German Economic Review 5(4): 381–406

Dynamic Costs of the Draft

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Abstract. *We propose a dynamic general-equilibrium model with human capital accumulation to evaluate the economic consequences of compulsory services (such as military draft or social work). Our analysis identifies a so far ignored dynamic cost arising from distortions in time allocation over the life cycle. We provide conservative estimates for the excess burden that arises when the government relies on forced labor rather than on income taxation to finance public expenditures. Our results suggest that eliminating the draft could produce considerable dynamic gains, both in terms of GDP and lifetime utility.*

JEL classification: *H*20, *H*57, *J*22, *C*68.

Keywords: Conscription; time allocation; distortionary taxation; computable general-equilibrium models.

1. INTRODUCTION

To recruit military manpower, governments can rely on conscription (the draft), on voluntary enlistments, or on a combination of both. The United Kingdom and the United States have historically relied on a volunteer military while many countries in continental Europe traditionally got most of the military personnel through conscription. Recently a number of countries, including France, Spain, the Netherlands, Belgium and Italy, have abolished or started to phase out conscription; other countries such as Germany or Poland are discussing such a move. As a corollary to the military draft, most democratic countries offer conscripts who object to bearing arms the option of civil service, i.e. to take active duty in social services, elsewhere in the public sector or in certain associations rather than in the army. In several countries (notably in Germany) draftees in the social sector make substantial or, according to some supporters of conscription, even indispensable contributions to the welfare system.

In its common form a draft system with compulsory military or social service has two specific features. First, it only affects males (Israel being a prominent exception).[1] Second, draftees are paid well below market rates for similar types of services, both in the military and in the social sector.[2] This second feature leads many observers to believe that the draft opens an inexpensive way for the government to provide military or other services. Yet economists have argued since long that the cheap-labor argument is misleading since it confuses accounting (monetary) costs with opportunity (real) costs. The main economic arguments against the draft are the following (Hansen and Weisbrod, 1967; Fisher, 1969; Lee and McKenzie, 1992; Sandler and Hartley, 1995, Ch. 6; Warner and Asch, 2000):

- The draft imposes opportunity costs on conscripts that do not show up in fiscal budgets. The opportunity costs exceed budgetary costs by the maximum amount draftees are willing to pay to avoid compulsory service. This can be calculated as the difference between potential market income and the lower pay during the service plus the pecuniary value of disutility from having to work in an occupation and under circumstances that draftees otherwise would not have chosen.
- Independently on how it is acquired, manning an army or the welfare industry comes at the cost of labor input foregone in other sectors of the economy. Productivity-based market wages reflect this cost while a purely fiscal perspective based on draftees' arbitrary and low pay understates them.
- The draft leads to an inefficient match between people and jobs and thus to an avoidable loss in output. Young men are rather arbitrarily allocated to military or social work without consideration of productivity, comparative advantages and outside options.
- The allocation of labor within the military may be inefficient for two reasons. First, cheap labor may lead to an excessive use of personnel and thus a waste of resources. Second, the productivity of draftees in military and social sectors is lower than the productivity of professionals due to shorter periods of training, higher turnover rates and lack of motivation and incentives.

1. However, even in countries with a draft system not every young and able-bodied man is required to actually do the service: e.g., when a universal draft (of males) delivers too many personnel, ballots might be used to determine whom to actually call up. Moreover, certain classes of individuals (e.g. clergymen or cases of special hardship) are automatically exempt in most draft systems.
2. Currently, conscripts in Germany are paid between 7.41 and 9.71 euros per day plus some allowances for food and clothing. In Finland, daily pay varies between 3.60 euros during the first six months and 8.25 euros after nine months. People doing civil service are also provided housing and 8.90 euros per day in case the employer provides no meals. Denmark is a less drastic case: draftees do not get free meals, but receive 359 euros per month to cover living expenses, and the taxable compensation varies between 526 euros during the first four months and 1,722 euros after one year.

While the static efficiency losses of a draft system are sizable,[3] we argue in this paper that the draft also involves additional dynamic costs that have been ignored so far. The draft imposes an intertemporal excess burden on the economy by distorting the allocation of time over the life cycle for conscripts, and by front-loading the cost of financing public services to the early years of life. In particular, the system postpones or interrupts draftees' education and learning, and reduces the present value of lifetime income. The draft system thus reduces the accumulation of both human and physical capital, with negative and lasting impacts on labor productivity and aggregate output.

Conscription has a negative impact on human capital formation since young men (and sometimes women) typically are called up to compulsory service during a period of their lives which they otherwise would devote to learning or gathering first experiences on the job. In many countries, male high-school graduates do compulsory military service immediately after leaving school and begin university studies or vocational training after the military duty is done.[4] Firms may even be reluctant to train high-school graduates unless they have finished or are exempt from military service, because military and civil service authorities do not always refrain from calling young men to service during their formal vocational training. Most young men without high-school degrees are drafted shortly after finishing their apprenticeship or vocational training. The draft prevents them from deepening or acquiring relevant professional experience, and freshly gained job-specific skills depreciate during compulsory service.[5]

Apart from distorting human capital accumulation, there is a second channel through which the draft might impose a dynamic burden on society. Draftees typically receive a low payment, and the difference between this payment and the market value of their labor supply corresponds to a supplementary income tax levied exclusively on draftees during the service. Taxes could alternatively be collected from all age cohorts alive in a certain period (including the non-drafted part of the population). This is basically how a voluntary military force is financed. Appropriately designed, such a general tax could in every period earn the same revenue for the government as the specific tax on draftees' income. However, by spreading tax liabilities more evenly over the life cycle the general tax would come at a smaller cost in terms of the present value of lifetime income than a single and non-recurring supplementary tax on income during conscription. In the presence of

3. For example, Kerstens and Meyermans (1993) estimate that the social cost of the (now abolished) Belgian draft system amounted to twice the budgetary cost. Lutz (1996) reviews several studies and reports that the annual opportunity cost of conscription in the German army is between 2.2 and 6.7 billion euros.
4. In 1998, compulsory military service in Germany (which lasted 12 months then) on average delayed the start of university studies by 16 to 18 months (DSW, 2000; Lewin *et al.*, 2000).
5. Time spent in the military or in the social sector is not entirely wasteful with respect to human capital accumulation, but the skills acquired there are of only limited value to most draftees.

consumption smoothing, a more even spread of tax liability over the life cycle would increase private saving and the accumulation of physical capital.

The adverse effects of the draft system on human and physical capital have not received much attention in the literature. To our knowledge, no study exists that deals with the impact of the draft on physical capital while only a few studies discuss human capital issues of the draft. In passing, Fisher (1969) mentions the impact of the American draft lottery in the 1960s on human capital decisions and suggests that uncertainty might impose a dynamic cost on the economy. In an econometric analysis, Imbens and van der Klaauw (1995) find that conscription in the Netherlands during the 1980s and early 1990s reduced earnings for conscripts by 5 per cent relative to the non-drafted men of the same cohort. Similar results are obtained by Angrist (1990) for American Vietnam War conscripts. In an empirical study of wage effects due to career interruptions in Germany, Kunze (2002) finds that compulsory service increases wage income for men by 3.2 per cent during the first year after conscription and depresses wage income beyond the first year, where the gap in wages increases with time.[6] To the extent that earning differentials reflect differences in human capital formation, empirical evidence thus supports the view that the draft involves dynamic costs from postponement of education and shorter work careers.

We identify and assess dynamic costs of conscription in a general-equilibrium model based on individual life cycle decisions. Individuals allocate time across work, learning and leisure and maximize intertemporal utility subject to an intertemporal budget constraint. There is one all-purpose good (output) in the economy, which is produced by a combination of labor services and physical capital, and aggregate output is either invested or consumed by both individuals and the public sector. Public expenditures on the all-purpose good include, but are not confined to, spending on defense. These expenditures are financed by a proportional tax rate on wage income, and the government operates with a dynamic budget constraint that is balanced in each period.

