Reconsidering the Fiscal Advantages of Conscription

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Abstract

A standard analysis of conscription claims that, by lowering the budgetary cost of the military, a draft could be less distortionary than a volunteer army, especially when military needs are large. However, when skills are heterogeneous, voluntary enlistments leave more high-income earners in the civilian sector, leading to a larger tax base. This paper reconsiders the advantages of conscription in an economy where agents are privately informed of their civilian and military productivities. In a calibrated version of the model, we find that voluntary enlistments lead to less distortionary taxation and higher social welfare than a draft. Drafts are more distortionary when military needs are large.

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1 Introduction

Should governments favor volunteer armies? Not necessarily. To finance voluntary enlistments, it was acknowledged by Milton Friedman (1967, pp. 202) that a volunteer army may require "very high pay in the armed forces and very high tax burdens on those who do not serve." By lowering the budgetary cost of the military, a draft may generate social savings through the reduced need for distortionary taxation. Although other costs are surely involved, a draft might be the least distortionary way to raise an army, especially when military needs are large.

The purpose of this paper is to analyze the fiscal advantages and the social desirability of conscription in an economy in which individuals differ in their military and civilian productivities and these productivities are *private information*. The informational asymmetries imply that the government cannot sort individuals according to their civilian and military productivities. Instead, we assume that the government can either let individuals self-select into the military or it can randomly draft them. Under a volunteer army, the government offers a wage sufficiently high to fulfill the necessary amount of enlistments. Under a draft, the government pays soldiers a wage as compensation for their service. The goal of the government is to design taxes so as to maximize social welfare subject to a set of constraints. Following Mirrlees (1971), we assume that to cover any budgetary costs of the military (whether drafted or not), the government relies on a distortionary nonlinear labor income tax among the individuals who remain in the civilian sector.

The model allows us to make the basic point that a draft and a voluntary system lead to different tax bases and that the voluntary system's tax base is larger. This larger tax base raises revenue with fewer distortions than under a draft, particularly when military needs are large. The key intuition is that under a volunteer army, self-selection allows for *comparative advantage* in raising revenue. A draft inducts high-income earners, leading to a loss of revenue. Thus, when these high-earning individuals are drafted, the government loses revenue that must be obtained from those who remain in the civilian economy, producing efficiency losses that may exceed those of a voluntary system.

In order to understand how these systems differ from a revenue perspective, it is important to point out that individuals who volunteer for the military generally have limited opportunities in the civilian labor market.[1] Thus, the civilian sector that supports a volunteer army has a tax base with a larger proportion of higher-earning individuals and this leads to fewer distortions than an equally sized, though possibly less expensive, drafted force. In fact, the distortions introduced under a draft may be more severe as the military needs grow. Suppose the drafted military compensates soldiers with a small wage, relative to the wage paid in a volunteer army of the same size. As the size of the army increases two changes take place. More revenue is needed to pay for the additional drafted soldiers and fewer high-income earners remain in the civilian economy. In a volunteer economy, as the size of the army increases, more revenue is needed but the sources of revenue do not decline as much as under a draft. Deadweight losses for the economy are lower under voluntary enlistments because the remaining civilians face lower marginal tax rates. These results contrast with the conventional wisdom that the most affordable way to raise and sustain a large military force is by drafting it.

This picture is illustrated in a series of numerical simulations based on a reasonable parameterization of the model. We find that marginal taxes are lower under a voluntary system than under a draft. The model also provides results on the productivity, social cost, and distributive properties of voluntary enlistments and a draft. Overall we find that a draft is generally less productive and less socially desirable than a volunteer force. For example, we find that voluntary service is more socially desirable than drafted service even once we allow the government to determine the military compensation of drafted soldiers so as to maximize social welfare. In the calibrated model, the military compensation that maximizes social welfare in a drafted economy exceeds the wage offered under voluntary enlistments. This difference arises because a higher military compensation provides partial insurance against the draft. We also show numerically that volunteer armies

[1] This implication of the model is consistent with the importance of the business cycle on unemployment and regional variations in unemployment rates for enlistments into the U.S. forces, see Sandler and Hartley (1999, pp. 160-162). This implication is also consistent with the fact that when the military has greater presence in a local labor market, there is a reduced black-white income gap and a larger gender gap, see, e.g., Kriner and Shen (2010, pp. 60-61). Military pay is not the only determinant of enlistment and retention; see, e.g. Hosek et al. (2004). We will examine a variant of our model in which non-pecuniary incentives motivate enlistment in order to capture this aspect of reality.

are more socially desirable under more redistributive social goals and for civilian ability distributions with thicker tails. These findings are also robust to random participation in the volunteer army, where well over half of the enlistments are for non-pecuniary reasons.

The draft as described so far is the non-discriminatory taking of time. Might there be a more efficient way to tax time instead of money? There are more sophisticated conscription methods beyond the draft and we provide insights about these methods as well. We allow the government to optimally choose a nonlinear "in-kind" tax for service time. In this case, the government taxes time for government production bypassing the labor market. We denote this alternative as an *optimal conscription tax*.[2] Our numerical analysis suggests that this method spreads out the burden of taxation across the population in a fairly uniform way (i.e., as in a lump sum way) but that overall it fares poorly compared to the income-based taxation, as it does not provide for income redistribution fundamental to social welfare in Mirrleesian economies.[3]

Our analysis of conscription is complementary to and considerably different from the classical references, see, e.g., Friedman (1967), Hansen and Weisbrod (1967) and Oi (1967). The traditional argument against the draft focuses on the foregone earnings of higher-earning individuals. These early papers, however, did not examine the tax distortions or redistributive needs of alternative recruitment methods. Our emphasis is on the revenue cost of the draft. One contribution of our study is that we consider a private information setting, whereas earlier discussions neglected the role of informational asymmetries in the analysis of conscription. The social savings associated with lower tax burdens under a draft have been emphasized in a number of recent papers, e.g., Garfinkel (1990), Lee and McKenzie (1992), Ross (1994), Warner and Asch (1996), Warner and Negrusa (2005), and Siu (2008), but these frameworks rely on homogeneous agents and linear taxes. The desirability of conscription may be sensitive to these assumptions.

[2]Examples of this tax include compulsory military service at certain ages and jury-duty. The opportunity costs of this kind of time tax, as measured by Martin (1972) and Oi (1967), appear to be non-trivial.

[3]As noted by Mulligan (2008), "in-kind" taxes are quite common but they are almost completely neglected in the public finance literature. A point of contrast with the analysis of conscription in Mulligan (2008) is that we examine a two-sector private-information economy and allow for nonlinear Mirrleesian in-kind taxation. Our view here, however, is complementary rather than competing.

Although the U.S. ended conscription in 1973, conscription is a reality in the majority of countries in the world. In 1996, 95 out of 164 countries relied on a form of conscription, see, e.g., Mulligan and Shleifer (2005). In 2006, military drafts were still quite prevalent especially outside of the OECD, see, e.g., Poutvaara and Wagener (2007). A few countries have recently ended conscription, or put in place plans to end it and replace it with voluntary enlistments. Conscription has ended in France (in 2001), Lebanon (in 2007), and Sweden (in 2010); Taiwan and Germany have scheduled conscription to end by 2014. Recruitment policies are in the agenda of many other countries, including Brazil, China, Egypt, Israel, Malaysia, Mexico, Russia, South Korea, Turkey, and the former Soviet republics see, e.g., Galiani, Rossi, and Schargrodsky (2011), Lokshin and Yemtsov (2008), Gilroy and Williams (2006), and Jehn and Selden (2002).

An outline of the paper is as follows. In Section 2 we present the main theoretical framework. Section 3 presents our quantitative results. Section 4 presents a version of the model with random participation. Section 5 discusses the optimal conscription tax. Section 6 concludes.

2 Theory

Consider an economy populated by a continuum of individuals. An individual is represented by a pair of skill levels (θ, m) which measure the marginal productivity in civilian and military activities. The population is normalized to one and skills are given and distributed according to a well-behaved distribution function $F(\theta, m)$ with density $f(\theta, m)$ and support $[0, \infty)^2$. Thus,

$$\int_0^\infty \int_0^\infty f(\theta, m) d\theta dm = 1, \tag{1}$$

with marginal densities $f_\Theta(\theta) \equiv \int_0^\infty f(\theta, m)dm$, and $f_M(m) \equiv \int_0^\infty f(\theta, m)d\theta$.

