruitment (with  $\chi(s^t) = \varphi(s^t)w(s^t)$ ) to optimal conscription (with  $\phi = 0$ ) depends on the extent of the underlying tax distortions imposed by fiscal policy. The value of conscription is

<sup>18</sup> Note that both in the case of voluntary recruitment and conscription (presented in Section 2), the household allocates equal consumption to individuals in the military and civilian sectors. A potentially more realistic scenario might involve limiting the consumption of military personnel to a value less than that of civilians to reflect the fact that soldiers consumed little more than the basics (food, lodging, etc.) provided by the military. However, a divergence in consumption across individuals of this sort is a cost of military service, and one that would be borne regardless of military recruitment regime. As such, this modification would have no substantive implications for the welfare value of conscription.

obviously minimized when tax policy solves the Ramsey policy problem, i.e., when it achieves the Pareto second best. As will be clear, the value of conscription is greater when tax policy follows the historically observed policy rules.

## 5. The welfare value of conscription

This section presents results from the counterfactual experiments and quantifies the fiscal value of conscription. To this end, results are presented for three *scenarios*. The scenarios differ in their specification for tax policy in response to the counterfactual modifications.

### 5.1. Scenario A: historical wartime tax rates

The specification for taxes in this scenario is as follows. The capital and labor tax rates during the war years are kept at their historically observed values. After the war, the tax rates follow the benchmark policy rules. This is called *Scenario A*.

#### 5.1.1. Counterfactual without conscription

First, the exogenous WWII variables are fed through the version of the model without conscription. Hiring an all-volunteer military involves greater labor compensation relative to the case with conscription; in the model, this stems from the convexity of preferences ( $v$ ) in hours, and the fact that per-period hours worked in the military is greater than in the civilian sector ( $\bar{h} > h(s^t)$ ). This means greater government debt accumulation during the war. Given the specification of the tax rate rules, postwar taxes respond positively to the accumulated debt, and the counterfactual economy eventually converges to the same steady state as in the historical simulation.

The results from this counterfactual are displayed in Fig. 3. Panel A shows the difference in the military pay to government spending ratios between the counterfactual simulation (solid line) and the historical one (dashed line). The ratio peaks at 35% in 1945 as opposed to 22% under conscription, and is greater throughout the war for the counterfactual. The degree to which military pay increases depends on the predicted military-to-civilian wage premium,  $\varphi(s^t)$ ; given the importance of this prediction for the model's welfare calculations, more detailed discussion is provided below.

The increased military spending coupled with unchanged fiscal policy during the war results in greater debt accumulation in the counterfactual economy. This is displayed in panel B. The market value of outstanding debt to GDP ratio now reaches 139% as opposed to 118% in the benchmark economy in 1945, and peaks at 156% as opposed to 120% in 1946. As a result, the capital and labor tax rates (displayed in panels C and D) are higher in the years following the war until the debt level is drawn down to that of the historical simulation.