The model is first calibrated to a steady-state equilibrium without compulsory service. This represents the case of an all-volunteer army: military services (including labor services) are purchased at market prices and are entirely tax-financed. Conscription is then introduced as an obligation by a share of the population to spend the first economically active year doing work instead of being allowed to freely allocate time between work, learning and leisure. A natural interpretation is that the output of the all-purpose good produced by draftees is earmarked for the

6. Kunze (2002) suggests that the increase in wage income during the first year after conscription is driven by effects unrelated to human capital, e.g. by signaling effects. Alternatively, the wage increase immediately after conscription might be caused by lower wage offers before conscription since the authorities sometimes call up people during apprenticeship or vocational training.

purpose of national defense and acquired by the government. The supply of public services, including defense, is held constant, and we distinguish two features of the draft. First, we assume that labor services during conscription are paid at the market wage rate. The only difference to the benchmark scenario, thus, is the constraint on use of time imposed on the youngest generation in every period. Second, we introduce a supplementary tax on income during conscription. This tax has the equivalent interpretation that, by underpaying conscripts, governments purchase defense goods (or the labor services needed to produce them) at a lower budgetary cost than the market value.

Our results show that both the constraint on time and the supplementary income tax during conscription create dynamic excess burdens (output and utility losses). Ignoring general-equilibrium effects, the constraint on allocation of time distorts investment in human capital, while the supplementary tax on income has a negative impact on private saving and physical capital accumulation. The impact of the draft is significant at the individual level. More than a decade after completion of conscription, former conscripts have not caught up in productivity compared to non-conscripts at the same age. The economic burden of the draft may also yield negative income effects for non-conscripts due to general-equilibrium effects.

2. THE MODEL

We apply a dynamic life cycle model in which individuals spend time on labor supply, learning and leisure. Private and public agents have perfect knowledge about current and future economic events, and individuals maximize lifetime utility from consumption and leisure subject to an intertemporal budget constraint. Wage income taxes are collected by the public sector to satisfy a given revenue requirement, which is spent on public provision of goods and services.

The model represents a closed economy where the production technology combines labor services and physical capital. Perfect competition prevails in each market, and private and public agents take output and factor prices as given. Individuals are economically active for 60 years, beginning at age 18 and ending at age 77.

Including human capital formation provides one way of explaining the existence of wage differentials over the life cycle. Individuals can invest in human capital or invest in financial assets. Investment in human capital is costly and specific to each individual, and it is therefore concentrated at the beginning of the life cycle and ends when retirement sets in.[7] Human capital depreciates at a constant rate, and the wage rate per unit of working time thus declines when learning ends.

7. New human capital can be produced through education and formal/informal on-the-job training, together referred to as learning.

There are two different types of individuals in the model: conscripts (indexed by subscript c) and non-conscripts (subscript n). Conscripts are subject to draft and are forced to spend their time on work in the first period of the life cycle, possibly with a low income. Non-conscripts do not face the time constraint or the supplementary tax.

2.1. Intertemporal optimization

In each period of the life cycle, individuals divide time between work, q, learning, s, and leisure, v. The economic life-span of each individual consists of 60 periods, each period representing one year, and the periods are indexed from 0 to 59. Total use of time in each period cannot exceed the endowment of time:

$$v_{i,t} + q_{i,t} + s_{i,t} \leq e \tag{1}$$

where e is the constant endowment of time in each period. The endowment of time denotes hours available to work, learning and leisure, and it is therefore interpreted as the normal length of a work week, say 40 hours.[8] Subscript t refers to the person's age, and subscript i indicates whether the individual is or has been subject to conscription ($i = c$) or not ($i = n$).

Gross investment in human capital is determined by learning, and the stock of human capital evolves according to the following law of motion:

$$h_{i,t+1} = (1 - \delta^H) \cdot h_{i,t} + s_{i,t}^{\eta} \tag{2}$$

where h is the individual stock of human capital, δ^H is the rate of depreciation with respect to human capital, and η measures the elasticity of new human capital with respect to learning, where $0 < \eta \leq 1$. This specification implies that learning is spread more evenly across time when η falls. The initial stock of human capital, h_0, is positive and every person enters the economy with some productive skills.

The effective supply of labor services depends on time devoted to work and the stock of human capital:

$$l_{i,t} = q_{i,t} h_{i,t}^{\beta} \tag{3}$$

where l is the individual supply of labor services, and β denotes the elasticity of labor services with respect to the stock of human capital. We assume that $0 < \beta < 1$, implying diminishing marginal productivity of human capital in the supply of labor services. Marginal and average labor productivity is

8. Our results are not sensitive to the choice of time units or their interpretation. In the numerical model below, we normalize the total amount of time e to unity.

independent of working time and equal to human capital raised to the power of β.[9]

The individual maximization problem is based on an explicit representation of the utility function:

$$U_i = \sum_{t=0}^{59} \frac{1}{(1+\rho)^t} \cdot \left[\left(\frac{c_{i,t}^{1-\gamma}}{1-\gamma} \right) + \alpha \cdot \left(v_{i,t} - \mu v_{i,t}^2 \right) \right] \tag{4}$$

where c is consumption of goods, v is demand for leisure, ρ is the rate of time preference, γ is the inverse of the intertemporal elasticity of substitution (σ), α measures the weight assigned to leisure in the instantaneous utility function, and the coefficient μ reflects the rate at which the marginal utility of leisure decreases as the amount of leisure is increased.

The specification of the instantaneous utility function implies that individuals smooth consumption over the life cycle, whereas leisure is not necessarily consumed in every period. Marginal utility from leisure is $\alpha \cdot (1 - 2\mu v_{i,t}), i \in \{c, n\}$, where marginal utility is constant if μ is equal to zero. A natural upper bound for μ is $1/2e$, which implies that the marginal utility of leisure goes to zero if time is spent entirely on leisure. Contrary to popular constant elasticity of substitution formulations of the utility function, the additively separable utility function allows the point in time at which the individual begins to retire to be endogenous. Retirement begins when the individual starts to demand a positive amount of leisure, which means that less time than the normal work week is devoted to work and human capital formation.

The quadratic utility function with respect to leisure allows us to capture two labor market features. First, the demand for leisure is concentrated at the end of the life cycle. Active labor market participation is phased out at old age since labor productivity falls. The fall in productivity at old age follows from intertemporal maximization of lifetime utility. Since the return to investment in human capital depends on remaining lifetime, human capital accumulation is concentrated in the beginning of the life cycle and phased out towards the end of life. Human capital depreciates at a constant rate, and the opportunity cost to leisure thus declines when learning ends. Second, the model captures the idea that people typically require a higher marginal wage compensation when leisure time is scarce.

Individuals are born without financial wealth, and they can save and borrow without liquidity constraints at the market interest rate, r. The financial wealth of individuals, measured at the beginning of each period, is given by:

$$a_{i,t} = (1 + r) \cdot \left[w(1 - \tau^l) \cdot l_{i,t-1} - c_{i,t-1} + a_{i,t-1} \right] \tag{5}$$

for $t = 1, \ldots, 59$ with $a_{i,0} \equiv 0$, where w is the wage rate, and τ^l is the tax rate on wage income.

9. Marginal and average labor productivity will also depend on working time if we use homothetic Cobb–Douglas or CES specifications. If one of these specifications is applied, labor productivity may increase at the end of the life cycle when working time decreases.