The government requires a fraction X of the population for the military. We take X as given for several reasons. First, we are not interested in determining the optimal size of the military. To formulate such a problem, we would need to know the value society places on national defense as well as the military production function and the substitution across inputs, i.e., we would have to specify the patterns of substitution between labor (or labor-types) and capital in the production of military services. These patterns are not easily determined, see Sandler and Hartley (1999, pp. 156-160). Second, in practice, the military typically establishes recruitment quotas rather than other possible targets. Finally, since the government cannot observe skills, the fraction of individuals required for service, along with the distribution $f(\theta, m)$ and the military production function, is a *sufficient statistic* to examine the effect of alternative recruitment policies on military output. Later on, Proposition 4 provides an illustration for average productivity. Higher moments of military outcomes can be studied in similar ways.

A Volunteer Military. Suppose individuals self-select between working in the civilian sector or joining the military. In the military, and for simplicity, soldiers work for a fixed number of hours, $\bar{h}$.[4] Since military skills are not observed, the government is restricted to compensate soldiers by paying a constant per-hour wage, w. As we will see below, both assumptions imply that the participation constraint is type-independent.

While in the civilian sector, individuals supply $h(\theta)$ hours of work. The government is restricted to setting civilian taxes as a function only of earnings, $y(\theta) = \theta h(\theta)$. The consumption of an individual with civilian skills θ is given by $c(\theta) = y(\theta) - T(y(\theta))$ with $T(y(\theta))$ as the labor income tax. All individuals have the same separable preferences defined over consumption c and labor supply h, $U(c, h) = u(c) - v(h)$.

Let $V(\theta)$ represent the value of participating in the civilian sector for an individual with civilian skills θ given the tax schedule $T(y(\theta))$. While in the civilian sector, labor supply decisions solve

$$V(\theta) \equiv \max_{h(\theta)} \left\{ u(\theta h(\theta) - T(\theta h(\theta))) - v(h(\theta)) \right\}. \tag{2}$$

[4] As noted by Sandler and Hartley (1999, pp. 156), military employment has distinctive features compared to civilian employment that make the previous assumption desirable. For example, pay, working conditions, and duration of employment for individuals in the armed forces are solely determined by the state. Further, contractual commitments are subject to military discipline, breaches of which can involve severe punishment. These aspects imply less flexibility in military contracts compared to the civilian labor market.

This problem is standard.[5] The first order condition for an individual with civilian skills θ is: $\theta u_c(c(\theta))(1 - T_y(y(\theta)) = v_h(h(\theta))$, where subscripts denote partial derivatives throughout. The second order condition can be written as $y_\theta(\theta) \geq 0$, see, Salanie (2003, section 4.2.2). Thus, individuals with higher civilian ability have higher earnings than individuals with lower civilian ability (i.e., the *agent monotonicity* assumption of Mirrlees (1971) holds). Further, $V(\theta)$ is increasing in θ provided that $T_y(y(\theta)) \leq 1$, which must hold for the optimal tax, see, e.g., Mirrlees (1971) and Salanie (2003, pp. 84-85). A consequence of these results is stated in the following Theorem due to Mirrlees (1971):

Theorem 1 (Mirrlees) *The gross income $y(\theta)$ and utility $V(\theta)$ for individuals with higher civilian skills is higher than for individuals with lower civilian skills.*

Consider next the *participation constraint*. The utility of individuals who join the military is $u(w\bar{h}) - v(\bar{h})$ where w is the untaxed military compensation.[6] Let $V^v(\theta)$ denote the value an individual with civilian skills θ places on being in an economy that relies on a volunteer military:

$$V^v(\theta) \equiv \max\{V(\theta), u(w\bar{h}) - v(\bar{h})\}. \tag{3}$$

Thus, an individual with civilian skills θ would participate in the civilian sector if

$$V(\theta) \geq u(w\bar{h}) - v(\bar{h}), \tag{4}$$

and he would join the military otherwise.

The participation decision (4) can be represented by a cut-off skill $\bar{\theta}(w)$ which partitions the skill distribution into a set of individuals $\theta \leq \bar{\theta}(w)$ who join the military and a set $\theta \geq \bar{\theta}(w)$ who participate in the civilian sector (we ignore situations of indifference).

[5] Throughout this paper we examine non-stochastic allocations and taxes. Individual randomization is sometimes welfare improving in the presence of indivisibilities in occupational choice, see, e.g., Bergstrom (1986). Sometimes it is also desirable to impose random tax schedules, see, e.g., Stiglitz (1982). The conditions that make random tax schedules undesirable have been recently studied by Hellwig (2007).

[6] Soldiers are not subject to income taxation. This is actually consistent with current practice. Military pay earned in combat zones is exempted from taxation, see Siu (2008, pp. 1098).

The cut-off skill $\bar{\theta}(w)$ is the solution to $V(\bar{\theta}(w)) = u(w\bar{h}) - v(\bar{h})$, which exists as shown below. A notable feature of (4) is that the decision to participate in the military depends exclusively on the civilian ability and not on the military ability. This assumption is convenient but it also accommodates the common notion that the military is attractive primarily to individuals with limited civilian opportunities.[7] Later on, we examine a random participation decision to accommodate heterogeneity in preferences for military service.

The government also faces a series of *feasibility* constraints. A volunteer military requires

$$X = \int_0^\infty \int_0^{\bar{\theta}(w)} f(\theta, m) d\theta dm, \tag{5}$$

where the right-hand-side represents the fraction of soldiers who join the military. It is also necessary to cover the budgetary costs of the military. The government's *budget constraint* is

$$w\bar{h}X = \int_0^\infty \int_{\bar{\theta}(w)}^\infty T(y(\theta)) f(\theta, m) d\theta dm, \tag{6}$$

which on the left-hand-side represents the cost of the military (i.e., the per-hour wage times the number of hours worked times the number of soldiers) and on the right-hand-side the revenues collected from the workers who remain in the civilian sector.

The *incentive compatibility* constraints are $V_\theta(\theta) = v_h(\theta)h(\theta)/\theta$ and $y_\theta(\theta) \geq 0$, for all $\theta \geq \bar{\theta}(w)$. An exposition of these conditions can be found in Salanie (2003, chapter 4).[8]

The government maximizes a social welfare function

$$W^v \equiv G(u(w\bar{h}) - v(\bar{h}))X + \int_0^\infty \int_{\bar{\theta}(w)}^\infty G(V(\theta)) f(\theta, m) d\theta dm, \tag{7}$$

[7] The convenience of the previous assumption lies in the fact that it effectively reduces the two-dimensional information problem to a one-dimensional problem. Multidimensional screening problems are notoriously difficult to study because they lack a natural order of types such as that described by Theorem 1. See Rochet and Stole (2003), Basov (2005), and Kleven, Kreiner, and Saez (2009) for general discussions of multidimensional screening problems. See also Jullien (2000) for an analysis that would allow for a less stark participation decision to join the military in private-information economies.

[8] The first condition follows from the individual's first order condition whereas the second is a monotonicity and positivity requirement on earnings profiles associated with the second-order condition of the individual problem. The solution to the optimal tax problem can be studied in its general form to allow for *bunching* (see, e.g., Ebert (1992)). We impose the constraint $y_\theta(\theta) \geq 0$ in the quantitative section.

where G is an increasing and concave function. The first term in (7) represents the welfare of soldiers and the second represents the welfare of civilian workers. Social welfare W^v does not directly take into account the productivity of the military because we have assumed that the government's goal is to fulfill a quota X. However, as Proposition 4 shows later, our analysis provides strong predictions about military outcomes.

In order to characterize the solution to the government problem we partition the problem into two parts. We first examine the decision to join the military and then the optimal taxation of civilian incomes.

Proposition 1 *There exists a unique military wage $w > 0$ that satisfies the military size requirement (5). Moreover, for a given tax schedule, the military wage w is increasing in the size requirement X.*

Proof. Recall that $V(\bar{\theta}(w)) = u(w\bar{h}) - v(\bar{h})$. Thus, $\bar{\theta}_w(w) = u_c(w\bar{h})\bar{h}/V_\theta(\bar{\theta}(w))$, which is positive. Let $\Xi(w) \equiv \int_0^{\bar{\theta}(w)} f_\Theta(\theta)d\theta$, with $\Xi(0) = 0$ and $\Xi(\infty) = 1$. Thus, by continuity, there is a wage that satisfies $\Xi(w) = X$. By monotonicity, this wage is unique and increasing in X. ■

For a given tax schedule, the previous Proposition shows that w is determined from the size requirement (5). Military wages, and hence the term $G(u(w\bar{h}) - v(\bar{h}))X$, are not a choice for the government under voluntary recruitment. The previous result also implies that larger militaries are more expensive than smaller ones. The reason is simple: in order to voluntarily attract a larger fraction of individuals into the military sector, the military must compensate them at higher rates.