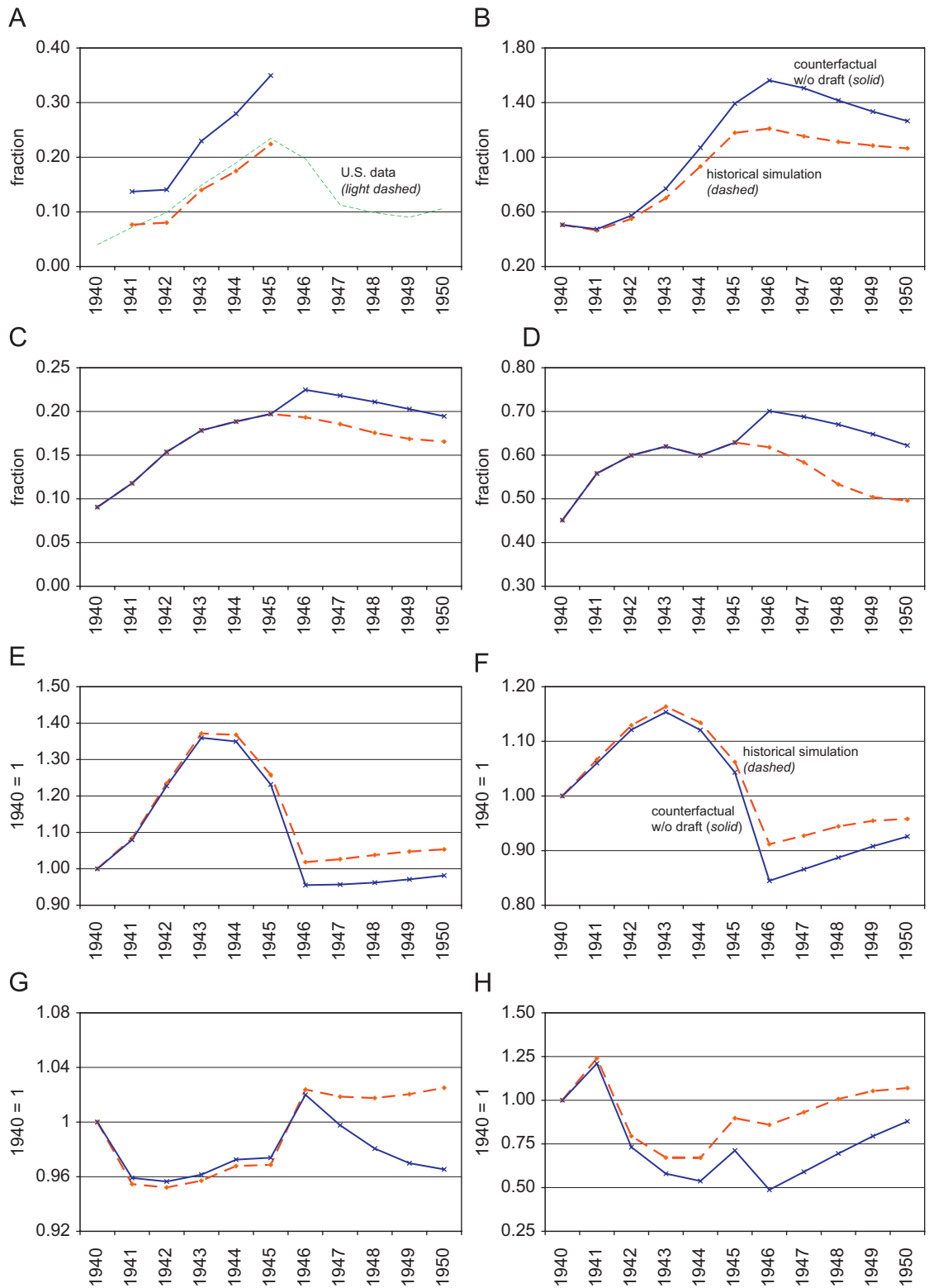
The higher tax rates depress the returns to working and capital accumulation, so that counterfactual postwar economic activity is depressed relative to the historical simulation. In 1946, private sector output (the sum of private consumption, government consumption, and private investment) in the counterfactual is 6.5% lower than in the historical simulation, and is 7.0% lower in 1950; private sector output does not converge to within 1.0% across simulations until 1970, 25 years after the war. This depressed economic activity is particularly pronounced in investment. While investment is lower in the counterfactual during the war, it falls dramatically in 1946 due to the jump in (future) capital tax rates. In 1946, investment is approximately 43% lower than in the historical simulation, and in 1950 it is still 18% lower. The high postwar taxation generates a prolonged transition to the steady state.

The increased wartime spending and postwar taxation with the all-volunteer military means lost welfare relative to the historical simulation. To quantify this, I consider the period-by-period consumption compensation that must be given to the representative household in the counterfactual economy in order for it to be as well off as in the historical simulation. This is calculated to be an annual consumption increase of 1.24% *in perpetuity*. The results from this counterfactual are summarized in Table 2.

