

To draft or not to draft? Inefficiency, generational incidence, and political economy of military conscription

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Abstract

We study the military draft as a form of intergenerational redistribution, taking into account endogenous human capital formation. Introducing the military draft initially benefits the older generation while it harms the young and all future generations. As it distorts human capital formation more severely than an equivalent intergenerational transfer using public debt or pay-as-you-go pensions, the draft can be abolished in a Pareto-improving way if age-dependent taxes are available. In the absence of age-specific taxes, the political allure of the draft can be explained by the specific intergenerational incidence of its costs and benefits.

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1. Introduction

States can recruit the manpower that is necessary to produce government output either by hiring workers at market wages or by compulsory labor services. Both methods rely on the government's power to tax: either as an in-kind tax levied on drafted people in the form of forced

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labor, or as pecuniary taxes, raised to be spent on remunerating hired workers. Today's democracies no longer rely on forced labor — with the notable exception of the military draft and its corollary, civil or alternative service.

Eight of the 26 NATO members are still utilizing conscription, among them Germany, Turkey, and Greece. With spells of two years or more, the draft also heavily intrudes into the lives of young men in Russia, many Asian countries, Latin America, the Arab World and the Middle East.¹

At least since Adam Smith, economists have had serious reservations about the military draft and other forms of involuntary service (Sandler and Hartley, 1995, Chapter 6; Warner and Asch, 2000). Most obviously, relying on forced labor foregoes the benefits of specialization. It also fails to account for differences in opportunity costs and comparative advantages. Staffing the military or hospitals with unmotivated or underpaid draftees easily leads to shirking and considerable loss of potential output. Moreover, conscripts usually suffer from lower lifetime earnings than those exempted from the draft (see Angrist, 1990; Imbens and van der Klaauw, 1995). To the extent that these reductions in earnings are due to a lower stock of human capital of ex-draftees, they constitute a sizable dynamic cost of the draft that affects society as a whole — and not just draftees (Lau et al., 2004).

Even with a consensus that the military draft is inefficient, considerable opposition might resist its abolition. Older cohorts who have already done their military service, understandably, raise the objection that they would suffer a double burden in the case of moving to voluntary forces: first as young draftees and then later in the form of higher taxes to finance a professional army. Correspondingly, middle-aged taxpayers might be tempted to introduce a draft system in order to escape the monetary tax burden of paying for a professional army, thereby neglecting the dynamic costs that a draft imposes on future generations.

In this paper, we consider the economic and political dynamics of establishing and abolishing compulsory labor services. We show that setting up a draft system (rather than running an all-volunteer army) distorts the accumulation of human capital and imposes a larger burden than collecting the same resources with distorting wage taxes. Therefore, the draft comes at the cost of a lower steady-state stock of human capital. This holds both with and without benefits from specialization for military and civilian tasks.

Military draft turns out to be an inefficient way to make intergenerational transfers, even in the absence of benefits from specialization or comparative advantage. The military draft can be viewed as a combination of a restriction on time use, forcing young people to work before they have completed their human capital investment, and a specific one-hundred percent wage tax during the mandated work period. Ordinary wage taxes do not involve the additional distortion of restricting the time use of individuals. Once established, the military draft can always be abolished in a Pareto-improving manner by replacing it with a professional army, financed by age-dependent taxes, collected only from the young. With a positive interest rate, such a front-loading of the tax burden results in a lower utility for steady-state generations, compared to financing a professional army with taxes collected from all age cohorts. Thus, it is impossible to fully undo the dynamic costs of a once established draft system without hurting at least one generation.

Our paper is organized as follows. We introduce an overlapping generations model with a given public sector resource requirement and private investment in education in Section 2. We derive steady states with and without military draft in Section 3, and study transition in Section 4. Section 5 extends the model to a two-sector economy with sector-specific types of education and an eventual draft taking place after private investment in education. Section 6 concludes. All proofs are relegated to the Appendix.

¹ Israel, Eritrea, and Tunisia also draw women into compulsory military service. For a comprehensive listing of military systems throughout the world, see CIA (2006).

2. Model

In a small, open economy with two active overlapping generations, every generation consists of the same number of ex-ante identical individuals; this number is normalized to one. When necessary, we index time by t . Generation t is the cohort that is in its youth in period t . The economy operates with perfect capital markets where consumption can be shifted over time at an exogenous interest rate of $r \geq 0$ per period.