Given the participation decision and the pricing of military services, the analysis of optimal income taxes is identical to Mirrlees (1971). Let $\zeta^u(\theta)$ and $\zeta^c(\theta)$ denote the uncompensated and compensated labor supply elasticities at θ, and let p be the (average) marginal social value of revenue, i.e., the Lagrange multiplier on (6).

Theorem 2 (Mirrlees) *The first-order condition for the optimal tax rate at a civilian* *income $y(\theta)$ satisfies*

$$\frac{T_y(y(\theta))}{1-T_y(y(\theta))} = \left(\frac{1+\zeta^u(\theta)}{\zeta^c(\theta)}\right)\frac{u_c(c(\theta))}{\theta f_\Theta(\theta)}\int_\theta^\infty \left[1-\frac{G_V(V(s))u_c(c(s))}{p}\right]\left(\frac{1}{u_c(c(s))}\right) f_\Theta(s)ds, \tag{8}$$

for all $\theta \geq \bar{\theta}(w)$.

The derivation and interpretation of the marginal taxes has been treated in several places, notably by Saez (2001). A repetition of these interpretations is unnecessary but it is useful to highlight the aspects that are specific to the problem under consideration.[9] First, since individuals have the option of joining the military, the lower tail of the distribution of civilian skills is truncated. Second, marginal taxes in (8) only depend on the distribution $f_\Theta(\theta)$, the marginal distribution of civilian skills. Thus, the distribution of military productivity can be conditioned upon to determine marginal taxes in the civilian economy. This point allows us to separately study civilian and military outcomes. The reason for these simplifications is that selection into the volunteer military takes place independently of military ability, as per (4).

One way to examine the importance of these aspects is to consider the Lagrange multiplier p:

$$p = \frac{\int_{\bar{\theta}(w)}^\infty G_V(V(s))f_\Theta(s)ds}{\int_{\bar{\theta}(w)}^\infty \left(\frac{1}{u_c(s)}\right) f_\Theta(s)ds}. \tag{9}$$

This multiplier measures the (average) marginal social value of revenue for the government. Notice that (9) takes into account the individuals who have joined the military. Their decision effectively eliminates the lower tail of the distribution of civilian earnings and this lowers the value of p (compared to a case with $\bar{\theta}(w) = 0$). Thus, as the fraction of individuals who join the military increases, the marginal social value of additional revenue declines.

A Military Draft. Suppose now that a draft lottery selects individuals into the

[9] Essentially, the shape of marginal taxes depends on three terms: the labor supply elasticity since an elastic labor response implies lower marginal taxes, the skill distribution since the aggregate distortion of taxation depends on the population affected by the marginal tax at each level, and the preferences for redistribution implicit in the welfare function, see, e.g., Salanie (2003) and Saez (2001).

military. Individuals are no longer required to satisfy the participation constraint (4) and instead soldiers are randomly selected from the population. In a fair draft, the budget constraint for the government is

$$w^d \bar{h} X = \int_0^\infty \int_0^\infty T^d(y(\theta))(1-X) f(\theta, m) d\theta dm, \tag{10}$$

where w^d represents the per-hour wage paid to draftees and $T^d(y(\theta))(1-X)$ is the revenue collected from individuals with income $y(\theta)$ who have not been drafted into service. Notice that w^d is exogenous and differs from the compensation in the volunteer military, w. In the quantitative section we will treat w^d as a choice variable for the government.

The value an individual with skills θ places on being in a draft economy is

$$V^d(\theta) \equiv [u(w^d \bar{h}) - v(\bar{h})]X + V(\theta)(1-X). \tag{11}$$

The value function $V(\theta)$ is equivalent to (2) with the tax function $T^d(y(\theta))$. This value function applies to the fraction $(1-X)$ of individuals who participate in the civilian sector. In other words, a draft in (11) imposes a "tax" of X on civilians. Finally, conditional on not being drafted, individual decisions are standard. Work decisions satisfy the optimality conditions obtainable under a volunteer military with $\bar{\theta}(w) = 0$.

The social welfare function is given by

$$W^d \equiv G(u(w^d \bar{h}) - v(\bar{h}))X + \int_0^\infty \int_0^\infty G(V(\theta))(1-X) f(\theta, m) d\theta dm, \tag{12}$$

which shall be maximized subject to (10) and the appropriate incentive compatibility conditions.

Let $T_y(y(\theta), p, \bar{\theta}(w))$ denote a marginal tax rate that satisfies (8) as a function of $(y(\theta), p, \bar{\theta}(w))$, and let p^d be the Lagrange multiplier on the budget constraint (10). The following proposition describes optimal income taxes in a drafted economy:

Proposition 2 *Under a draft, the first-order condition for the optimal tax rate at a civilian income* $y(\theta)$ *satisfies* $T^d_y(y(\theta), p^d, 0) = T_y(y(\theta), p, \bar{\theta}(w))$*, for all* $\theta \geq 0$.

Proof. Notice that the relevant terms in (10) and (12) can be written as in (6) and (7) with $f^d_\Theta(\theta) \equiv f_\Theta(\theta)(1-X)$. In (8), however, the term $(1-X)$ in the numerator and in the denominator would simply cancel. ■

The intuition behind the previous proposition is that a fair draft does not alter the distribution of skills in the civilian sector. There are, however, important differences between the income tax needed to finance a volunteer military and that needed to finance a drafted military. First, under the draft, there is a mass of individuals $(1-X)f_\Theta(\theta)$ with $\theta \in [0, \bar{\theta}(w)]$ who will now participate in the civilian sector. Similarly, the mass of individuals with civilian skills above $\bar{\theta}(w)$ is smaller under a draft than under the volunteer military since a fraction X is removed from civilian activities. Second, the total budgetary cost of the drafted military can be lowered by reducing the compensation of soldiers, w^d. We will discuss these differences in our numerical analyses below.

Finally, notice that there should be differences in the value of a marginal social value of revenue, $p^d \neq p$. In particular,

$$p^d = \frac{\int_0^\infty G_V(V(s)) f_\Theta(s) ds}{\int_0^\infty \left(\frac{1}{u_c(s)}\right) f_\Theta(s) ds}, \tag{13}$$

which, in contrast to (9), integrates over the entire domain of civilian skills. This implies that the marginal social value of revenue for the government is higher under a draft than under a volunteer army. The reason is that a fair draft and a voluntary system alter the distribution of civilian earnings in different ways.

Discussion. The analytic results for labor income taxes are limited. However, we can obtain some simple results about the overall performance of volunteer and drafted economies and armies.

Let Y^v denote the average gross income of civilians under volunteer enlistments. That is, $Y^v \equiv \mathbb{E}[y(\theta)|\theta \geq \bar{\theta}(w)]$. In turn, the average gross income of civilians under a draft is $Y^d \equiv \mathbb{E}[y(\theta)]$. It is possible to show that:

Proposition 3 *For a given military requirement X and a given tax schedule, the average* *gross income of the civilian sector is higher under a volunteer military than under a draft. That is,* $Y^v \geq Y^d$.

Proof. Individuals who voluntarily serve in the military have low civilian ability. Thus, those who remain in the civilian sector invariably have higher ability that those who serve in the military. As a consequence of Theorem 1, i.e., $y_\theta(\theta) \geq 0$, we have that $\mathbb{E}[y(\theta)|\theta \geq \bar{\theta}(w)] \geq \mathbb{E}[y(\theta)]$. ■

The key implication of Proposition 3 is that the tax base under a volunteer system is larger than under a draft. This result is a consequence of self-selection and the agent's monotonicity requirement, Theorem 1.

The comparison between both methods cannot be directly extended to a utility comparison since $V^v(\theta)$ and $V^d(\theta)$ depend on the tax schedules and the military compensations. A comparison of after-tax (net) civilian incomes also depends on these factors and hence it cannot be unambiguously signed. Notice, however, that since the government sets marginal taxes taking into account the marginal loss in social welfare relative to the average loss in social welfare (i.e., the ratio $G_V(V(s))/p$), it is likely that the marginal taxes will be lower under a voluntary system.