The counterfactual prediction for the military-to-civilian wage premium is an important element in this assessment, as it determines the fiscal cost of voluntary recruitment. In the counterfactual experiment, the military wage premium ranges from 15.5% to 20.5% during the war years. To gauge the plausibility of this prediction, I first consider results from the “value of a statistical life” or VSL literature. In a recent survey article, [Viscusi and Aldy \(2003\)](#) find a median estimate that implies a wage elasticity with respect to the probability of death of approximately 8 (see also [Moore and Viscusi, 1988](#)). Given that the fatality rate was approximately 2% in the armed forces during WWII (see Table 1) as compared to essentially zero in the civilian sector, it is reasonable to conclude that the predicted wage premium is not unreasonably large.

Indeed, there are several arguments for why this is an overly conservative estimate of the cost of an all-volunteer military. First, the occupational fatality probabilities observed in the VSL studies are very close to zero. Given that the probability of death in the armed forces during WWII was substantially “out of sample,” it is possible that the locally estimated elasticities in the VSL studies do not apply; specifically, they would represent an underestimate of the military-to-civilian wage premium if the wage elasticity was increasing in the probability of death.

Second, this simple comparison with the VSL literature does not account for the other obvious disamenities associated with military work. In this respect, [Altman and Barro \(1971\)](#) provide more direct evidence on the military-to-civilian wage premium using data from 1960–1970, a period covering the height of the Vietnam War recruitment. Using Army ROTC enrollment rates in college, conscription rates of college graduates, and data on annual earnings of first-term army officers,



**Fig. 3.** Historical simulation and counterfactual scenario A, volunteer military experiment. (A) Military pay to government spending ratio. (B) Outstanding debt to GDP ratio. (C) Labor tax rate. (D) Capital tax rate. (E) Private sector output. (F) Civilian hours worked. (G) Consumption. (H) Investment.

**Table 2**

Summary statistics: historical simulation and counterfactual scenario A

	Wartime fiscal variables		Welfare
	Average military-to-civilian wage ratio	Debt to GDP ratio in 1945	Consumption equivalent compensation
Historical simulation	0.63	1.18	n/a
All-volunteer military			
Benchmark case	1.18	1.39	+1.24%
High wage premium case	1.60	1.59	+3.40%
Optimal conscription	0	0.83	−0.67%

Note: Counterfactual experiments conducted holding wartime (1941–1945) tax rates unchanged. Consumption equivalent compensation denotes additional annual consumption required in perpetuity for counterfactual economy to be indifferent to historical economy.

draftees, and civilian sector college graduates, they estimate a wage premium for military officers of 64%.<sup>19</sup> This figure is substantially higher than the premia generated by the counterfactual simulation for the benchmark calibration.

To gauge the implication of this, an alternative calibration is considered, one intended to match the estimate of Altman and Barro. This is referred to as the *high wage premium* calibration. Specifically, the value of  $\bar{h}$  is increased from 0.64 to 0.86 in the counterfactual simulation so that during 1941–1945, the average military wage premium is 60%; no other element of the counterfactual is altered. In the high wage premium counterfactual, welfare is lowered relative to the historical simulation for two reasons: (1) greater tax distortions associated with financing increased military spending, and (2) the fact that military personnel experience greater displeasure from working more.

Since the objective of the paper is to explore the welfare implications of feature (1), and to maintain comparability with the counterfactual in the benchmark calibration, the welfare cost in the high wage premium calibration is measured as follows. The consumption compensation for the representative household is computed in order for its *civilian* family members to be as well off in the counterfactual as in the historical simulation. That is, the direct welfare effect of military hours worked is explicitly omitted. This is calculated to be a consumption increase of 3.40% in each period of the household's infinite lifetime. This is appreciably larger than the value of 1.24% computed for the counterfactual under the benchmark calibration, in which the average military wage premium is 17.5% during the war years.

### 5.1.2. Counterfactual with optimal conscription

Note that the counterfactual experiments considered above do not capture the full welfare value of conscription. This is because conscripted military personnel are paid a wage that is 63% of the civilian wage in the historical simulation, while it is optimal to pay the military no wages at all.