The price of the consumption good is chosen as numéraire and normalized at unity. The lifetime budget constraint states that the present value of lifetime expenditures on consumption cannot exceed the present value of lifetime wage income:

$$\sum_{t=0}^{59} \frac{1}{(1+r)^t} w(1-\tau^l) \cdot l_{i,t} \geq \sum_{t=0}^{59} \frac{1}{(1+r)^t} \cdot c_{i,t} \tag{6}$$

Each individual maximizes the present value of lifetime utility, U, subject to the time endowment constraint, the law of motion with respect to human capital, and the intertemporal budget constraint.

2.2. Conscription

Having established the intertemporal maximization problem for each individual, we next describe how the draft system is introduced in the model. We assume that conscripts are forced to spend available time in the first period of the life cycle on work, i.e. $q_{c,0} = e$. Wage income during conscription can be subject to supplementary taxation, and the intertemporal budget constraint for conscripts changes to:

$$\sum_{t=0}^{59} \frac{1}{(1+r)^t} w\left(1-\tau^l\right) \cdot l_{c,t} - \tau \cdot w\left(1-\tau^l\right) \cdot l_{c,0} \geq \sum_{t=0}^{59} \frac{1}{(1+r)^t} \cdot c_{c,t} \tag{7}$$

where τ is the supplementary tax rate on wage income during conscription. Since $w(1-\tau^l)$ is the return to labor services after tax, $\tau = 0$ corresponds to a situation where conscripts receive the market value of labor (net of income taxes), whereas $\tau = 1$ corresponds to a situation where conscripts receive no pay. The true value of τ is difficult to estimate; it furthermore varies with family and educational status.[10] The financial wealth of conscripts, measured at the beginning of each period, is given by:

$$\begin{aligned} a_{c,1} &= (1+r) \cdot \left[w(1-\tau^l) \cdot l_{c,0} - \tau \cdot w(1-\tau^l) \cdot l_{c,0} - c_{c,0}\right] \\ a_{c,t} &= (1+r) \cdot \left[w(1-\tau^l) \cdot l_{c,t-1} - c_{c,t-1} + a_{c,t-1}\right], \quad \text{when } t \geq 2 \end{aligned} \tag{8}$$

The use of time is constrained to work in the first period of the life cycle for conscripts, and the extra payments from conscripts do not further distort the allocation of time. However, the extra payments reduce private saving by conscripts since private consumption is determined by lifetime income and follows an exponential pattern over the life cycle, where the consumption growth rate is determined by the Euler condition (the difference between the

10. Schleicher (1996) estimates that net income foregone for an average German conscript in 1993 was 2.4 times the pay during conscription, which implies that $\tau = 2.4/3.4 = 0.7$.

real interest rate and the rate of time preference divided by the intertemporal elasticity of substitution).

The intertemporal budget constraint for non-conscripts is:

$$\sum_{t=0}^{59} \frac{1}{(1+r)^t} w(1-\tau^l) \cdot l_{n,t} \geq \sum_{t=0}^{59} \frac{1}{(1+r)^t} \cdot c_{n,t} \tag{9}$$

The financial wealth of non-conscripts is given by (5), letting $i = n$.

2.3. General equilibrium

The life cycle model is used to simulate steady-state equilibrium effects of the restriction on time allocation and the supplementary tax. Since population growth is not important to the analysis, each cohort size is kept constant and normalized at unity. Prices and aggregate quantities are constant in steady state, and the variables do not carry time indices unless necessary.

Consumption and investment decisions by the representative individuals reflect the behavior of current generations in the steady-state equilibrium. It is therefore simple to derive the aggregate supply of labor services to the labor market and the aggregate private demand for leisure, learning and consumption in the steady state. The aggregate supply of labor services is equal to the weighted sum of the supply of labor services over the life cycle for the two different types of individuals:

$$L = \varepsilon \cdot \sum_{t=0}^{59} l_{c,t} + (1-\varepsilon) \cdot \sum_{t=0}^{59} l_{n,t} \tag{10}$$

where L is the aggregate supply of labor services in steady state, and ε is the share of the population subject to conscription.

The production of final goods combines labor services and physical capital, and the technology is represented by a Cobb–Douglas specification:

$$Y = K^{\phi} \cdot L^{(1-\phi)} \tag{11}$$

where Y is aggregate output, K is the aggregate stock of physical capital, and ϕ is the value share of physical capital. Each producer of goods maximizes profits subject to the production technology (11), and the first-order conditions imply that the marginal product of a particular factor input is equal to the producer price of that factor input.

Physical capital depreciates at rate $\delta^K > 0$. The capital stock in period t is equal to the capital stock at the beginning of the previous period less depreciation plus investment in the previous period. As the capital stock is constant in the steady state, gross investment I in physical capital is given by:

$$I = \delta^K \cdot K \tag{12}$$

Aggregate output is either invested or consumed by individuals or the public sector, and the market-clearing condition for output is:

$$Y = C + I + G \tag{13}$$

where C is aggregate private consumption and G is the public consumption. Finally, the government operates with a dynamic budget constraint that is balanced in each period:

$$\tau^l \cdot w \cdot L + \varepsilon \cdot (\tau \cdot w(1 - \tau^l) \cdot l_{c,o}) = G \tag{14}$$

The total tax revenue from the proportional and supplementary tax rates on wage income on the left-hand side is equal to the cost of public provision of goods and services on the right-hand side. In practice, the supplementary draft tax does not appear on the revenue side of the government budget but it is rather reflected by the lower budgetary costs of a conscripted army, relative to an all-volunteer force.

2.4. Welfare effects

We use the equivalent variation measure to assess the welfare effects of introducing conscription. This measure is derived as the percentage change in lifetime earnings necessary to yield the utility level reached in the new steady state. More formally, it is determined by:

$$\hat{U}_i(E_{i,0} \cdot (1 + \chi_i), r_0, w_0) = \hat{U}_i(E_{i,1}, r_1, w_1) \tag{15}$$

where $\hat{U}_i$ denotes the indirect utility function for group $i = c, n$, and E_i is the net present value of group i's lifetime income. As we focus on the factor prices faced by individuals, we define w_0 and w_1 to measure after-tax wage rates. Therefore, they combine the changes in gross wage rates and in wage tax rates. The subscripts 0 and 1 denote initial steady-state values without and with conscription, respectively. The variable χ_i measures the change in group i's welfare between the two steady states. This welfare measure can be compared across different steady states and is applicable for changes of any size and not only differential approximations.

3. CALIBRATION

There is no draft system in the initial steady-state equilibrium, i.e. there is initially no distinction between conscripts and non-conscripts. The model is calibrated to the dataset presented in Table 1, and the following standard parameter values are applied in the baseline scenario. Capital income accounts for 31.2 per cent of GDP and labor income accounts for 68.8 per cent of GDP, which implies that the labor–capital income ratio is equal to 2.2.

Table 1 Parameter values, tax rates and factor prices in the initial steady-state equilibrium

Parameter values:		
ρ	Time preference rate	0.031
σ	Intertemporal elasticity of substitution	0.667
μ	Coefficient in quadratic utility function	0.250
α	Weight parameter in quadratic utility function w.r.t. leisure	0.750
η	Elasticity of human capital w.r.t. time devoted to learning	0.750
δ^H	Depreciation rate for human capital	0.100
β	Elasticity of labor services w.r.t. human capital	0.350
φ	Value share of physical capital in production of goods	0.312
δ^K	Depreciation rate for physical capital	0.100
h_0	Initial human capital stock	1.000
e	Endowment of time in each period	1.000
Tax rates:		
τ^l	Tax rate on wage income	0.375
Factor prices:		
r	Annual interest rate	0.050
w	Wage rate before tax	1.600

The level of investment is equal to 20.8 per cent of GDP, given a net interest rate of 5 per cent and a 10 per cent depreciation rate with respect to physical capital. To achieve a sufficiently high private saving rate, the rate of time preference is set equal to 3.1 per cent. We assume that the intertemporal elasticity of substitution is equal to 0.667, which is within the range from 0.5 to 1 that is used in most numerical studies.