The performance of the military sector cannot be signed unambiguously. Let M^v denote the average productivity of the volunteer military. Thus,

$$M^v \equiv \mathbb{E}[m\bar{h}|\theta \leq \bar{\theta}(w)] = \frac{1}{X}\int_0^\infty \int_0^{\bar{\theta}(w)} m\bar{h}f(\theta, m)d\theta dm.$$

The average productivity of a drafted military is $M^d \equiv \mathbb{E}[m\bar{h}] = \mathbb{E}[m]\bar{h}$.

To compare M^v with M^d it is crucial to understand the *association* between civilian and military skills in the population. There are multiple ways to describe bivariate dependence between random variables. The weakest concept of dependence that we can use here is that of *positive quadrant dependence in expectation.*[10] This concept requires that

$$\mathbb{E}[m|\theta \leq \bar{\theta}(w)] \leq \mathbb{E}[m], \tag{14}$$

with negative dependence defined similarly.

Proposition 4 *Suppose civilian and military skills are positively (negatively) associated. Then, for a given military requirement X and a given tax schedule,the average military productivity of a volunteer army will be lower (higher) than that of a drafted army. That is, $M^v \leq (\geq) M^d$.*

Proof. Follows from (14). ■

The previous proposition shows that a volunteer army need not be desirable from a military productivity point of view. The logic for the previous results is also that of *self-selection*: if civilian and military skills are positively associated in the population, those who voluntarily serve will have low military skills. Thus, as in *adverse selection* models, the average productivity of the military will be lower than the productivity of a randomly selected sample.

A notable feature of (14) is that this condition can be empirically tested. In a separate paper, Birchenall and Koch (2010), we have tested for the possibility of adverse selection in the U.S. Army during World War II. The empirical tests lead us to conclude that, on the whole, selection was advantageous. That is, those who volunteered for the U.S. army were more likely to win high honors for valor than were drafted men. Since this analysis is discussed in a separate paper, we instead focus on the civilian burdens associated with alternative recruitment methods.

[10] The strongest concept of dependence is that of positive likelihood dependence. The distribution of skills $f(\theta, m)$ is said to be *positively likelihood ratio dependent* if $f(\theta', m')f(\theta, m) \geq f(\theta', m)f(\theta, m')$, for $\theta' > \theta$ and $m' > m$. The previous inequality implies that we are more likely to observe civilian and military skills take larger values together and smaller values together than any mixture of these. See Balakrishnan and Lai (2009) for a discussion of these concepts.

3 Quantitative results

In this section we report the results of a quantitative comparison of volunteer and drafted systems for armies of various sizes. The purpose is to evaluate these methods for a reasonable parameterized version of the model.

Parametrization. As we remarked after Proposition 2, knowledge of the marginal distribution of civilian ability, $f_\Theta(\theta)$, is sufficient to determine marginal income taxes and all other civilian outcomes. Thus, we start our discussion of parametrization with the civilian ability distribution.

Our choice for functional forms and parameters relies chiefly on the existing literature on optimal income taxation. We employ a lognormal distribution with mean and variance $(2.757, 0.5611)$, specified by Mankiw, Weinzierl, and Yagan (2009) to fit the distribution of wages (i.e., civilian ability) from the March Current Population Survey (CPS) of 2007.[11] We rely on an iterative procedure and assume a dense grid over the ability distribution.[12]

We use individual preferences of the form

$$U(c,h) = \frac{c^{1-\gamma}-1}{1-\gamma} - \frac{\alpha h^{\sigma}}{\sigma}, \tag{15}$$

with a coefficient of risk aversion of $\gamma = 1.5$ and with a Frisch elasticity of labor supply of $1/(\sigma - 1) = 0.5$. The parameter α specifies the value of nonmarket productive time for the individual. We assume that $\alpha = 2.55$ to obtain an average of 40 hours of work per week in the civilian sector, per Mankiw, Weinzierl, and Yagan (2009).

We use a social welfare function $G(V)$ given by

$$G(V) = -\frac{\exp\{-\xi V\}}{\xi}, \tag{16}$$

[11] This ignores the fact that those currently employed by the military are counted as receiving "civilian wages" and are thus included in this parameterizations. We performed several robustness checks with adjusted lower-ends of the ability distribution, and the distributional consequences were the same.

[12] In order to compute the marginal tax schedules for a wide array of army sizes, the distribution of abilities had to be relatively dense. The bins begin at \$4.76, and are fifty cents wide. The bins continue until \$109.76, the 99.97th percentile. This allows for military sizes from zero to forty percent of the population.

where ξ measures the degree of preference for equity. Higher values of ξ represent greater concern for equity. When $\xi \to 0$, $G(V) = V$ and we obtain a *utilitarian* case. When $\xi \to \infty$, (16) corresponds to a utility-based *maximin* principle. We consider $\xi = 0$ and $\xi = 1$.

Military wages. Wages for the volunteer military, w, are endogenous but we need to determine the compensation for the drafted military. We consider three main scenarios. First, we assume that $w^d = w$. This implies that the total cost of the military is the same regardless of the recruitment method. Second, we assume that $w^d = (1 - X)w$. This assumption lowers the cost of the military but it preserves the amount of revenue that needs to be raised from the civilian sector. Third, we examine a wage-setting rule that maximizes social welfare, (12). In some instances we consider $w^d = 0$, which assumes that drafted soldiers receive no compensation at all.

Utilitarian case. First consider the utilitarian case for the draft and volunteer armies, i.e., $\xi \to 0$ in (16). We are interested in two *social* outcomes: (i) the marginal social value of revenue p and p^d, which measure how valuable revenue is from a social point of view, and (ii) the social welfare functions W^v and W^d. We are also interested in two *individual* outcomes: (i) average tax rates $T(y(\theta))$ and $T^d(y(\theta))$, which measure the tax burden for different individuals, and (ii) value functions $V^v(\theta)$ and $V^d(\theta)$, which measure individual welfare, i.e., who gains the most from each recruitment method.

Marginal social value of revenue. Figure 1 plots p, the marginal social value of revenue for a volunteer army, against similar values for a draft economy, p^d. The figure varies military size from $X = 0$ to $X = 0.40$ and considers three wage-setting mechanisms: pay the drafted army $w^d = 0$, the budget neutral wage $w^d = w(1 - X)$, or the volunteer army wage, $w^d = w$. When the value of p^d is large, the marginal social value of additional revenue is large. Thus, the government is more willing to distort the economy in order to raise revenue. At $X = 0$, $p = p^d$ trivially. However, as Figure 1 suggests, p is smaller than p^d regardless of the wage-setting mechanism.

The intuition behind these results is consistent with our discussion in the introduction and with expressions (9) and (13). Under a voluntary system, the tax base is larger and the redistributive needs in the civilian economy are lower. This reduces the marginal social value of revenue. In fact, p actually falls as the size of the army grows. This is because as the army requires more soldiers, it takes them from the bottom of the earnings distribution. The civilian economy that is left behind has richer tax payers and suffers from less earnings inequality. Notice that when the drafted army pays high wages, i.e., $w^d = w$, the value of p^d is larger than for lower wages, i.e., $w^d = 0$, because the government has larger expenses and larger redistributive needs. That is, under $w^d = 0$, the social marginal value of revenue is indeed lower than under $w^d = w$. However, p^d at $w^d = 0$ is still larger than p as long as $X > 0$. One way to understand p and p^d is to note that a voluntary military provides a large transfer to all inframarginal soldiers. p is consequently lower than p^d because some redistribution is already being done.

Social welfare. There are broader consequences to paying a drafted army low wages. It is true that lowering the military wage will decrease the tax burden in the civilian sector. However, a lower military wage makes the *forgone earnings cost* of the draft much higher, see, e.g., Friedman (1967), Hansen and Weisbrod (1967) and Oi (1967). Figure 2 plots the average welfare of volunteer armies and drafted armies under the assumption that the government sets the military wage w^d to maximize the social welfare function, W^d. For completeness, we also consider the previous wage-setting rules.

Three results are clear: first, optimally setting the military wage in the draft economy provides greater social welfare than when the military wage is set at the value of the volunteer economy, i.e., $w^d = w$. The former economy is an unconstrained version of the latter, so this is a trivial result. Second, despite these gains, the volunteer economy is still better on average than either of the draft economies. In fact, having low military wages, $w^d = w(1 - X)$, fairs worst. There are budgetary gains from lowering military wages, and thus relaxing the tax burden on the civilian sector. However, those gains are small compared to the welfare loss due to the forgone earnings. The intuition for these differences is that to lower the social cost of the draft, the compensation given to soldiers w^d must be large since high military wages yield higher consumption value for draftees (i.e., a high military wage provides *partial insurance* against the draft).