To this end, a second counterfactual—the optimal conscription case—is considered, in which military personnel are conscripted and paid nothing. As before, taxes are unchanged relative to the historical simulation during the war, and follow the benchmark policy rules afterward. Since wartime expenditures are minimized under optimal conscription, less government debt is accumulated. This implies lower postwar taxation and a faster transition to the steady state in the optimal conscription case relative to the historical simulation.

This implies a welfare gain under optimal conscription. Lifetime consumption would need to be increased by 0.67% in the historical simulation in order for the household to be as well off as under optimal conscription. Again, the results from this counterfactual are summarized in Table 2. Hence, for the tax rate specification of Scenario A, the total value of conscription from a fiscal perspective equals 1.92% of lifetime consumption for the benchmark calibration. When military wage premia during the war are calibrated to match the estimates of Altman and Barro (1971), the full value is worth 4.07% of lifetime consumption.

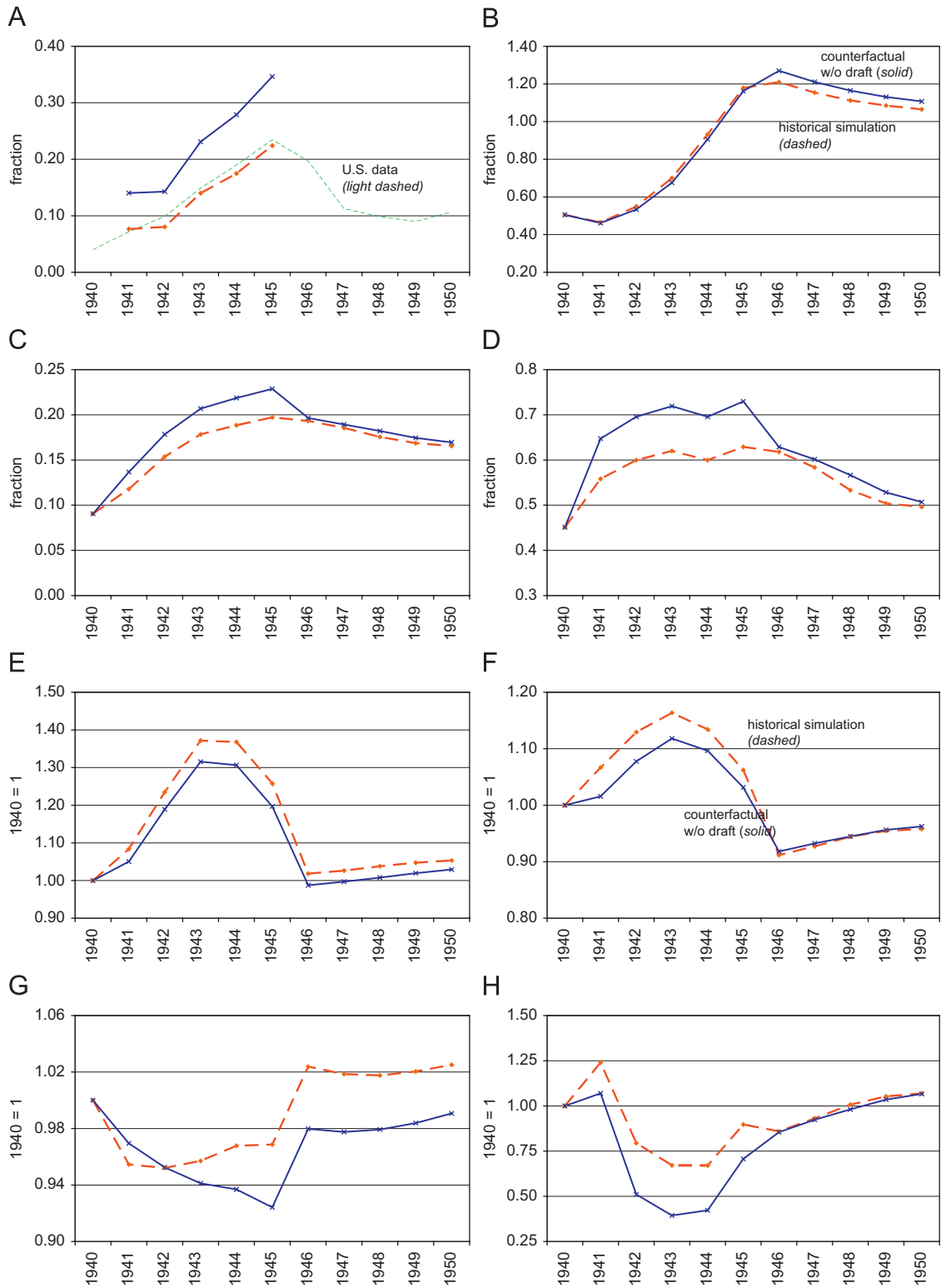
## 5.2. Scenario B: scaling wartime tax rates