An individual's time endowment in each of the two periods of his life is normalized to one. During youth, a fixed fraction α of the time endowment has to be spent on education. Moreover, the young may be called for military² service, lasting a fraction d of their time endowment. The rest of the time is used for working and is denoted by ℓ . During working age, individuals work full-time.

Individuals are born with some innate human capital, the productivity of which is normalized to unity. During their education period, they decide how much effort to spend on studying or training. Studying effort increases the productivity of human capital according to a strictly increasing and strictly concave function $w = w(e)$ that satisfies $w(0) = 1$. Once acquired, the quality of human capital does not change over the life-cycle.

An individual's preferences are separable in consumption over the two periods of life and effort in studying. With perfect capital markets, individuals are, as far as consumption is concerned, only interested in the net-present value of income over their life-cycle. Education effort generates a utility cost which in terms of consumption equals $c(e)$. The function c is strictly increasing and convex.

There are two sectors in the economy: a civilian one and the military. In each period t , output y_t in the civilian sector is produced by employing labor (measured in efficiency units) with a time-invariant linear production technology:

$$y_t = \ell_t \cdot w(e_t) + 1 \cdot w(e_{t-1}).$$

Here ℓ_t and 1 are the working hours of generations t and $t-1$ in period t .

Running the military is the only task of the government. We measure output of the military in terms of consumption and assume that its level is exogenously fixed at $\bar{m} > 0$, which society is supposed to consider as a suitable level of national defense and security.

To produce \bar{m} , the government can choose between a professional army (an all-volunteer force) and a draft system.³ In a professional army, the government buys the number of labor units that is necessary to produce \bar{m} from the labor market. It finances military expenditure with a tax on income (from civilian output). Denoting the tax rate in period t by τ_t , a balanced government budget requires

$$\tau_t y_t = \bar{m}. \tag{1}$$

With a professional army, the net-present value of an individual's income is

$$w(e_t) \cdot \left[(1-\tau_t)(1-\alpha) + \frac{(1-\tau_{t+1})}{1+r} \right]$$

where $w(e_t)$ is the individual's wage rate and productivity, $1-\alpha$ is the working time during youth, and $1/(1+r)$ is the present value of an additional unit of income during the working age (where the working

² We phrase our analysis purely in terms of military service. All arguments apply, *mutatis mutandis*, to alternative service, too.

³ In reality, countries with a draft system also employ some professionals in their armies. Incorporating this aspect into our model would not affect the qualitative results.

time is one). If the tax rate does not change over the life-cycle ($\tau_{t+1} = \tau_t$), we can write lifetime income as $(1 - \tau) \cdot w(e_t) \cdot \Gamma$ where

$$\Gamma = \frac{2 - \alpha - \alpha r + r}{1 + r} \leq 2 - \alpha \quad (2)$$

for all $r \geq 0$ and $0 \leq \alpha \leq 1$. Lifetime utility with a professional army then amounts to

$$u^p(e_t) = -c(e_t) + (1 - \tau_t) \cdot w(e_t) \cdot \Gamma. \quad (3)$$

In a draft system, the government recruits young individuals before they start their education and employs them in the production of military output for a certain duration d . Since the productivity of uneducated youth is normalized to unity, the length of the draft necessary to produce output \bar{m} is $d = \bar{m}$. As only labor is used to operate the military, there is no need to set up a government budget constraint.

With a draft system, an individual's time spent on work during youth is $1 - \alpha - d$. Since no income taxes are collected, lifetime income equals

$$w(e_t) \cdot \left[(1 - d - \alpha) + \frac{1}{1 + r} \right] = w(e_t) \cdot (\Gamma - d)$$

and the resulting utility level amounts to

$$u^d(e_t) = -c(e_t) + w(e_t) \cdot (\Gamma - d). \quad (4)$$

3. Steady states

We now compare the steady-state equilibria of economies with a professional army and with a draft system. As all variables are time-invariant, we omit time subscripts.