Figure 2 also plots the ratio of the optimal draft economy military wage and the volunteer wage. The third result is that the optimal military wage exceeds the volunteer military wage. Starting at 1.7 times the volunteer wage, this mark-up falls as the military size grows. As the military size grows, agents face a larger chance of being drafted, so it makes sense to transfer resources to that state by increasing the military wage. However, this transfer is paid for by costly taxation.

Individual tax burden. Figure 3 plots the average tax rates for the volunteer and drafted economies against the cumulative distribution of civilian ability. We plot two military sizes: two and a half percent and seventeen percent, though the patterns we describe are consistent with those for the other military sizes we considered. The differences in the marginal social value of revenue correspond to differences in marginal taxes, see (8). In particular, since $p^d > p$, the draft leads to the larger marginal taxes, and thus steeper average tax curves evident in Figure 3. That is, for low productivity agents, a draft leads to a more negative average tax, i.e., a larger net transfer from the government. The average tax contribution of high-income earners is larger under the draft than under the voluntary system, even at lower military wages.[13] These average tax curves cross, leaving some individuals with a larger net subsidy from the government with a draft. The crossing of the average tax curves has important consequences for individual welfare differences.

Individual welfare. Figure 4(a) plots the difference between the individual welfare of an economy with a drafted military versus one with a volunteer military, by civilian productivity, and by military size. The vertical axis plots the percent consumption equivalent to $V^v(\theta) - V^d(\theta)$ (i.e., divided by the marginal utility and level of consumption). If this

[13] We can make the previous argument a little bit more precise in the following sense. Suppose that $w^d = w(1 - X)$ and $p = p^d$. The first assumption implies that

$$\int_0^{\infty} T^d(y(\theta)) f_\Theta(\theta) d\theta = \int_{\bar{\theta}(w)}^{\infty} T(y(\theta)) f_\Theta(\theta) d\theta, \tag{17}$$

whereas the second assumption implies that $T^d_y(y(\theta))$ and $T_y(y(\theta))$ are differential equations that only differ in their initial condition, see Proposition 2. Since average taxes are represented by solutions of a differential equation (8), and because of the existence and uniqueness theorem for differential equations, one and only one integral curve passes through each point. That is, $T^d(y(\theta))$ and $T(y(\theta))$ cannot cross. By (17), it follows that $T(y(\theta)) > T^d(y(\theta))$ for all $\theta \in [\bar{\theta}(w), \infty)$. In other words, under a budget neutral draft with equal value of a marginal unit of public funds, the tax burden of highly-productive civilians is higher under a draft than under a voluntary system.

value is positive, then the agent prefers the volunteer military. If it is negative, the draft is preferred. The level values correspond to the amount of consumption in the volunteer economy that an agent would give up to avoid the level of utility he or she would have in a drafted economy. The first of the other two axes represents the military size required in the economy, i.e., the fraction of the economy's agents required for service. The second axis indexes the agent's productivity in the civilian economy.

For armies of all sizes the individual welfare differences exhibit a V-shape. At one extreme, the individuals with the highest civilian ability are better off with a volunteer military since they are able to exploit their comparative advantage. At the other extreme, the individuals with the lowest civilian ability, those who would join the military, prefer the volunteer military as it keeps them from their low-productivity civilian jobs in the event these individuals are not drafted.

For some individuals, a draft is preferred. These are the agents for whom volunteering for the military is near-marginal. In theory, the marginal individual who decides to participate in the military is indifferent between a voluntary system and a drafted one. These near-marginal individuals have valuable civilian options. This is why the left-side of the V slopes down as agent productivity grows: the civilian options grow more lucrative, making the volunteer military relatively less attractive. Because the military earnings are close to the civilian options, the difference $V^v(\theta) - V^d(\theta)$ comes down to the average taxation. Thus, the low marginal gains from volunteer enlistments and the lower average taxes make the draft preferred for some.

Figures 4(b) and 4(c) plot the individual welfare difference between a volunteer economy and one with a draft, for alternative military wage-setting mechanism. The distributional consequences are essentially the same as in Figure 4(a): we get V-shaped utility differences, which leaves near-marginal agents better off with a draft economy when the military needs are small. This shows that the distributional consequences of the drafted military are not tied to the size of military compensation.

The figures suggest that these simulation results are not just qualitatively instructive, but also quantitatively important. For example, when the military is five percent of the population, the average consumption equivalent is 4.3 percent of consumption. The mean masks a larger cross-sectional difference between agents: the median agent would give up ten percent of civilian consumption in the economy with a volunteer army to avoid a draft. The magnitude of this difference should not be surprising, as the draft represents a five percent chance of consuming one quarter in the military of what he or she would have made in the civilian sector.

Robustness. The simulation results to this point rely upon utilitarian welfare. Next we employ a social welfare function with higher preferences for equity. As in Tuomala (1984), we set $\xi = 1$ in (16). Table 1 presents the results of this and our other robustness checks. In terms of welfare differences, the results are stronger than before. That is, the volunteer military is better on average, and for all individuals. This can be seen in the final column of Table 1, which reports the fraction of the population that prefers a draft.

Table 1 also reports the average tax functions for the same two military sizes as above, at the 5th and 95th percentile in the ability distribution. The average tax function does not cross with stronger preference for redistribution, as opposed to the utilitarian case. Here, the average taxes with the draft are larger (i.e., less negative) for the lower productivity agents than in the volunteer military. The stronger redistribution motives remove any potential for some agents to be better off with a draft.

The labor supply elasticity is a key parameter in our model. We increase the labor supply elasticity to 3 ($\sigma = 1.33$), while targeting average hours worked consistent with the U.S. data ($\alpha = 0.64$). The deadweight losses of a volunteer army are the largest here due to the distortionary costs of taxation. This specification provides the draft its largest group of advocates yet, over 12 percent. This recedes as the military grows to its larger size. A more responsive labor supply increases the potential gains from a draft, but it is limited to small militaries.

While our focus has been on the bottom of the ability distribution, the optimal tax literature have focused at the top, e.g. Saez (2001). For a second specification test, we directly adopt Mankiw, Weinzierl, and Yagan's (2009) distribution of abilities, which appends a Pareto tail with coefficient 2 to the top of the wage distribution. A Pareto tail can be seen as a distribution of civilian ability with a higher fraction of high-earning individuals. The simulation results can be found in Table 2. The Pareto tail leads to much lower (negative) average taxes for the low ability agents. However, this relative difference is not enough to make those low ability agents prefer the draft. This results in a Pareto preference for the volunteer military.[14]

In addition to this, we studied simulations with another four civilian ability distributions: the first two adjust the mean of the civilian ability distribution (plus and minus ten percent), while the second two adjust the standard deviation of the civilian ability distribution (also plus and minus ten percent). The results are reported in Table 2. In practice, nothing changes; olunteer armies are still preferred by the vast majority of agents in the economy. Varying the ability distribution does lead to differences in redistribution, as is evident in the average taxes for the fifth and ninety-fifth percentile in the ability distribution. These taxes are less burdensome with the volunteer economy.

4 Random participation

So far, the participation decision has been simple and restrictive. We have focused exclusively on pecuniary incentives whereas in reality individuals enlist due to non-pecuniary motives such as patriotism and an affinity for the military lifestyle.[15] In this section, we allow for deviations from the strict behavior of the baseline model. In this section we consider a version of the model with random participation, as in Rochet and Stole (2002).

Suppose that the utility of individuals who join the military is $u(w\bar{h}) - v(\bar{h}) + \upsilon$, where υ is an additive utility of military service (or, equivalently, the disutility of staying in the civilian sector). We assume that individuals are heterogeneous in υ and that υ is randomly distributed with a cumulative distribution function $\Phi(\theta, \upsilon)$. We assume that υ

[14] A distribution focused on older individuals, or those without physical disabilities, might similarly exhibit thicker tails. The consequences of changes to the ability distribution appear limited.

[15] A recent study of participation and retention in the U.S. military suggest that non-pecuniary incentives play an important role in these decisions. In their study of information technology (IT) workers in and out of the military, Hosek et al. (2004) found that the recruitment into the U.S. military of these specialized workers held steady in spite of growing civilian market opportunities in the late 1990s. Likewise, "taste" for military service plays a central role in the econometric model of recruitment and retention estimated by Hosek and Mattock (2003).

and m are independent.