The welfare value of conscription obviously depends on the specification of the government's other policy variables. Here, a second scenario is considered to gauge robustness to the details regarding counterfactual tax rates. In *Scenario B*, both the labor and capital tax rates are scaled by a constant factor during the war years. This is done so that in 1945, the market value of government debt in the counterfactual experiments is equal to that of the historical simulation. Given that peacetime tax rates are specified as functions of inherited government debt, the postwar tax rates are equated across experiments.

### 5.2.1. Counterfactual without conscription

Fig. 4 displays the results from simulating the all-volunteer economy in this scenario for the benchmark calibration. Again, the ratio of military pay to government spending is higher without conscription relative to the historical simulation.

<sup>19</sup> This estimate holds the effect of war-related casualty rates on the wage premium constant at zero. Estimates using casualty rates observed during the Vietnam War are substantially higher; see Altman and Barro (1971) for details.



**Fig. 4.** Historical simulation and counterfactual scenario B, volunteer military experiment. (A) Military pay to government spending ratio. (B) Outstanding debt to GDP ratio. (C) Labor tax rate. (D) Capital tax rate. (E) Private sector output. (F) Civilian hours worked. (G) Consumption. (H) Investment.

**Table 3**

Summary statistics: historical simulation and counterfactual scenario B

	Wartime fiscal variables			Welfare
	Average military-to-civilian wage ratio	Average labor tax rate (%)	Average capital tax rate (%)	Consumption equivalent compensation
Historical simulation	0.63	16.7	60.1	n/a
All-volunteer military				
Benchmark case	1.18	19.4	69.7	+0.92%
High wage premium case	1.61	24.6	88.2	+3.52%
Optimal conscription	0	13.4	48.1	−0.83%

Note: Counterfactual experiments conducted scaling wartime (1941–1945) tax rates so that government debt to GDP ratio in 1945 is unchanged. Consumption equivalent compensation denotes additional annual consumption required in perpetuity for counterfactual economy to be indifferent to historical economy.

As a result, both tax rates must be increased by 17% during the 1941–1945 period; this is seen in panels C and D. This has the effect of depressing civilian hours worked and private sector output (panels E and F) during the war by an average of approximately 4% compared to the historical simulation. As a result of the lower private sector output, wartime consumption and investment are lower in the counterfactual experiment as well. Given the increased capital income taxation, investment is disproportionately affected relative to consumption.

Output in the counterfactual is lower in the years following the war as well. This is due to depressed investment during the war, resulting in a lower postwar capital stock. After the war, hours worked are (slightly) higher, and consumption lower, relative to the historical simulation as the economy transitions to steady state.

Again, the increased spending associated with the all-volunteer military results in lost welfare relative to the historical case, this time due primarily to the uneven distribution of tax distortions during and after the war. In order to compensate the household in the counterfactual, annual consumption would need to be increased by 0.92% in perpetuity relative to the historical simulation.

Next, the counterfactual experiment under the high wage premium calibration is considered.<sup>20</sup> In this case, wartime tax rates must be increased by 47% relative to their historically observed values. The compensation for the representative household in the counterfactual so that its civilian family members are as well off as in the historical simulation is 3.52% of lifetime consumption. These results are summarized in Table 3.