With a professional army, individuals choose e in order to maximize Eq. (3), taking the tax rate as given. The first-order condition

$$-c'(e) + (1 - \tau)\Gamma w'(e) = 0 \quad (5)$$

defines education effort as a (decreasing) function of the tax rate. Steady-state national income with a professional army is

$$y(e) = (2 - \alpha) \cdot w(e). \quad (6)$$

The tax rate τ is adjusted in order to balance the government budget; i.e., from Eqs. (1) and (6),

$$\tau = \frac{\bar{m}}{(2 - \alpha)w(e)}. \quad (7)$$

Educational investment e^p in an economy with a professional army can be determined from substituting Eq. (7) into Eq. (5). It is implicitly given by:

$$-c'(e^p) + w'(e^p) \cdot \frac{(2 - \alpha)w(e^p) - \bar{m}}{(2 - \alpha)w(e^p)} \cdot \Gamma = 0. \quad (8)$$

Denote by V^p the steady-state indirect utility in an economy with a professional army:

$$V^p = u^p(e^p) = -c(e^p) + (1 - \tau^p)w(e^p) \cdot \Gamma$$

where $\tau^p = \frac{\bar{m}}{(2 - \alpha)w(e^p)}$.

With a draft system, the optimal investment in human capital e^d is determined from maximizing Eq. (4). The first-order condition then reads as

$$-c'(e^d) + w'(e^d) \cdot (\Gamma - \bar{m}) = 0 \quad (9)$$

where we already substituted m^- for d . Denote by V^d the maximum utility obtainable in an economy with a drafted military:

$$V^d = u^d(e^d) = -c(e^d) + w(e^d)(\Gamma - \bar{m}).$$

Proposition 1. *For all levels of military output \bar{m} , the steady-state levels of study effort, output, consumption, and utility are lower in an economy with a military draft than in an economy with a professional army:*

$$e^d < e^p \text{ and } V^d < V^p.$$

Empirical evidence on the distortion of the accumulation of human capital which a draft system generates, relative to a professional army, has been found by Angrist (1990) and Imbens and van der Klaauw (1995). Computational estimates for its considerable impact on national output are provided in Lau et al. (2004).

The way in which military output \bar{m} crowds out marginal incentives for human capital investment is quite different under a draft system than with a professional army. In the case of the draft, the disincentives result from the fact that the returns to human capital investment do not accrue over the full length of life but only for the remaining lifetime after draft d . In the case of a professional army, military output enters utility in Eq. (3) via the tax rate. The disincentive effects on human capital investment are lower with a professional army than with military conscription for two independent reasons. First, there is a *timing effect*: The draft hits individuals in the early period of their lives while the burden from tax-financing a professional army is evenly spread over the life-cycle. Second, there is a *level effect*: While in the case of the draft, military output is produced using uneducated labor of low productivity $w(0)$, it is effectively provided with (average) post-education productivity $w(e) > w(0)$ in the case of a professional army. Again, this leads to higher disincentives for education effort under a draft regime.

The utility comparison in Proposition 1 establishes the superiority of a professional army over a drafted army. It adds to a collection of results on the inefficiency of military draft (for a survey see, e.g., Sandler and Hartley, 1995, Chapter 6). However, while previous findings were based on static inefficiencies, Proposition 1 highlights the dynamic cost that emerges from the intertemporal distortion of human capital investments.

4. Transition dynamics

4.1. Introducing the draft

Suppose that prior to some date t the economy had a professional army, but that the government announces an unanticipated plan to introduce a draft system effectively from date t , before generation t will decide on their study effort.⁴ Clearly, all generations t' with $t' \leq t-2$ will

⁴ If the introduction of the military draft were anticipated, the last generation free from draft would invest more in education, anticipating that its second-period income would not be taxed. This would increase the utility gain of the old transition generation, without affecting the utility loss of the drafted generations.

be unaffected (they are dead already at t). From Proposition 1, all generations t' with $t' \geq t$ will suffer from the introduction of the draft, relative to the professional-army scenario. Generation $t-1$ will, however, welcome the draft since it will avoid the taxes for a professional army.

4.2. Abolishing the draft

Suppose now the economy was running a conscription system but that the government announces an unanticipated plan to switch to a professional army effectively at date t .

Introducing a professional army requires additional tax revenues. For a Pareto-improving transition, generation $t-1$ (who has already delivered its military service under the draft system) must not be harmed by new taxes. Hence, the taxes due in t can only be levied on the young generation t .