The tax revenue from the wage income tax in the initial steady state is equal to 25.8 per cent of GDP. This revenue is achieved by a 37.5 per cent tax rate on wage income. We choose parameter values such that the average individual labor supply profile resembles the estimated average individual labor supply profile (measured in hours worked) for recent generations in McGratten and Rogerson (1998). Figure 1 illustrates the allocation of time over the life cycle for the representative agent in the initial steady state. Human capital formation is highest at the beginning of the life cycle, roughly constant between the ages of 25 and 55, and then phased out. Retirement starts at the age of 64, and time spent on leisure exceeds time spent working around the age of 70.

Investment in human capital is costly and specific to each individual, and it is concentrated in the beginning of the life cycle. The marginal product of human capital investment falls with the level of learning, and the buildup of human capital is thus spread over several periods. Figure 2 shows that labor productivity in the first period of the life cycle is normalized at unity, and it

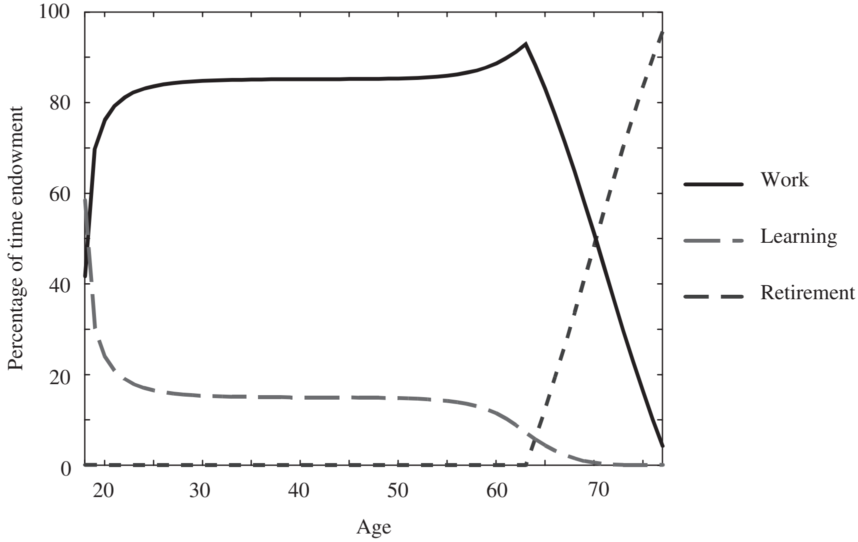

Figure 1 Allocation of time over the life cycle (initial steady-state equilibrium)

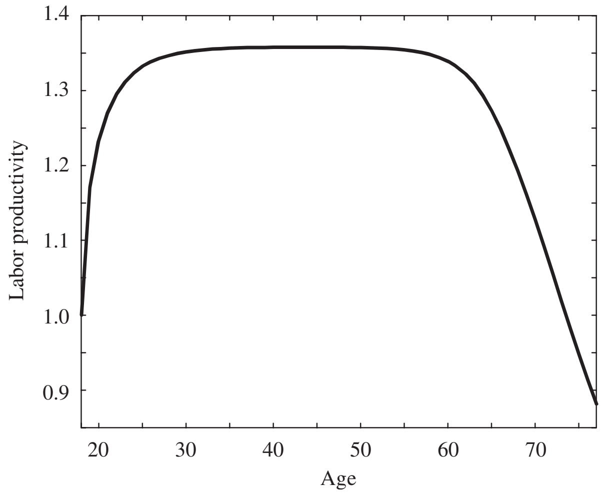

Figure 2 Labor productivity over the life cycle (initial steady-state equilibrium)

increases during the first ten years of the life cycle. The level of labor productivity is maintained during the next 30 years and falls when the individual begins to retire from the labor market. Human capital depreciates at a constant rate, and the wage rate per unit of working time is falling during the last third of the life cycle.

4. RESULTS

We next analyze the economic consequences of replacing the volunteer military force with a draft system. We distinguish two features of the draft system. First, conscripts are forced to spend available time in the first period of the life cycle on work. Second, conscripts may be paid less than the market value of their labor services (after the ordinary wage tax). This is formalized as a supplementary tax being imposed on their net wage income in the first period. Public spending on goods and services is held constant, and the proportional tax rate on wage income is determined endogenously to balance the public budget. To assess the long-run impacts of the policy reform, the simulated policy changes are compared with a baseline scenario reflecting the initial steady state.

4.1. Income and welfare effects

Introducing a draft system has negative effects in the long run on income and consumption. This is driven partly by direct effects on draftees, and partly by indirect general-equilibrium effects of changes in factor prices on the behavior of non-draftees. Table 2 shows that GDP and aggregate consumption decrease by 0.2 per cent when 25 per cent of the population is subject to draft and the supplementary tax rate is equal to 0. The reduction in private saving is more significant than the fall in labor services, and the capital intensity falls. The decrease in capital intensity drives up the return on physical capital and drives down the gross wage rate. The reduction in labor income erodes the revenue from the initial tax rate on wage income, and the tax rate on wage income has to be raised to balance the public budget. The negative impact on the economy is more significant when the share of the population subject draft increases. For example, GDP decreases by 0.7 per cent when the entire population is subject to draft and the supplementary tax rate is equal to 0.

Table 2 also shows that supplementary tax payments by conscripts magnify the negative effects on income and consumption. The tax rate on wage income is reduced by the revenue from the supplementary tax, and the changes in the tax structure thus transfer income from conscripts to non-conscripts, and from young generations to older generations who are not subject to draft. The impact on the economy may be significant. For example, GDP falls by 3 per cent if the entire population is subject to draft and no compensation is paid during conscription. Most of the decrease in GDP is due to reduced private saving, and the capital intensity in the economy drops further. This increases the return on physical capital and decreases the gross wage rate.

Figures 3a and 3b illustrate the effects on individual learning decisions when 25 per cent of the population is subject to conscription and the supplementary tax rate on net wage income is 50 per cent. Conscripts are forced to spend available time on work in the first period of the life cycle,

Table 2 Effects of move to draft system (percentage change from initial steady-state equilibrium)[a]

	Share of population subject to draft								
	25 per cent			50 per cent			100 per cent		
	Supplementary tax rate			Supplementary tax rate			Supplementary tax rate		
	0%	50%	100%	0%	50%	100%	0%	50%	100%
GDP	– 0.2	–0.5	– 0.8	– 0.4	– 0.9	– 1.5	– 0.7	– 1.9	– 3.0
Consumption	– 0.2	– 0.6	– 1.0	– 0.5	– 1.1	– 1.9	– 0.9	– 2.3	– 3.7
Physical capital stock	– 0.3	– 0.8	– 1.3	– 0.5	– 1.5	– 2.6	– 1.0	– 3.1	– 5.2
Labor services	– 0.1	– 0.3	– 0.6	– 0.3	– 0.7	– 1.1	– 0.6	– 1.3	– 2.1
Rental rate on physical capital	0.08	0.29	0.51	0.16	0.61	1.07	0.33	1.24	2.23
Wage rate	– 0.04	– 0.13	– 0.23	– 0.07	– 0.28	– 0.48	– 0.15	– 0.56	– 1.00
Tax rate on wage income[b]	0.18	0.12	0.08	0.35	0.23	0.13	0.69	0.45	0.26

[a] The initial tax rate on wage income is 37.5 per cent.
[b] Measured in percentage points.

where labor productivity is low and a significant share of their time otherwise would be spent on learning. They compensate for the initial loss in learning by raising human capital investment in subsequent periods after conscription. Lifetime income is reduced by the inefficient allocation of time and the supplementary tax payments during conscription, and conscripts raise learning efforts late in the life cycle to compensate for the income loss.