Individuals will now join the military for pure pecuniary reasons (as in the basic model) but also due to non-pecuniary motives. The participation decision is such that the probability that an individual with civilian ability θ stays in the civilian sector is $\Pr\{(\theta,\upsilon)|V(\theta) \geq u(w\bar{h}) - v(\bar{h}) + \upsilon\}$. Trivially, the probability that an individual with civilian ability joins the military is $\Pr\{(\theta,\upsilon)|V(\theta) < u(w\bar{h}) - v(\bar{h}) + \upsilon\}$. Notice that the previous probabilities are still independent of the military productivity m, as in our benchmark model.

Participation in the civilian sector is based on a threshold. Let $\pi(\theta) \equiv V(\theta) - [u(w\bar{h}) - v(\bar{h})]$ denote the pure pecuniary difference between the civilian and the military utility for an individual with civilian skills θ. (For notational convenience, we dropped the terms w and $\bar{h}$ from the function $\pi(\theta)$.) The probability that such an individual stays in the civilian economy is

$$\Phi(\theta,\upsilon) \equiv \Pr\{(\theta,\upsilon)|\pi(\theta) \geq \upsilon\}.$$

That is, those with a utility υ lower than $\pi(\theta)$ choose to remain in the civilian sector. The density of individuals with civilian skills θ in the civilian sector is

$$\hat{f}_\Theta(\theta) \equiv \int_0^{\pi(\theta)} f_\Theta(\theta)\Phi(\theta,\upsilon)d\upsilon. \tag{18}$$

Notice that $\hat{f}_\Theta(\theta)$ differs from the distribution in our benchmark case. In the benchmark case, this density function was degenerate whereas here some highly-skilled civilian individuals may opt to join the military for non-pecuniary reasons. We use the density $\hat{f}_\Theta(\theta)$ to obtain marginal tax rates and other outcomes following the same steps as in our benchmark specification.

In order to implement numerically the random participation decision we assume that υ is independent of θ. Further, we assume that υ is normally distributed with mean zero and variance σ_υ^2. In order to examine the importance of pecuniary versus non-pecuniary motives, we examine different values of σ_υ^2. In particular, let σ_π^2 be the variance of $\pi(\theta)$ in the population. (Since θ is heterogeneous in the population, $\pi(\theta)$ is also heterogeneous.)

We assume that $\sigma_\upsilon^2 = k\sigma_\pi^2$. Thus, k represents how much more or less disperse the non-pecuniary motive is relative to the pecuniary motive.

Two extreme cases are illustrative. First, if $k = 0$, we return to the baseline model. Second, if k is large, e.g., as $k \to \infty$, the decision to participate becomes independent of the pecuniary motive; agents enlist half of the time and remain in the civilian sector the other half. Since we have assumed that υ and θ are independent, the resulting distribution will be identical to the distribution under a draft. To see this equivalence, notice that the independence between υ and θ implies that (18) becomes $\hat{f}_\Theta(\theta) \equiv f_\Theta(\theta)\Phi(\pi(\theta))$. Further, for large values of k, $\Phi(\pi(\theta))$ will tend to a one half for all civilian productivity types.[16] The pecuniary differences, $\pi(\theta)$ are swamped by the non-pecuniary differences. Half of the population enists in the military, independent of θ. The civilian population remains in the same proportions as in a draft. The budgetary cost, and thus the tax schedule, depends upon the wage paid by the military, just as it does with a draft.

The logic of the previous equivalence is the following. In the draft, nature decides who joins the military. When preferences are the only driver for enlistments (and these preferences are independent of civilian ability), the decision to join is also "as if" nature determines who serves. Thus, if the military relies entirely upon participation driven by non-pecuniary motives, the government may set the military wage to zero, and still recruit a sufficiently large military. For the purposes of optimal taxation, a "pure" random participation is essentially the same as a draft. Obviously, since the motivation to enlist in this case is driven by preferences, the welfare aspects of the analysis are quite different.

Figure 5 plots the military participation and the marginal social value of government revenue for the random participation model. The horizontal axes vary the values of k, from near zero to eighty percent of the standard deviation of $\pi(\theta)$. The starting point is the case where the military wage would draw seventeen percent of the population in the baseline model. As expected, at the lowest values of $k \approx 0$, the military size is approximately the same as it would be in the baseline model. All of those who enlist in

[16] This can be demonstrated by taking the usual normal distribution partial and cumulative densities, and taking the limit as their variance goes to infinity. The partial density converges to zero, while the cumulative density conveges to 0.5.

the random participation model would have in the baseline model; i.e., individuals with $\theta < \bar{\theta}(w)$.

The mass of individuals who enlist in the random participation model, and would also in the baseline model, is annotated in the graph as "Pecuniary enlistment." The individuals who enlist due to non-pecuniary motives are identified as the residual from total enlistments. As the figure shows, the amount of pecuniary enlistment shrinks as k grows, because a larger fraction of them draw υs that keep them out of the military. The incidence of non-pecuniary enlistment grows as the standard deviation of υ grows. Further, the fraction of individuals who enlist in spite of their civilian opportunity costs, relative to those who do so because more limited opportunity cost, grows as the standard deviation of υ grows.

As k varies, so does the size and cost of the resulting military, though the wage in the military does not change. To compare the volunteer army against the corresponding draft and baseline volunteer economies, we also plot the marginal social values of government revenue under these two systems with a military of the same size.[17]

The central finding in Figure 5 is that as the (relative) variance of υ grows, the marginal social value of government revenue increases for both the draft and volunteering with random participation. However, even with random participation, the opportunity cost of revenue is lower under a volunteer system than under a draft. For the largest value of k under study here, well over half of those who enlist would not enlist in the baseline model. (I.e., those individuals with $\theta > \bar{\theta}(w)$.) In spite of this large volume of enlistment motivated by non-pecuniary reasons, the voluntary system is supported by taxation that is less distortionary than a draft.

The logic for the results in this section is that of the baseline model. Because a draft is non-discriminatory, it takes an equal proportion of low and high productivity individuals from the civilian sector. With the random participation, some individuals

[17] Because simulations by military sizes vary on a grid, and not smoothly, the military sizes in the random participation models are matched to grid point closest in size. This would lead to a step function in the marginal social values of government revenue for the draft and volunteer army. The plot uses a third-degree polynomial to smooth these plots. The difference between the smoothed values and the matched values is purely cosmetic.

with potentially high earnings in the civilian sector do enlist voluntarily. However, $\pi(\theta)$ is larger for more productive individuals in the civilian sector. Thus, a smaller fraction of high-earning individuals enlist than do low income individuals; as typically observed in the data. Our findings in this section thus suggest that the differences in efficiency between the draft and the voluntary military do not originate in the stark participation decisions of the baseline model. The ability of volunteer systems to allow for favorable selection on opportunity cost and, thus, comparative advantage in generating tax revenue, is what mitigates its distortions, even if the decision to volunteer is noisily related to that comparative advantage.

5 An optimal conscription tax

The purpose of this section is to consider a more sophisticated recruitment system based on an optimal "in-kind" tax. We assume that the government taxes individuals' productive time directly and uses this time input in the production of government-related activities.[18]

Let $H(y(\theta))$ denote the number of hours a typical individual with reported civilian income $y(\theta)$ must spend in the army, i.e., a conscription tax. As before, this conscription tax depends on the individual's earnings because skills are private information. Individuals take this tax schedule as given.[19] Let $V^c(\theta)$ represent the value function for an individual with civilian skills θ in an economy with a conscription tax. Let $\ell(\theta) \equiv h(\theta) + H(\theta h(\theta))$ denote the total labor supply of an individual with skills θ. The first term, $h(\theta)$, is the number of hours supplied to the civilian sector and the second, $H(y(\theta))$, the hours in the military.

[18] In this case, the government does not directly compete with the civilian labor market. The closest example that may serve to describe this recruitment procedure is *jury duty* in which individuals are required to serve as members of a jury from time to time.

[19] One way to understand the workings of this tax is to assume that the total number of taxed hours is divided into a series of working "shifts" of duration $\bar{h}$. Thus, we can write $H(y(\theta)) = \bar{h}x(y(\theta))$ where $x(y(\theta))$ is the number of shifts for individuals with reported earnings $y(\theta)$. To save on notation, we represent the problem in terms of $H(y(\theta))$ directly.