The necessary tax rate τ_t^a to finance the abolition of the draft in period t emerges from the budget constraint:

$$\tau_t^a \cdot (1-\alpha)w(e_t) = \bar{m}$$

where $(1-\alpha)$ is the working time of generation t in period t . In period $t+1$, this generation will not pay any taxes. Hence, generation t 's lifetime income amounts to

$$w(e_t) \cdot \left[(1-\alpha)(1-\tau_t^a) + \frac{1}{1+r} \right].$$

The same applies to all future generations, which allows us to omit time subscripts henceforth. Substituting the (time-invariant) tax rate τ^a into the first-order condition for individually optimal study effort yields an implicit definition of the equilibrium value of education effort e^a :

$$-c'(e^a) + w'(e^a) \cdot \left[1-\alpha + \frac{1}{1+r} - \frac{\bar{m}}{w(e^a)} \right] = 0. \quad (10)$$

Denoting the attending utility level by V^a , we obtain.

Proposition 2. *For all levels of military output \bar{m} , provided through a volunteer army, study effort, output, consumption, and utility for the steady-state generations are never larger if the taxes needed to finance the army are levied exclusively on the young generation rather than spread across all cohorts:*

$$e^a \leq e^p \text{ and } V^a \leq V^p. \quad (11)$$

Both inequalities are strict whenever $r > 0$.

The first part of Proposition 2 is driven by the same timing effect as its analogue in Proposition 1. Proposition 2 compares a situation where taxes are levied at the same rate over the entire life-cycle to a scenario where taxes are due only in the first period of one's life. With a zero interest rate, the timing of taxes is irrelevant. With a positive interest rate, front-loading taxes entail a higher burden, even if the undiscounted sum of taxes collected over the individual lifetime stays constant and, thus, tax revenues for the government are identical at any point in time. A lower after-tax return to education reduces private investment in education, even in the absence of a level effect, as in Proposition 1.⁵

⁵ This result does not change if we allow the use of government debt during a transition (see Poutvaara and Wagener, 2005).

Replacing the draft by a professional army, financed only by the young, leads to a situation that is worse for the steady-state generations than if the draft had never been introduced. Levying the tax on the young is, however, the only way to insulate the older generation when the transition from draft to a professional army takes place. Thus, the welfare of the steady-state generations is lower once the draft is introduced and again abolished than if it had never existed in the first place.

This impossibility to completely undo the effects of a once-introduced draft system is due to the same mechanism as the impossibility to replace an inefficient pay-as-you-go pension scheme by a funded one: Like the introduction of a pay-as-you-go scheme, introducing a draft amounts to a “present” to the older generation at that moment. Such a gift may be revolved, but can never be accomplished such as to make everybody in the future equally well off as without the gift. The military draft differs in a crucial way from a pay-as-you-go social security scheme that could be viewed as an implicit government debt. First, the draft not only reduces private returns to education but also distorts the timing of education and labor supply periods over the life-cycle. Second, given that human capital cannot be transferred between generations and over time, there is no hope for neutrality in the sense of Ricardian equivalence with a draft system.

Although it can never re-establish the situation with a professional army, abolishing the draft is nevertheless advisable:

Proposition 3. *Replacing a draft system with a professional army that is financed by taxes that are exclusively levied on the young leads to a Pareto-improvement and to an increase in the human capital stock of the economy.*

Taking stock of the results, we obtain:

$$V^p \geq V^a > V^d,$$

where the first inequality is strict if $r > 0$. The professional army, thus, is the best option a society could choose. The military draft is an inefficient way of transferring resources to the initially older generation. Should society want such transfers, age-dependent taxes are the instrument of choice.

5. Extension: military and civilian careers

5.1. Modification of the model

Our analysis so far has been based on the assumptions that (i) education is not sector-specific to the military or the civilian sector, and (ii) that, while draftees enter into military service uneducated and with low productivity, a professional army operates with educated individuals of average productivity. The first assumption rules out all benefits from specialization. The second one involves a bias against military conscription: In reality, draftees and professionals often do not differ in age and, thus, human capital when they enter into the army.

In this section we dispense with these assumptions. Individuals can now choose between “military” and “civilian” education, by which they will acquire a comparative advantage for the respective sector. Each type of education is applicable in either sector, but possibly with reduced productivity if the types of sector and education do not match. We denote the proportional decline in productivity when human capital is applied outside its sector by β , so that $0 < \beta \leq 1$.

Under a draft system, people invest in their civilian education⁶ before being drafted to the army for a time d . In the case of a professional army, people invest either in civilian or military education and then decide on the sector in which they want to become employed.

Wages in the civilian sector equal marginal productivity. However, the government may decide to deviate from productivity wages if it recruits soldiers to the army. With a professional army, people can choose between a “military career” (i.e., working as a professional soldier in the first period of life and in the civilian sector in the second) and a “civilian career” (working in the civilian sector for the whole life).