### 5.2.2. Counterfactual with optimal conscription

By contrast, under optimal conscription, wartime tax rates would be decreased by 20% relative to the historical simulation, representing a much smoother time profile for taxes. As a result, lifetime consumption in the historical simulation would need to be increased by 0.83% in order to make the household as well off as in the optimal conscription case. Hence, using the tax policy of Scenario B, the full value of conscription is equivalent to 1.75% of lifetime consumption under the benchmark calibration. For the high wage premium calibration, the full welfare value of conscription as a fiscal policy tool is equivalent to 4.35% of lifetime consumption.

### 5.3. Scenario C: Ramsey tax policy

The final experiment evaluates the welfare value of conscription when the government's tax rates solve the Ramsey policy problem. Given the extensive literature on the welfare value of implementing the Ramsey equilibrium, it provides a benchmark with which to evaluate the value of conscription. The experiment also provides an additional check on the robustness of results to the specification of tax policy.

#### 5.3.1. Ramsey versus historical tax rates

First, the optimal policy problem outlined in Section 4 is solved with the restriction that  $\phi = 0.63$ , so that conscripted personnel are paid a wage that is 63% of the civilian wage, as in the historical simulation.<sup>21</sup> It is well known that in Ramsey problems, the policy maker has an incentive to confiscate the real value of private assets at date 0 in order to relax the intertemporal government budget constraint (see, for instance, Chari et al., 1994). In the present model, this would be accomplished through an arbitrarily high initial tax rate on capital income. In order to make the problem interesting, tax rates are restricted in all periods to be at most 100% (i.e., the government can only tax capital income, and cannot confiscate the capital generating that income). In a non-stochastic setting and for the functional form on preferences considered here,

<sup>20</sup> That is, when  $\bar{n}$  is increased to 0.86. From Table 3, we see that this generates a military-to-civilian wage premium of 61.3%, which is greater than the 60% premium generated in Scenario A. This is due to the fact that wartime tax rates are higher in Scenario B; this depresses civilian hours relative to Scenario A, increasing the military-to-civilian hours worked difference and the wage premium.

<sup>21</sup> Recall that the unrestricted solution to the Ramsey problem would set  $\phi = 0$ .

Chari et al. (1994) show that optimality involves setting the capital tax to its upper bound for a finite number of periods beginning at date 0, followed by a one-period transition; after that, the optimal capital income tax rate is zero (see also Chamley, 1985).

The solid line depicted in panel A of Fig. 5 confirms this: the Ramsey policy sets the capital tax to 100% in the first three periods (1941–1943), and to 0% by 1945; there is a single deviation from zero thereafter, when the (uncertain) high productivity state in 1946 is realized. The optimal labor income tax rate is plotted in Panel B. Following a labor subsidy in the first period, the labor tax gradually increases before settling around 27% in 1946. Evidently, tax rates under the Ramsey plan differ drastically from those in the historical simulation (plotted as the dashed lines), which are specified to match historical observation.

These differences are reflected in the dynamics of government debt, plotted relative to GDP in panel C. The initial periods of high capital income taxation drive down the debt to GDP ratio under the Ramsey plan. The ratio rises in the latter stages of the war, before a final jump and stabilization in 1946 when the high productivity peace state is realized.