Non-conscripts, on the other hand, marginally reduce the learning period. The increase in the interest rate reduces the present value of the return to learning and leads to a reduction in human capital accumulation. Investment in human capital is also reduced by the decrease in the net wage rate. The reduced net wage rate increases the demand for leisure and reduces the amortization period for investment in human capital. Hence, both changes in net factor prices have a negative impact on learning efforts by non-conscripts.

Human capital depreciates over time, and the lack of learning in the first period of the life cycle has a negative impact on labor productivity for conscripts during the first ten years on the labor market compared to the initial labor productivity profile (Figure 4a). Labor productivity is unchanged at middle age, and the extended learning period increases labor productivity at the end of the life cycle. The small negative impact on labor productivity at the end of the life cycle for non-conscripts follows from the reduction in learning (Figure 4b).

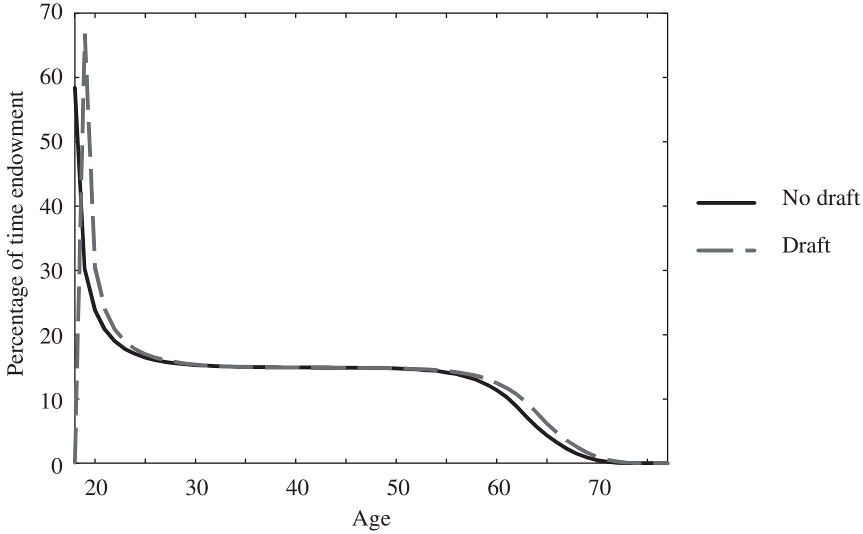

Figure 3a Learning for conscripts (move to draft system: epsilon = 0.25 and tau = 0.50)

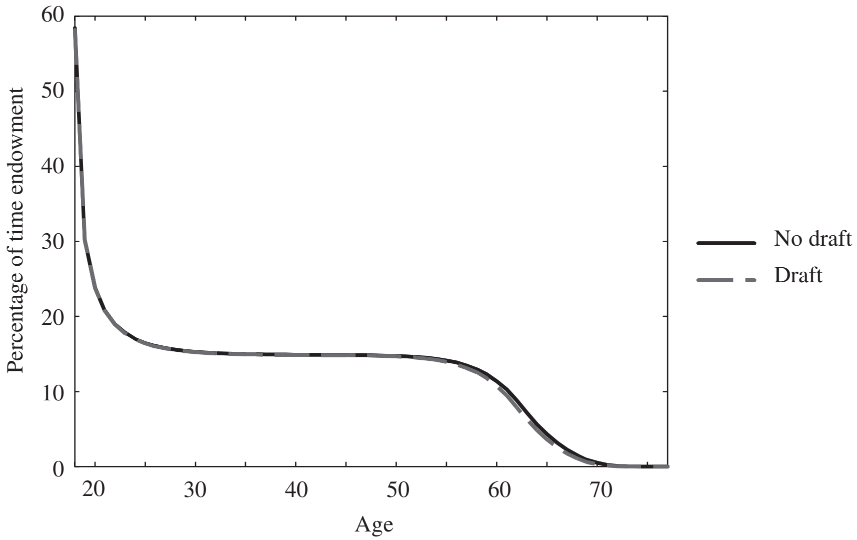

Figure 3b Learning for non-conscripts (move to draft system: epsilon = 0.25 and tau = 0.50)

Figures 5a and 5b show the effects on individual labor supply decisions for conscripts and non-conscripts, respectively. Conscripts reduce their labor force participation rates during the first couple of years after conscription and build up human capital instead. Labor force participation rates return to the

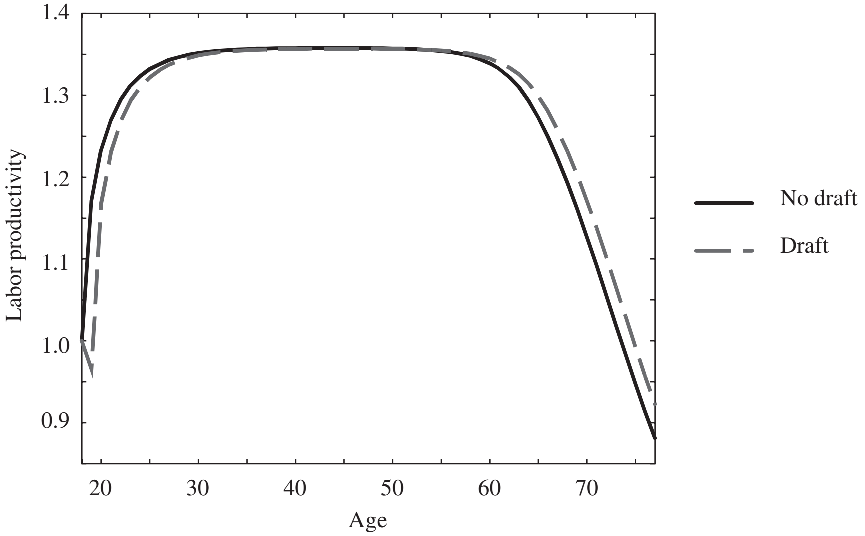

Figure 4a Labor productivity for conscripts (move to draft system: epsilon = 0.25 and tau = 0.50)

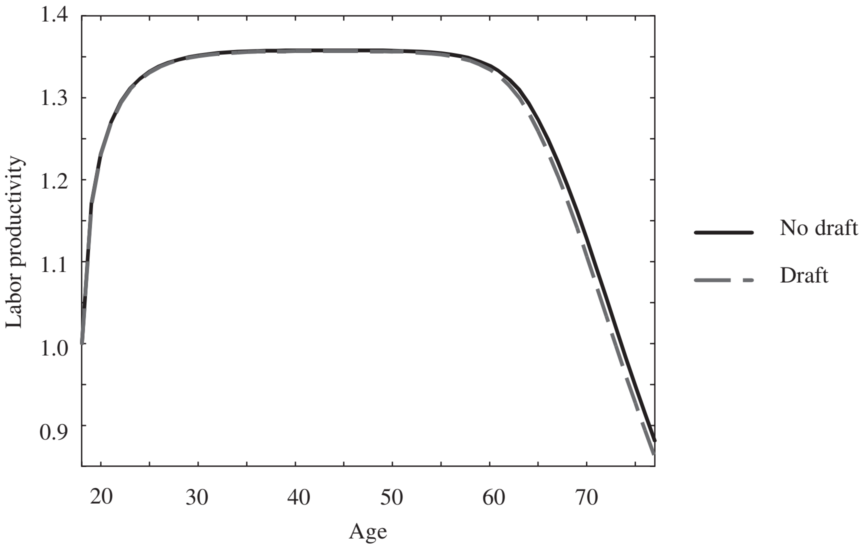

Figure 4b Labor productivity for non-conscripts (move to draft system: epsilon = 0.25 and tau = 0.50)

levels without draft at middle age, and the increased labor productivity at the end of the life cycle provides an incentive to postpone retirement and stay longer in the labor market. Non-conscripts retire a little earlier compared to the initial steady-state equilibrium.