Incomes over the life-cycle depend on education effort and on the choices of career and education type:

- With “civilian” education in a “civilian career”, wage rates in the first and second period are $(w(e), w(e))$. The lifetime utility from this “civilian biography” amounts to

$$U^c(e) = -c(e) + (1-\tau) \left[1-\alpha + \frac{1}{1+r} \right] w(e). \quad (12)$$

- With “military” education in a “military career”, wage rates in the first and second period are given by $(\gamma w(e), (1-\beta)w(e))$ where $\beta, \gamma > 0$ and γ is the wage rate that the army pays per unit of effective labor. The utility from this “military biography” is given by

$$U^m(e) = -c(e) + (1-\tau) \left[\gamma(1-\alpha) + \frac{1-\beta}{1+r} \right] w(e). \quad (13)$$

- With “civilian” education but a “military career”, the wage history is $((1-\beta)\gamma w(e), w(e))$. Such a “mixed biography” earns a utility of

$$U^{cm}(e) = -c(e) + (1-\tau) \left[(1-\alpha)(1-\beta)\gamma + \frac{1}{1+r} \right] w(e). \quad (14)$$

In the case of a professional army, the government can decide whether to hire those with military or those with civilian education for the military.

5.2. Hiring civilians for the military

If the government chooses to hire only those for the military who have completed a civilian education, potential gains from specialization are forgone. Yet, comparing such a scenario with a draft regime (which also employs individuals with civilian education) enables us to show the inferiority of the latter.

In order to attract individuals with a civilian education to the army, the government has to set γ such as to make lifetime utilities for civilian and mixed biographies coincide, i.e., $\gamma = (1-\beta)^{-1}$. Civilians and soldiers who acquire civilian education choose the same optimal education effort, $e^c = e^{cm}$, and an occupational equilibrium with $U^c(e^c) = U^{cm}(e^{cm})$ is reached.

⁶ Our assumptions ensure that, with a draft system, civilian education is always individually preferred to military education.

Proposition 4. *For all \bar{m} and $r > 0$, the government can choose a recruiting strategy for a professional army so that study effort and, therefore, national output and private consumption are higher than with a draft system.*

Hence, a professional army that employs soldiers with a civilian education always dominates a draftee army. The reason is the timing effect, i.e., the specific incidence of the draft tax in the first period of the life-cycle. For $r = 0$, a professional army staffed with civilians and a draft system are equivalent. The “level effects” of Section 3 are absent.

5.3. Hiring soldiers for the military

To realize the benefits of specialization, individuals with military (rather than civilian) education should be recruited to a professional army. However, after finishing their military contract, these individuals will work in the civilian sector for which their human capital is less than ideally suited. Can a professional army nevertheless dominate a conscripted army?

Again, an occupational equilibrium requires that all biographies that are actually chosen by some individual yield the same utility. If the government pays a wage rate of

$$\gamma = 1 + \frac{\beta}{(1-\alpha)(1+r)} \tag{15}$$

in the military sector, then the bracketed terms in utility functions (12) and (13) coincide. Hence, civilians and soldiers choose the same education effort, $e^c = e^m$, and $U^c(e^c) = U^m(e^m)$ holds.

Proposition 5. *An economy that applies a compensation strategy (15) to attract individuals with military training to its professional army induces a higher study effort than an otherwise identical economy that uses a draft system if and only if*

$$(1-\beta) \left[1 + \frac{\beta}{(1-\alpha)(1+r)} \right] \leq \frac{2-\alpha - \frac{\bar{m}\beta}{w(e^c)(1-\alpha)(1+r)}}{1-\alpha + \frac{1}{1+r}}. \tag{16}$$

As it generally includes $w(e^c)$, one cannot properly analyze condition (16) without knowing the comparative statics of e^c . However, condition (16) is more likely to hold if the military budget \bar{m} is small.

No productivity differences ($\beta = 0$): For $r = 0$, we obtain $e^c = e^d$ (no difference between a professional army and a draft system) while for $r > 0$ we have $e^c > e^d$. The inferiority of the draft system here results from the timing effect.

Zero interest rate ($r = 0$): From Eq. (16), a draft system will lead to higher investments in human capital than a professional army hiring soldiers with military education only if $\alpha \leq \beta$, i.e., if productivity differences between military and civilian employment are small or if professional life (relative to education time α) is short in the first period. Recall, however, that a professional army hiring soldiers with a civilian education would dominate also in these cases.