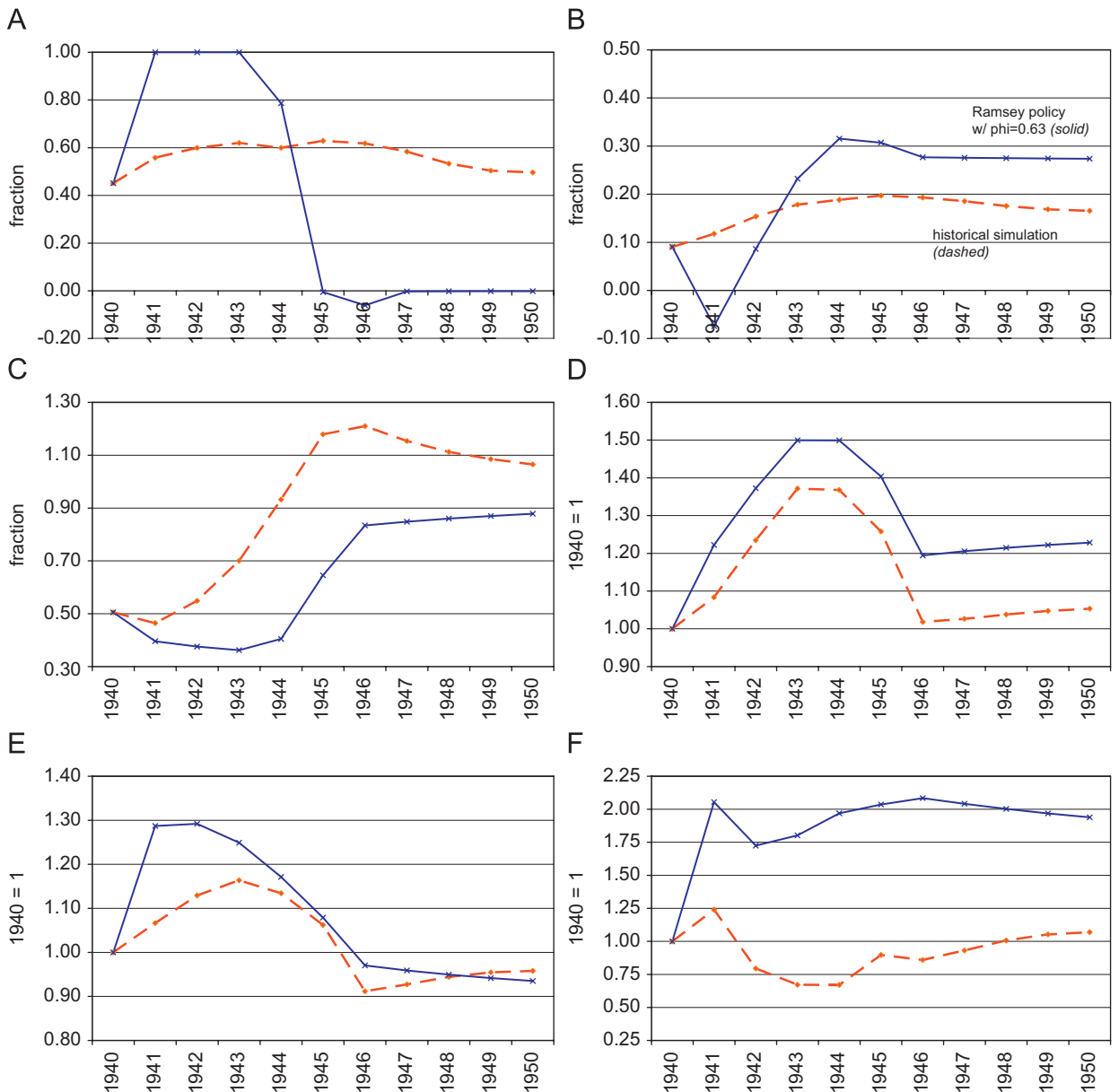


Fig. 5. Historical simulation and Ramsey tax policy simulation. (A) Capital tax rate. (B) Labor tax rate. (C) Outstanding debt to GDP ratio. (D) Private sector output. (E) Civilian hours worked. (F) Investment.

Private sector output, civilian hours worked, and investment are plotted in panels D through F. All three measures boom during the war relative to the historical simulation. The values for output and, especially, investment remain high after the war. This reflects the stimulus induced by the move to zero capital taxation under the Ramsey policy plan.

To gauge the quantitative importance of these differences, I compute the compensation that must be given to the household in the historical simulation in order for it to be as well off as in the current case (when tax rates solve the Ramsey problem, with the restriction that  $\phi = 0.63$ ). On a period-by-period basis, consumption would need to be increased by 3.47% in perpetuity to make the household as well off. This primarily reflects the move to zero capital taxation under the Ramsey plan. This long-run policy change allows for a 11% reduction in hours worked in the steady state of the Ramsey equilibrium relative to the historical simulation, with virtually identical levels of steady-state consumption.