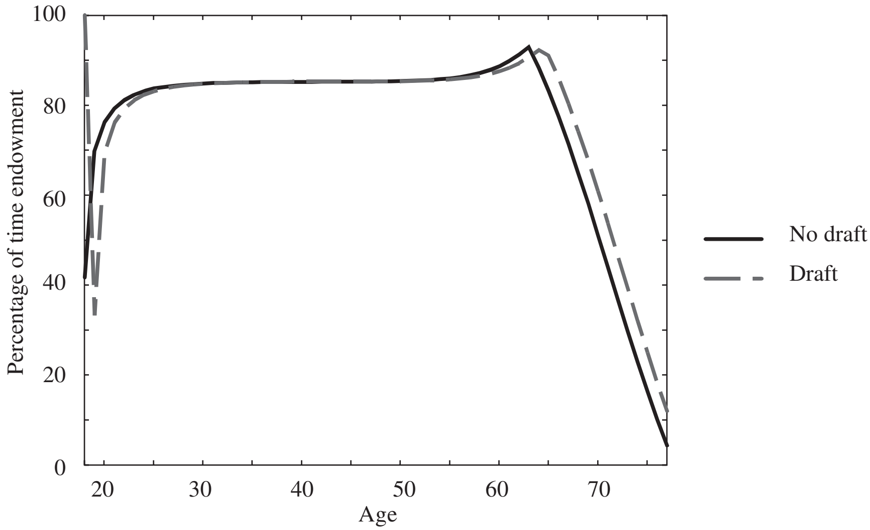

Figure 5a Work by conscripts (move to draft system: epsilon = 0.25 and tau = 0.50)

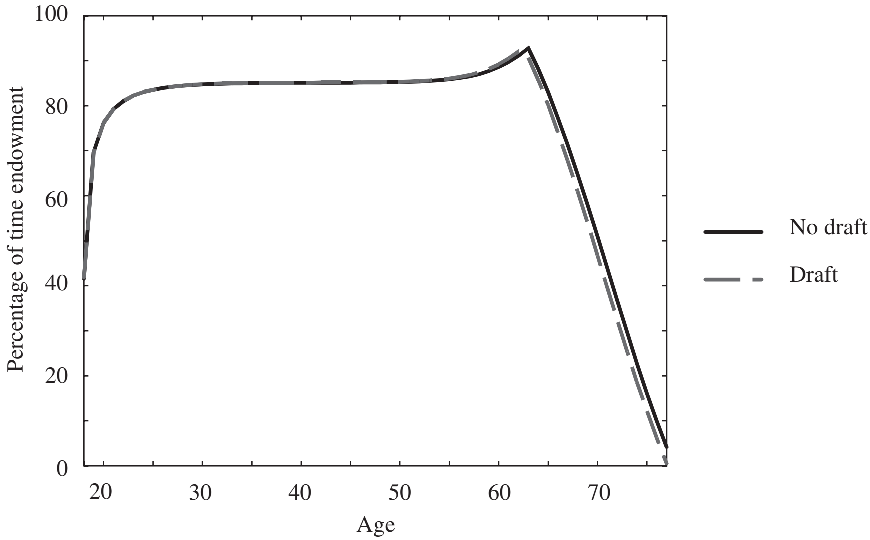

Figure 5b Work by non-conscripts (move to draft system: epsilon = 0.25 and tau = 0.50)

Capital ownership shares across generations are illustrated for conscripts and non-conscripts before and after the reform in Figure 6. The results show that the capital ownership structure changes significantly by the reform. Conscripts are forced to work in the first period when productivity is low and it takes approximately ten years to catch up with labor productivity compared

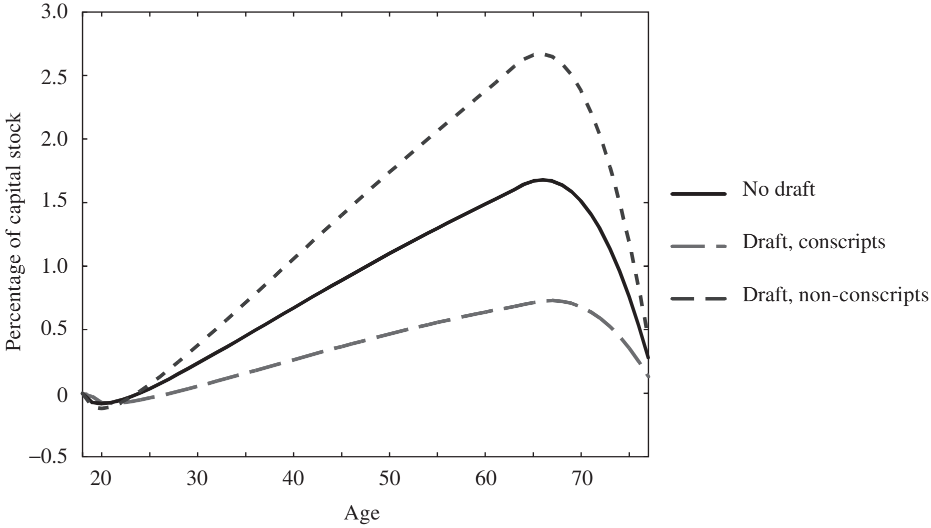

Figure 6 Capital ownership shares across generations (move to draft system: epsilon = 0.25 and tau = 0.50)

to non-conscripts. The reduced wage income during the first ten years of the life cycle implies that capital ownership shares by conscripts are considerably smaller after the reform. Non-conscripts, on the other hand, increase investment in physical capital because they retire earlier and the interest rate increases, and they possess a larger share of the capital stock in the final steady-state equilibrium. Raising the supplementary tax rate will further reduce capital ownership shares by conscripts, while non-conscripts obviously increase their share of the capital stock.

Table 3 presents the welfare effects for conscripts and non-conscripts for different initial proportional tax rates on wage income and supplementary tax rates. We keep the supply of physical capital and labor services constant across different initial levels of public spending, i.e. the capital–labor ratio is unchanged. Net factor prices are kept unchanged as well, and the cost of labor services varies with the initial tax rate on wage income, i.e. the capital value share is reduced when the initial tax rate on wage income increases.[11] The level of output is adjusted to meet the changes in public spending requirements. This method implies that private net income and the tax base with respect to the supplementary tax rate are unchanged across the different initial steady-state equilibria.

The results indicate that conscripts may experience a significant welfare loss, while the welfare effects for non-conscripts are less certain. The reform leads to a reduction in labor income and thus erodes the revenue from the tax

11. We could alternatively change another parameter value to keep constant the capital value share in the initial steady-state equilibrium.

Table 3 Effects of move to draft system across initial public expenditure levels (percentage change from initial steady-state equilibrium)[a]

	Supplementary tax rate					
	0 per cent		50 per cent		100 per cent	
	Welfare of conscripts	Welfare of others	Welfare of conscripts	Welfare of others	Welfare of conscripts	Welfare of others
Initial tax rate on wage income:						
16.7 per cent	– 0.9	– 0.1	– 3.3	0.0	– 5.6	0.2
37.5 per cent	– 1.0	– 0.1	– 3.4	– 0.1	– 5.8	– 0.1
50.0 per cent	– 1.1	– 0.2	– 3.6	– 0.3	– 6.1	– 0.3

[a] 25 per cent of the population is subject to draft.

on wage income. The loss in tax revenue is more significant when the initial tax rate on wage income is high, and welfare falls for both conscripts and non-conscripts if public spending is high. This pattern is reflected in the last six columns in Table 3.