6. Conclusion

We analyze efficiency and distributional implications of the military draft and other compulsory work services, giving specific emphasis to the introduction and abolition of such schemes. We adopt a dynamic framework taking into account that both the draft and wage taxes affect individual incentives

to invest in education. The draft forces young people to work for the government. It thereby postpones their education and entry into the labor market and shortens their remaining working career. Wage taxes reduce the after-tax return to education and, thus, also discourage investment in education.

Even in the absence of its well-understood static inefficiencies, the military draft still is worse for steady-state generations than levying wage taxes to acquire the same labor input at market wages. While the initially older generation gains from the introduction of the draft, all future generations will lose. Abolishing the draft can always be done in a Pareto-improving manner. However, the utility available to the steady-state generations after a draft system has been abolished still falls short of their utility if a draft system had not been introduced in the first place. A Pareto-improving elimination of the draft requires collecting taxes only from the young, so as not to levy a double burden on the elderly who have already been subject to the draft. Importantly, our results generalize to the case of different types of education and also hold when the military draft takes place only after education has been completed.

The specific intergenerational incidence of the draft may help to explain its political allure. Older cohorts benefit from introducing the draft. Moreover, once a draft scheme is installed, its abolition would harm the older generation, at least if one reasonably assumes that age-specific taxes are not feasible. Since age cohorts beyond the draft age typically outnumber younger cohorts at or below the draft age, both the introduction and the continuance of the military draft garner widespread political support — in spite of their inefficiency. However, the military draft is an inefficient way for intergenerational transfers and if age-specific taxes are available, then the draft can be abolished in a Pareto-improving manner.

In recent years, quite a number of countries have abolished their military draft (while, e.g., similar reforms in pay-as-you-go pension schemes are still unheard of). This seems to contradict our proposition that conscription is, *ceteris paribus*, unlikely to disappear. However, it should be noticed that the abolition of the military draft in many countries paralleled other changes in the social, military, and geopolitical environment. Standing armies for territorial defense have become increasingly obsolete, technological changes have rendered warfare less labor-intensive, and many countries have reduced their military expenditures since the end of the Cold War. All this made the transition from the draft to a professional army less costly for those opposing it. In our model, these effects could be captured by an increase in the specialization parameter β or by a reduction in \bar{m} , the numerical equivalent of military output.

Moreover, we derived our result in the absence of other intergenerational transfer institutions, most notably pay-as-you-go pensions. These give the older generation a stake in the future productivity of those who are currently young. Therefore, an increase in pensions and health-care costs may well have strengthened political support to abolish the military draft, as the elderly also share part of the burden through reductions in the tax base for other transfers. The aging of societies may have increased the awareness that high levels of human capital are essential for sustaining intergenerational transfer schemes. Possibly also the desire to partially correct the intergenerational imbalances in fiscal burden sharing may have fostered the decline of conscription. Analyzing these links between the military draft and other intergenerational transfer institutions is left for future research.

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Appendix A

Proof of Proposition 1. Denote the function on the left-hand side of Eq. (9) by $\phi(e)$; it is strictly decreasing in e and $\phi(e^d)=0$. Evaluate ϕ for $e=e^p$ and replace $-c'(e^p)$ from Eq. (8):

$$\phi(e^p) = -c'(e^p) + w'(e^p) \cdot (\Gamma - \bar{m}) = w'(e^p) \cdot \left[\Gamma - \bar{m} - \Gamma \cdot \frac{(2-\alpha)w(e^p) - \bar{m}}{(2-\alpha)w(e^p)} \right].$$

This is negative if and only if $w(e^p) > \Gamma / (2-\alpha)$ which always holds due to Eq. (2) and $w(e)$ is increasing (i.e., $w(e^p) > w(0) = 1$). We, thus, have $\phi(e^p) < 0 = \phi(e^d)$ and the claim $e^d < e^p$ follows from the strict monotonicity of ϕ .

As productivity increases in e and \bar{m} is invariant across scenarios, the assertions for output and consumption follow immediately.