### 5.3.2. Welfare value of conscription with Ramsey tax rates

Finally, the welfare value of conscription in the Ramsey case is calculated by solving the optimal policy problem for the two counterfactual experiments. The first assumes the government is restricted to hiring an all-volunteer military. Relative to the conscription case with  $\phi = 0.63$  depicted in Fig. 5, the volunteer military represents a 0.63% welfare loss, as measured in units of per period consumption. The second case involves the implementation of a fully optimal policy, namely, the Ramsey policy with conscription and  $\phi = 0$ . Per period consumption in the  $\phi = 0.63$  economy would need to be increased by 0.55% in order to make the household as well off as in the full Ramsey equilibrium.<sup>22</sup>

Hence, the welfare value of conscription in its fiscal role is worth 1.18% of lifetime consumption when tax rates solve the Ramsey problem. This is somewhat smaller, but similar in magnitude to the values found in Scenarios A and B. Finally, the high wage premium calibration of the model in which  $\hat{h}$  is increased to 0.86 in the volunteer military experiment is considered. The welfare value of conscription is 2.06% of lifetime consumption; again this is similar to, but smaller than the values for Scenarios A and B.<sup>23</sup>

To summarize, the welfare gain in moving from voluntary recruitment to an optimal conscription remains quantitatively large when tax policy solves the Ramsey problem in the counterfactual experiments. Moreover, the welfare value of conscription is of the same order of magnitude as the value of switching from the benchmark specification of tax policy to the Ramsey specification, for a given military recruitment regime. In fact, the welfare values are very close in the case of the high wage premium calibration.

## 6. Conclusion

This paper quantifies the welfare value of conscription as a fiscal policy tool. Conscription allows the government to pay below-market wages to military personnel. As a result, it allows the government to minimize wartime expenditures and their associated tax distortions. In a model calibrated to the U.S. WWII experience, the welfare gains from instituting an optimal conscription are large. Relative to the case in which the government hires an all-volunteer military, the welfare gains are conservatively estimated to be equivalent to 1.2–2.0% of annual consumption in perpetuity, depending on the exact specification of tax policy in the counterfactual experiment. When the model is calibrated to match Altman and Barro's (1971) estimate of the military-to-civilian sector wage premium during the 1960s, the predicted welfare value of conscription is worth 2.0–4.4% of consumption in perpetuity.

This is a first step in the determination of optimal policy during a large fiscal event such as the U.S. WWII effort. One could consider the optimal use of other government policy tools, such as government provision of private sector capital (again, see Gordon, 1969; Braun and McGrattan, 1993; McGrattan and Ohanian, 2006), price controls and rationing (a form of non-linear taxation which provides expenditure saving on goods with competing private and military uses), and state-contingent monetary policy (see Chari et al., 1991; and Siu, 2004). Finally, there are many important considerations specific to conscription that could be fruitfully incorporated into a normative analysis like the one considered here. These include issues such as conscription's effect on resource misallocation and redistribution.

## Appendix A. Supplementary data

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.jmoneco.2008.07.005.

<sup>22</sup> Note that the welfare loss of 0.61% in moving from the  $\phi = 0.63$  case to the all-volunteer case is small, relative to the values of 1.24% and 0.92% derived in Experiments A and B. By contrast, the welfare gain of 0.55% in moving from the  $\phi = 0.63$  case to the  $\phi = 0$  case is proportionately closer to the values of 0.67% and 0.83% in Experiments A and B. This is partly due to the fact that the Ramsey plan calls for high levels of civilian hours during the war, regardless of the military recruitment regime; see, for instance, panel E of Fig. 5. This reduces the difference between civilian and military hours, and thus, the wage premium that must be paid to volunteer military personnel.

<sup>23</sup> Again, the welfare cost of moving to an all-volunteer military is mitigated because the Ramsey policy induces high levels of civilian hours during the war. This limits the difference between civilian and military hours, and thus limits the wage premium paid to military personnel under the volunteer system.

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