Moving across the columns in Table 3, the results show that supplementary tax payments not surprisingly reduce welfare for conscripts. For example, the welfare loss for conscripts in the final steady-state equilibrium is 1.0 per cent when the initial tax rate on wage income is 37.5 per cent and the supplementary tax rate is 0 per cent, while the welfare loss for conscripts is 5.8 per cent when the supplementary tax rate is increased to 100 per cent. Welfare effects are less certain for non-conscripts when supplementary tax payments by conscripts increase. Increasing the supplementary tax rate reduces the revenue requirement from the regular wage tax, which benefits non-conscripts. However, increasing the supplementary tax rate has a negative impact on private saving and production in the economy. The smaller capital stock hurts non-conscripts through lower gross wages and also by pushing for a higher wage tax rate to satisfy the given revenue requirement. The latter effect is stronger when the initial wage tax rate is high. Furthermore, a high initial tax rate on wage income implies that fewer resources (measured as a share of GDP) are collected by a given supplementary tax rate. Consequently, an increase in the supplementary tax rate has less potential to benefit non-conscripts when the initial tax rate on wage income is high. Our results suggest that the welfare effect of using a draft tax generally is negative for non-conscripts, although they may experience a marginal gain when a low tax rate on wage income is accompanied by a high supplementary tax rate on income during conscription.

The analysis is based on a stylized model, and the specific quantitative results should be interpreted with caution. The model does not examine the dynamic transition, and future generations may suffer because earlier generations benefit. The only way to consider this intergenerational redistribution is to examine the dynamic transition from the initial steady state to the final steady state. In order to find political support for eliminating the draft, policy-makers may have to propose compensation schemes that are attractive for generations subject to the draft. These compensation schemes could involve public debt adjustments or age-dependent tax instruments during the transition.[12] To finance the transition, younger generations who are now relieved from the draft might be required to pay higher income taxes compared to older generations who have been subject to the draft.

4.2. Sensitivity analysis

Table 4 shows that the qualitative results derived above hold for different assumptions concerning (i) the initial stock of human capital,[13] (ii) the elasticity of human capital with respect to time devoted to learning, and (iii) the functional form of instantaneous utility with respect to leisure. The need for investment in human capital is higher when the initial level of human capital is reduced, and the negative welfare implications for conscripts are therefore more significant. Reducing the elasticity of human capital with respect to time devoted to learning has similar consequences for conscripts because the cost of investment in human capital is increased. Finally, changes in the functional form of instantaneous utility with respect to leisure involve only marginal changes in welfare effects for both conscripts and non-conscripts.

5. DRAFT WITH BORROWING CONSTRAINTS

The analysis so far is based on the assumption that capital markets are perfect, and in particular that (young) generations do not face any borrowing constraints.[14] With perfect capital markets, the draft tax imposed on conscripts in the form of lower pay has a substantial negative effect on the aggregate capital stock, which also hurts non-conscripts through changes in net factor prices. If borrowing constraints are present, the burden of the draft is even more unequally distributed, hitting conscripts with full force in the first period. We address this issue next and assume that financial wealth is restricted to be non-negative in all periods of life, both for conscripts and for

12. Harrison *et al.* (2002) use a static CGE model and illustrate that compensation schemes are sensitive to undertaking a complete general equilibrium accounting for the 'secondary' effects of the side payments themselves. Analyses that simply draw up a list of winners and losers from some reform and effected side payments without checking for further effects on welfare could lead to misleading policy advice.
13. We keep constant the capital value share in the initial steady-state equilibrium and adjust the interest rate.
14. We are indebted to two anonymous referees for highlighting the role of private saving.

Table 4 Effects of move to draft system across different initial parameter values (percentage change from initial steady-state equilibrium)[a]

	Supplementary tax rate					
	0 per cent		50 per cent		100 per cent	
	Welfare of conscripts	Welfare of others	Welfare of conscripts	Welfare of others	Welfare of conscripts	Welfare of others
Initial stock of human capital:						
$h_0 = 1.00$; $r = 5.00\%$	–1.0	–0.1	–3.4	–0.1	–5.8	–0.1
$h_0 = 0.75$; $r = 5.07\%$	–1.3	–0.2	–3.5	–0.1	–5.7	–0.1
$h_0 = 0.50$; $r = 5.14\%$	–1.8	–0.2	–3.8	–0.2	–5.8	–0.2
$h_0 = 0.25$; $r = 5.21\%$	–2.6	–0.3	–4.2	–0.3	–5.8	–0.3
Elasticity w.r.t. training (η):						
$\eta = 0.90$	–0.6	–0.1	–3.2	0.0	–5.8	0.0
$\eta = 0.75$	–1.0	–0.1	–3.4	–0.1	–5.8	–0.1
$\eta = 0.60$	–1.3	–0.2	–3.6	–0.1	–5.8	–0.1
Preferences w.r.t. utility:						
$\mu = 0.15$; $\alpha = 0.66$	–1.0	–0.1	–3.4	–0.1	–5.8	–0.1
$\mu = 0.25$; $\alpha = 0.75$	–1.0	–0.1	–3.4	–0.1	–5.8	–0.1
$\mu = 0.35$; $\alpha = 0.85$	–1.0	–0.1	–3.4	–0.1	–5.8	0.0

[a] 25 per cent of the population is subject to draft and the initial tax rate on wage income is 37.5 per cent.

non-conscripts. Formally, we impose the additional constraint

$$a_{i,t} \geq 0 \quad \text{for all } i, t$$

The presence of borrowing constraints results in less investment in human capital. This is the case both with and without the draft. The inability of young individuals to borrow forces them to work more at the beginning of the life cycle, which postpones the accumulation of human capital. Figure 7 illustrates these effects in the initial steady-state equilibrium without draft. The parameter values are the same as those in Section 3, except the capital value share that is increased and now equal to 0.328.

We find that the draft may hurt conscripts more when borrowing constraints are present compared to a situation with perfect capital markets. Liquidity-constrained conscripts are not able to smooth consumption over the life cycle, and the timing of the supplementary tax payments is therefore less favorable to conscripts.[15] Hence, utility falls more sharply with the

15. The overall pattern of capital ownership shares across generations as depicted in Figure 6 does not change in the presence of a borrowing constraint. However, unlike in Figure 6, the borrowing constraint now forbids to hold negative net wealths at the beginning of the life cycle.

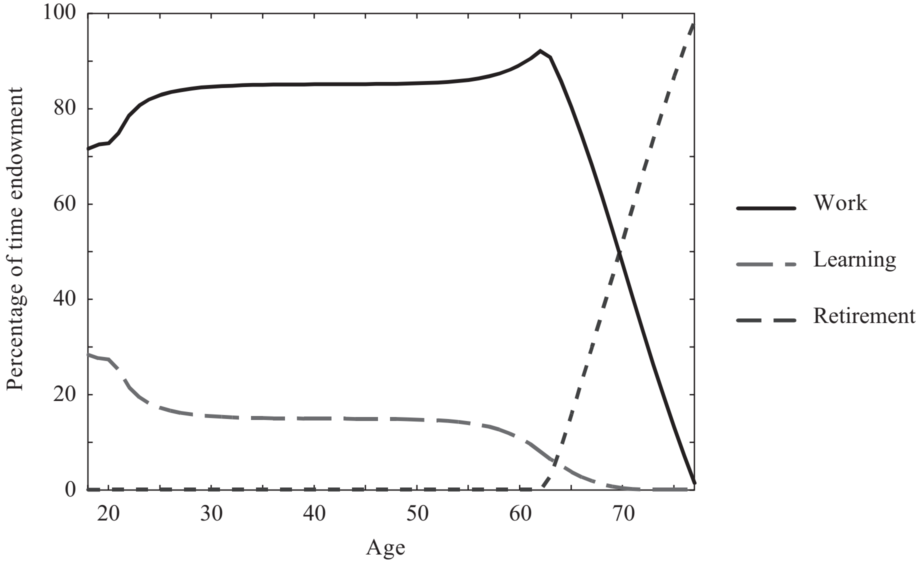

Figure 7 Allocation of time over the life cycle with borrowing constraint (initial steady-state equilibrium)

supplementary tax rate when capital markets are imperfect.[16] We do not find different qualitative effects for non-conscripts compared to the situation without borrowing constraints.[17] Non-conscripts may either lose or benefit from the reform, and the utility effects remain small compared to conscripts.