To establish the utility comparison, denote by τ^p the equilibrium tax rate with a professional army. Then:

$$\begin{aligned} V^p &= -c(e^p) + (1-\tau^p)w(e^p)\Gamma \geq -c(e^d) + (1-\tau^p)w(e^d)\Gamma \\ &= -c(e^d) + w(e^d)\Gamma - \frac{\bar{m}}{(2-\alpha)w(e^p)} w(e^d)\Gamma > -c(e^d) + w(e^d)(\Gamma - \bar{m}) = V^d. \end{aligned}$$

The second line is by a revealed-preference argument, the third replaces the budget-balancing tax rate τ^p , and the fourth follows from $e^d < e^p$. □

Proof of Proposition 2. Denote the function on the left-hand side of Eq. (10) by $\psi(e)$. Observe that $\psi(e^a)=0$ and that, from the second-order condition for e^a , ψ is strictly decreasing around e^a : $\psi'(e^a) < 0$. Evaluate ψ for $e=e^p$ and replace $-c'(e^p)$ from Eq. (8):

$$\begin{aligned} \psi(e^p) &= -c'(e^p) + w'(e^p) \cdot \left[1 - \alpha + \frac{1}{1+r} - \frac{\bar{m}}{w(e^p)} \right] \\ &= w'(e^p) \cdot \frac{\bar{m}}{w(e^p)} \cdot \left(\frac{\Gamma}{2-\alpha} - 1 \right) \leq 0 = \psi(e^a) \end{aligned}$$

where the non-positive sign of $\psi(e^p)$ follows from Eq. (2). The sign will be strictly negative whenever $r > 0$. We therefore have $e^p \geq e^a$ due to the local monotonicity of ψ ; the inequality being strict in the presence of discounting.

As productivity increases in e and \bar{m} is constant across scenarios, the assertions for output and consumption follow immediately. For utilities we get the following (in-)equalities:

$$\begin{aligned} V^p &= -c(e^p) + (1-\tau^p)w(e^p)\Gamma \\ &\geq -c(e^a) + (1-\tau^p)w(e^a)\Gamma \\ &= -c(e^a) + w(e^a) \left(1 - \alpha + \frac{1}{1+r} - \frac{\Gamma}{2-\alpha} \cdot \frac{\bar{m}}{w(e^p)} \right) \\ &\geq -c(e^a) + w(e^a) \left(1 - \alpha + \frac{1}{1+r} - \frac{\bar{m}}{w(e^p)} \right) \\ &\geq -c(e^a) + w(e^a) \left(1 - \alpha + \frac{1}{1+r} - \frac{\bar{m}}{w(e^a)} \right) = V^a. \end{aligned}$$

The second (in-)equality follows by a revealed-preference argument, the third replaces the budget-balancing tax rate τ^p and expands terms, the fourth follows from Eq. (2), and the fifth from $e^a \leq e^p$. The inequalities in the fourth and fifth lines will be strict whenever $r > 0$. □

Proof of Proposition 3. Calculate:

$$\begin{aligned} V^a - V^d &= -c(e^a) + c(e^d) + w(e^a) \left(\Gamma - \frac{\bar{m}}{w(e^a)} \right) - w(e^d) (\Gamma - \bar{m}) \\ &= \left[-c(e^a) + w(e^a) \left(\Gamma - \frac{\bar{m}}{w(e^a)} \right) + c(e^d) - w(e^d) \left(\Gamma - \frac{\bar{m}}{w(e^d)} \right) \right] + (w(e^d) - 1) \cdot \bar{m}. \end{aligned}$$

The expression in square brackets in the second line is non-negative as e^a maximizes $-c(e) + w(e) \left(\Gamma - \frac{\bar{m}}{w(e)} \right)$. Since $w(e^d) > 1$, we get $V^a > V^d$.

Evaluate $\phi(e)$ from the Proof of Proposition 1 at e^a , using Eq. (10):

$$\begin{aligned} \phi(e^a) &= -c'(e^a) + w'(e^a) \cdot (\Gamma - \bar{m}) = w'(e^a) \cdot \left[-\Gamma + \frac{\bar{m}}{w(e^a)} + \Gamma - \bar{m} \right] \\ &= -w'(e^a) \cdot \bar{m} \cdot \left(1 - \frac{1}{w(e^a)} \right) < 0 = \phi(e^d). \end{aligned}$$

Hence, $e^a > e^d$ due to the strict monotonicity of $\phi(e)$. □

Proof of Proposition 4. With $\gamma = (1 - \beta)^{-1}$, the amount of civilian human capital that is needed to produce military output \bar{m} is given by $\frac{\bar{m}}{1 - \beta} := \tilde{m}$. Hence, the length of the draft spell needed to produce \bar{m} is determined by $\tilde{m} = d w(e^d)$. The tax rate that is necessary to finance a professional army is determined through $\tau y = \tilde{m}$ and where $y = (2 - \alpha) w(e^c)$, independent of how many individuals choose to be a soldier. Hence, $\tau = \tilde{m} / [(2 - \alpha) w(e^c)]$.