Analogous to (2), labor supply decisions solve

$$V^c(\theta) \equiv \max_{h(\theta)} \{u(\theta h(\theta)) - v(\ell(\theta))\}. \tag{19}$$

The first order condition that solves (19) is: $\theta u_c(c(\theta)) = v_h(\ell(\theta))[1+\theta H_y(y(\theta))]$. From the envelope theorem, $V^c_\theta(\theta)$ can be written as

$$V^c_\theta(\theta) = v_h(\ell(\theta))h(\theta)/\theta. \tag{20}$$

A conscription tax is *feasible* if the number of man-hours provided by soldiers equals the given requirement $\bar{h}X$. That is,

$$\bar{h}X = \int_0^\infty \int_0^\infty H(y(\theta))f(\theta,m)d\theta dm. \tag{21}$$

A separate feasibility condition is

$$\int_0^\infty \int_0^\infty c(\theta)f(\theta,m)d\theta dm = \int_0^\infty \int_0^\infty \theta h(\theta)f(\theta,m)d\theta dm, \tag{22}$$

which equalizes total consumption with total earnings. A point to notice from the previous constraints is that there is no monetary compensation for military service. For instance, the cost of the army is not present in (22). Individuals have the option of working additional hours in the civilian sector to compensate for the time devoted to military service.

As before, the optimal conscription tax must be *incentive compatible*. The incentive compatibility requirements are given by (20) and $y_\theta(\theta) \geq 0$ for all $\theta \geq 0$. The derivation of these conditions is analogous to the case of income taxes treated before.

Finally, the government's social welfare function is

$$W^c \equiv \int_0^\infty \int_0^\infty G(V^c(\theta))f(\theta,m)d\theta dm, \tag{23}$$

which shall be maximized subject to the the incentive-compatibility constraint (20) and the feasibility constraints (21) and (22).

Let $T_y^d(y(\theta), p^d, V^d(\theta))$ denote a marginal tax rate for a draft economy as a function of $(y(\theta), p^d, V^d(\theta))$. Let p^c be the Lagrange multiplier on the feasibility constraint (22). The conscription tax is presented in the next proposition:

Proposition 5 *The first-order condition for the optimal conscription tax at a civilian income $y(\theta)$ satisfies*

$$\theta H_y(y(\theta), p^c, V^c(\theta)) = \frac{T_y^d(y(\theta), p^d, V^d(\theta))}{1 - T_y^d(y(\theta), p^d, V^d(\theta))}, \text{ for all } \theta \geq 0. \tag{24}$$

Proof. The proof is analogous to that of the income tax and hence it is available upon request. For example, notice that the first order condition for an income tax is: $\theta u_c(c(\theta))(1 - T_y(\theta)) = v_h(h(\theta))$. The first order condition for a conscription tax is $\theta u_c(c(\theta)) = v_h(\ell(\theta))(1 + \theta H_y(y(\theta))$. Equalizing both expressions gives the value of $\theta H_y(y(\theta))$ as a function of marginal income taxes. ■

The previous proposition yields results that are closely related to the optimal income tax and so (24) bears similar interpretations as those of $T_y(y(\theta))$. The central difference is that there is no direct budgetary cost of conscription and hence there is no need to raise tax revenues to pay for the army. A second important distinction is the inability to transfer time in the case of conscription. While revenues can be transferred across the population, time is an endowment that cannot be transferred. Thus, redistributive goals are more limited under conscription than under other systems of recruitment.

We study the optimal conscription tax numerically following the same steps of the previous methods. We employ the baseline parametrization: utilitarian welfare, lognormal ability distribution, and the initial individual preference parameters. Figure 7 plots the average time tax paid, by agent productivity for two military needs: 2.5 and 17 percent. The plot is essentially flat along the dimension of agent productivity. This means that, for a given military need, all agents essentially must serve the same amount of time. The optimal conscription time tax is effectively a lump sum time tax. The simulated marginal conscription rates are on the order of 1×10^{-3}.

Figure 6 plots the difference between average welfare in economies with (i) a volunteer army vs. a draft army, and (ii) a volunteer army and a conscripted army: essentially, how much better on average is a volunteer army versus some alternative. The stark inferiority of the conscription tax is readily apparent. The reason for this large difference is that the economies studied here value redistribution. Since conscription taxes are an in-kind tax denominated in hours, this tax does not allow for any income redistribution. Their inability to provide redistribution leads to low consumption, and thus low levels of utility, among the low ability agents.

6 Conclusion

The main point of this paper has been to suggest that a draft has a limited power to lower the tax distortions tied to the budgetary cost of the military. In the paper, we relied on a Mirrleesian approach and an economy composed of a military and a civilian sector. We found that a draft reduces the tax base because some high-income earners are inducted into the army. This reduction in the tax base increases marginal taxes and the distortions associated with taxation in the civilian sector. We found that the efficiency losses of the draft are higher at large military sizes. This conclusion contrast with the conventional wisdom that the only affordable way to raise and sustain a large military force is by drafting it.

The model allowed us to consider additional costs. In general, we found that a volunteer force leads to a more productive civilian economy and is more socially desirable; this result was robust to a series of alternative specifications. Some individuals do prefer a draft because draft economies may redistribute more income in the civilian sector. The size of this minority varies across specifications and tends to decline as military needs increase. Although low military compensations under a draft lower the budgetary cost of the military, we found that such compensation is undesirable as these wages are the only form of insurance under a draft. In the paper, we also considered a less stark random participation decision, where agents may join or not join the military in spite of pecuniary incentives. The results under random participation are fully consistent with the baseline results. Further, we considered a novel third option based on an optimal conscription tax. In our simulations, this third option fares worst, as it does not allow for income redistribution fundamental to social welfare in Mirrleesian economies.

Our model was purposefully simple. In order to examine the many competing trade-offs associated with alternative recruitment methods, we abstracted from many additional margins that may be important for military recruitment in reality. For example, we have also abstracted from potential gains in training once in the army as well as other dynamic considerations. We leave these explorations for future work.

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Figure 1: Utilitarian social welfare, log-normal wage distribution, alternate wage settings