Table 5 shows that GDP falls when the draft is introduced, and the quantitative effects do not change much with the supplementary tax rate when borrowing constraints are present. Hence, the burden of the draft is to a large extent determined by the constraint on the allocation of time. Comparing Table 5 with Table 2 suggests that the aggregate effects of the draft are similar when the supplementary tax rate is zero. However, the adverse effects of the supplementary tax payments are modest in the model with borrowing constraints, while these payments have significant effects on the physical capital stock and GDP in the model with perfect capital markets.

16. The welfare measure in Section 2 is derived as the percentage change in lifetime earnings necessary to yield the utility level reached in the new steady state. The timing of this compensation is not important when capital markets are perfect. However, the marginal utility from a given net present value of income increases during periods where the borrowing constraint is binding, and we are therefore not able to use the welfare measure defined above.
17. A small qualitative difference arises when the supplementary tax rate is so low that the draftees are able to save during the first period. In that case, they will allocate more time to learning in the second period, thereby somewhat limiting the adverse effects of draft on human capital formation.

Table 5 Effects of move to draft system with borrowing constraint (percentage change from initial steady-state equilibrium)[a]

	Share of population subject to draft								
	25 per cent			50 per cent			100 per cent		
	Supplementary tax rate			Supplementary tax rate			Supplementary tax rate		
	0%	50%	75%	0%	50%	75%	0%	50%	75%
GDP	−0.2	−0.3	−0.2	−0.3	−0.5	−0.5	−0.7	−1.0	−1.0
Consumption	−0.2	−0.3	−0.3	−0.4	−0.6	−0.6	−0.9	−1.3	−1.3
Physical capital stock	−0.3	−0.4	−0.4	−0.5	−0.8	−0.7	−1.0	−1.6	−1.5
Labor services	−0.1	−0.2	−0.2	−0.3	−0.4	−0.4	−0.5	−0.8	−0.8
Rental rate on physical capital	0.08	0.13	0.12	0.17	0.27	0.24	0.34	0.54	0.48
Wage rate	−0.04	−0.06	−0.06	−0.08	−0.13	−0.12	−0.16	−0.26	−0.23
Tax rate on wage income[b]	0.17	−0.09	−0.28	0.33	−0.19	−0.56	0.68	−0.36	−1.11

[a] The initial tax rate on wage income is 37.5 per cent.
[b] Measured in percentage points.

6. CONCLUSION

Our results show that the widely held view of the draft as a socially cheap method to recruit personnel for public services is a myth. To economists, such an observation may not be surprising, since volunteer recruitment via labor markets traditionally is considered as the most effective way to realize gains from the division of labor and specialization. Adam Smith made a clear case against conscription and found an 'irresistible superiority which a well-regulated standing [= all-volunteer] army has over a militia [= conscription]' (Smith, 1976 [1776], p. 701). Smith's observation and most other arguments against the draft mainly rely on differences in comparative advantages between citizens. What is striking in our findings is that the inefficiency of the draft also emerges in the absence of any such differences.

In our approach, the inefficiency of the draft results from its specific incidence over the life cycle: the draft hits individuals in the early stages of their economically active life, thereby postponing the accumulation of human capital and reducing labor productivity. Moreover, the supplementary tax on income during conscription involves a higher present-value burden of income taxation compared to tax schemes with a more even distribution of income tax payments over the life cycle. The uneven distribution of income tax payments has a negative impact on private saving and production. The reduced stock of physical capital lowers also the wage rate of non-conscripts, and reduced production puts an upward pressure on the wage tax rate. Due to general-equilibrium effects, the reduced aggregate labor supply by conscripts and a reduced aggregate stock of physical capital also may harm people who are exempt from the draft through changes in net factor prices.

Our analysis and results are in line with various other studies on dynamic tax incidence. For example, Driffill and Rosen (1983) argue that ignoring human capital accumulation may lead to substantial downward errors in estimates of the excess burden of taxation. We show that previous cost estimates of the draft may involve a similar downward bias. Dynamic general-equilibrium effects of different forms of taxation have been studied by numerous authors. In a seminal study, Summers (1981) compares consumption and wage income taxation and shows that differences in the timing of tax collection between the two taxes lead to differences in aggregate saving, production and utility levels even if annual tax revenues are identical. Auerbach *et al.* (1983) extend the model and include a labor–leisure choice and transitional dynamics. Differences in the efficiency properties of various tax instruments mainly result from differences in the timing of taxation over the life cycle and, in particular, from the extent to which taxes are levied during periods with capital accumulation rather than dissaving. For efficiency reasons, taxes with high marginal rates should be imposed on old generations (who are relatively inelastic in their behavior) rather than on young generations. Similar effects are present in our analysis where the draft and supplementary tax payments by conscripts are less efficient than a more evenly spread income tax that collects the same revenue over the life cycle.

By deliberately ignoring the (perhaps first-order) gains foregone from specialization and the division of labor, our analysis tends to underestimate the true cost of the draft system. We also ignore some potential benefits that a draft system might have relative to voluntary enlistment. For example, advocates of the draft often argue this system makes the military more 'representative' or bring liberal and critical thinking to soldiery.[18] Furthermore, some proponents of conscription consider it a quicker way of raising large numbers of troops and the only way to sustain large military reserve forces. We do not wish to discuss the validity of these arguments here (see Warner and Asch, 2000, for a more elaborate discussion), but emphasize that any potential benefits of the draft have to be weighed against the considerable static and dynamic costs identified here and in the economic literature.

Three omissions in our analysis open potential avenues for further research. First, our assumption of a one-sector economy blurs an important aspect in the comparison of conscription versus all-volunteer services: the

18. Similarly, it is argued that draftees in civil or social service gain civic competences and a greater awareness of social problems, items that also contribute to welfare in a broader understanding.

substitution of equipment and weaponry for labor that typically goes along with the abolition of the draft (Sandler and Hartley, 1995, pp. 172f.). A more elaborate analysis should account for such shifts in the input factor mix and the general-equilibrium effects. Second, it would be interesting to explore the cost of the draft in a model with endogenous growth. We expect that this feature will exacerbate the negative dynamic effects of the draft and, hence, strengthen the case for an all-volunteer force. Third, our steady-state analysis ignores economic effects during the transition to the final steady-state equilibrium. Since budgetary needs are likely to rise with all-volunteer forces, some age cohorts might be burdened twice during the transition: (i) by being drafted when young, and (ii) by being taxed more when the volunteer system is installed. Analyzing whether and how the elimination of conscription could produce a Pareto improvement is left for future research.

ACKNOWLEDGEMENTS

We are grateful to David Wildasin and two anonymous referees for helpful criticism and valuable suggestions. We also benefited from discussions at conferences and seminars in Innsbruck, Göttingen and Vienna. Financial support from the Danish Ministry of Economic and Business Affairs is gratefully acknowledged. Opinions expressed are those of the authors, and should not be assumed to be those of their employers.

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