All elements of the model are now identical to the scenario of Proposition 2, with the exception that \tilde{m} replaces \bar{m} . With this replacement, we can apply the same procedure as in the Proof of Proposition 2. This then leads to $e^c \geq e^d$ with strict inequality whenever $r > 0$. The assertions for output and consumption follow immediately. □

Proof of Proposition 5. With $g \in (0, 1)$ as the fraction of individuals choosing to be a soldier, steady-state national income when everybody chooses the same education effort amounts to:

$$y(e^c) = [g(1 - \alpha)\gamma + (1 - g)(1 - \alpha) + g(1 - \beta) + (1 - g)] w(e) = \left[2 - \alpha - \frac{gr\beta}{1 + r} \right] w(e)$$

where γ was replaced by Eq. (15) in the second line. Production of \bar{m} requires an army of size $g = \bar{m} / (w(e)(1 - \alpha))$. Using this and the definition of y , the tax rate necessary to finance the army turns out to be

$$\tau^c = \frac{\left[1 + \frac{\beta}{(1 - \alpha)(1 + r)} \right] \bar{m}}{\left[2 - \alpha - \frac{\bar{m}r\beta}{w(e^c)(1 - \alpha)(1 + r)} \right] w(e)}.$$

Inserting τ^c in the first-order condition for education effort implicitly defines the equilibrium value of e^c :

$$-c'(e^c) + (1-\tau^c) \left[1-\alpha + \frac{1}{1+r} \right] w'(e^c) = 0.$$

With a draft system, the required length of military service is determined by $\bar{m} = d(1-\beta)w(e^d)$, and the equilibrium value $e = e^d$ solves the following equation:

$$0 = \psi(e) := -c'(e) + \left[1-\alpha + \frac{1}{1+r} - \frac{\bar{m}}{(1-\beta)w(e)} \right] w'(e).$$

Evaluating ψ at e^c yields:

$$\begin{aligned} \psi(e^c) &= -c'(e^c) + \left[1-\alpha + \frac{1}{1+r} - \frac{\bar{m}}{(1-\beta)w(e^c)} \right] w'(e^c) \\ &= \left\{ \tau^c \left[1-\alpha + \frac{1}{1+r} \right] - \frac{\bar{m}}{(1-\beta)w(e^c)} \right\} w'(e^c) \\ &= \left\{ \frac{1 + \frac{\beta}{(1-\alpha)(1+r)}}{2-\alpha - \frac{\bar{m}\beta}{w(e^c)(1-\alpha)(1+r)}} \cdot \left[1-\alpha + \frac{1}{1+r} \right] - \frac{1}{1-\beta} \right\} \frac{w'(e^c)\bar{m}}{w(e^c)} \end{aligned}$$

where the second line uses the implicit definition of e^c . The condition $\psi(e^c) \leq 0$ is equivalent to Eq. (16). \square

References

- Angrist, J.D., 1990. Lifetime earnings and the Vietnam era draft lottery: evidence from Social Security Administration records. *American Economic Review* 80, 313–335.
- CIA, 2006. Military manpower — military age and obligation. In: *The World Fact Book*. Online at <http://www.odci.gov/cia/publications/fact-book/fields/2024.html>.
- Imbens, G., van der Klaauw, W., 1995. Evaluating the cost of conscription in the Netherlands. *Journal of Business and Economic Statistics* 13, 207–215.
- Lau, M.I., Poutvaara, P., Wagener, A., 2004. Dynamic costs of the draft. *German Economic Review* 5, 381–406.
- Poutvaara, P., Wagener, A., 2005. To draft or not to draft? Efficiency, generational incidence, and political economy of military conscription. IZA Discussion Paper 1559. IZA Bonn.
- Sandler, T., Hartley, K., 1995. *The Economics of Defense*. Cambridge University Press, Cambridge.
- Warner, J.T., Asch, B.J., 2000. The record and prospects of the all-volunteer military in the United States. *Journal of Economic Perspectives* 15, 169–192.