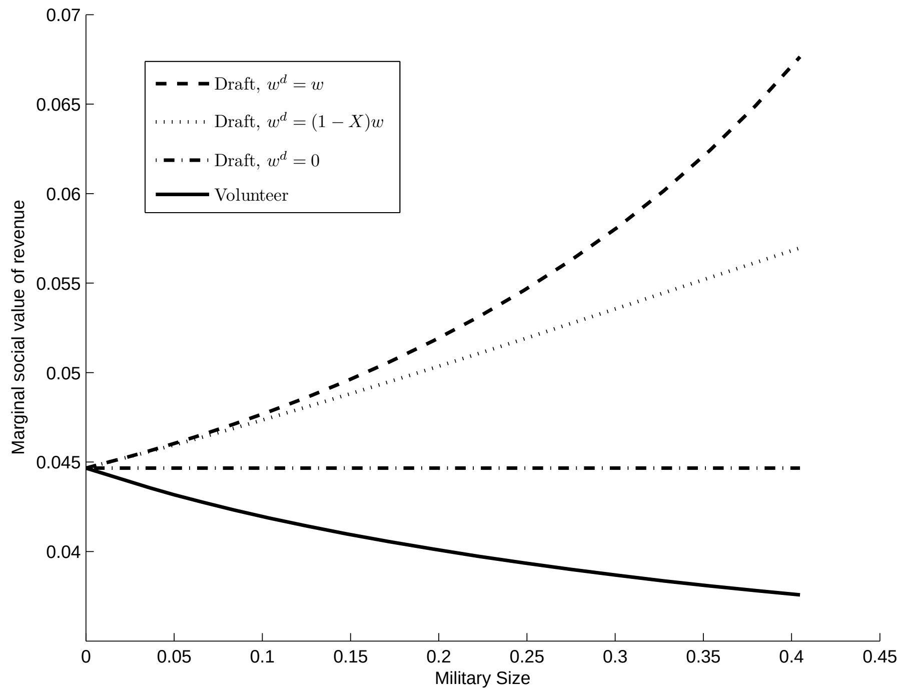


Figure 2: Utilitarian social welfare, log-normal wage distribution

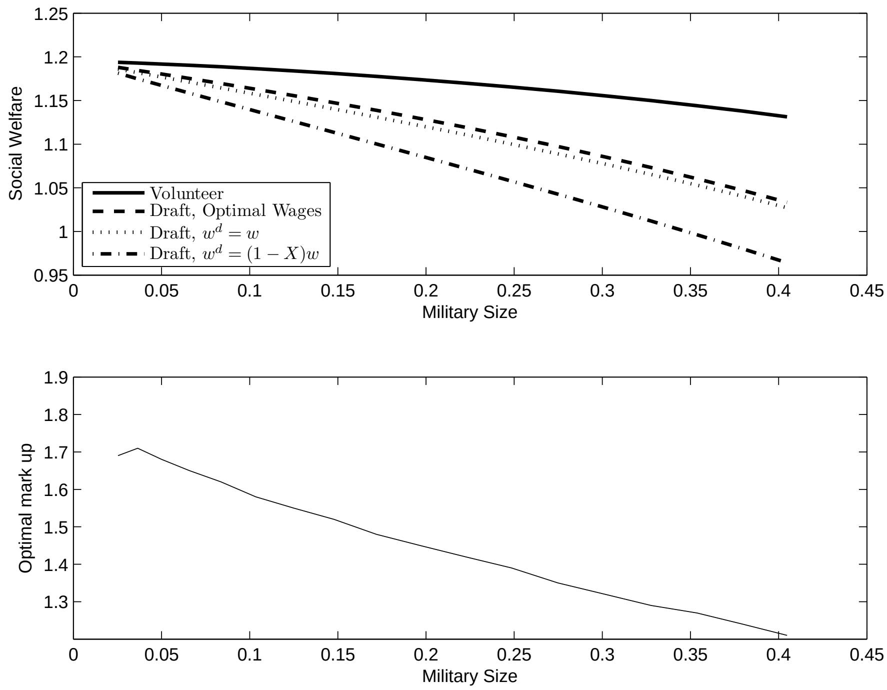


Figure 3: Utilitarian social welfare, log-normal wage distribution

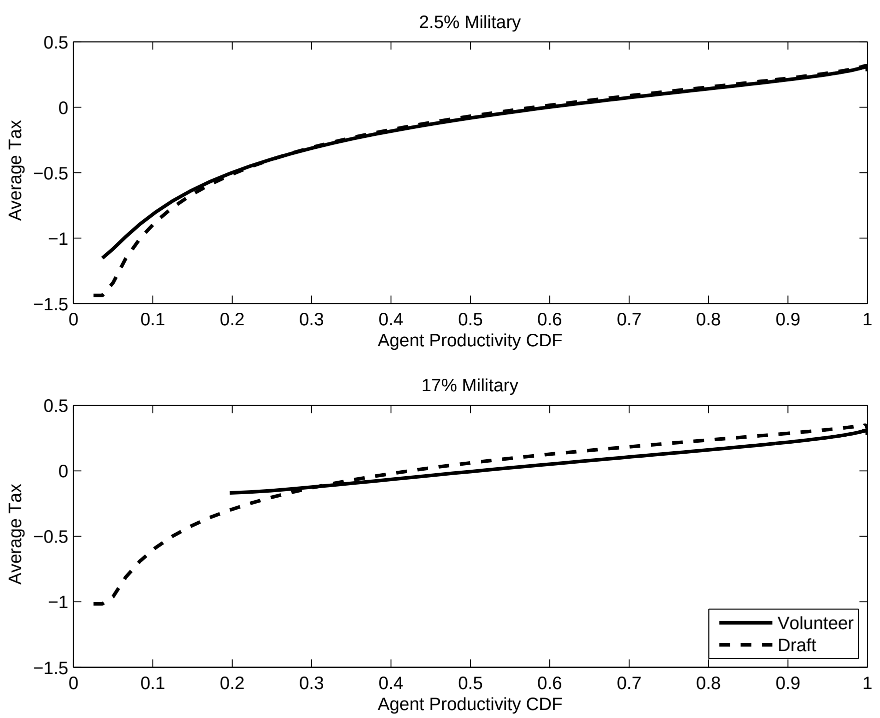
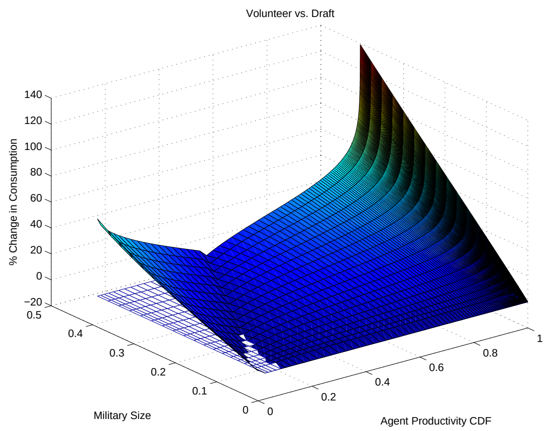
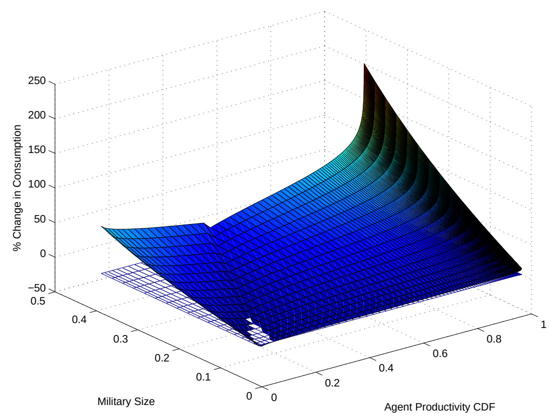


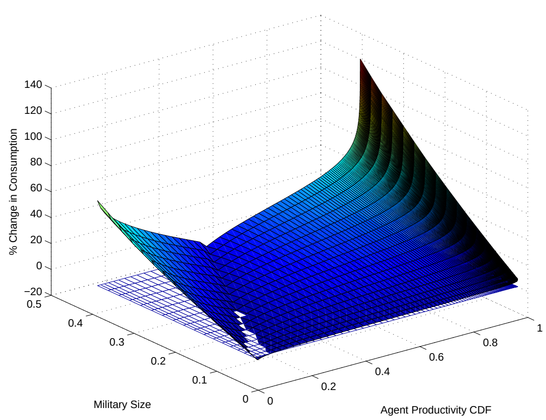
Figure 4: Utilitarian welfare, log-normal wage distribution, alternate draft wages



(a) $w^d = w$



(b) $w^d = (1 - X)w$



(c) Optimal military wages

Figure 5: Volunteering with random participation versus a draft: Utilitarian social welfare, log-normal wage distribution

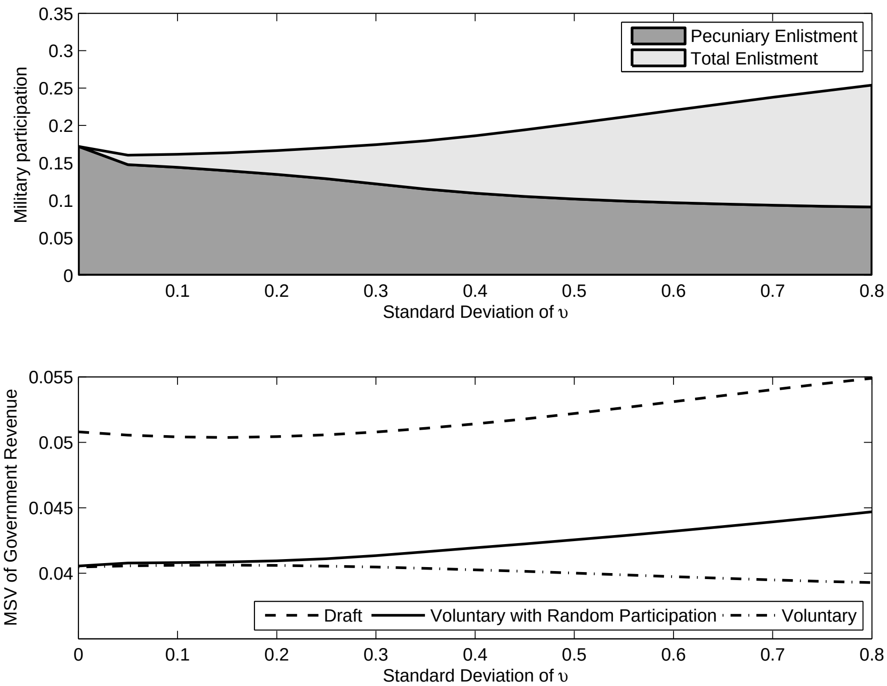


Figure 6: Utilitarian social welfare, log-normal wage distribution

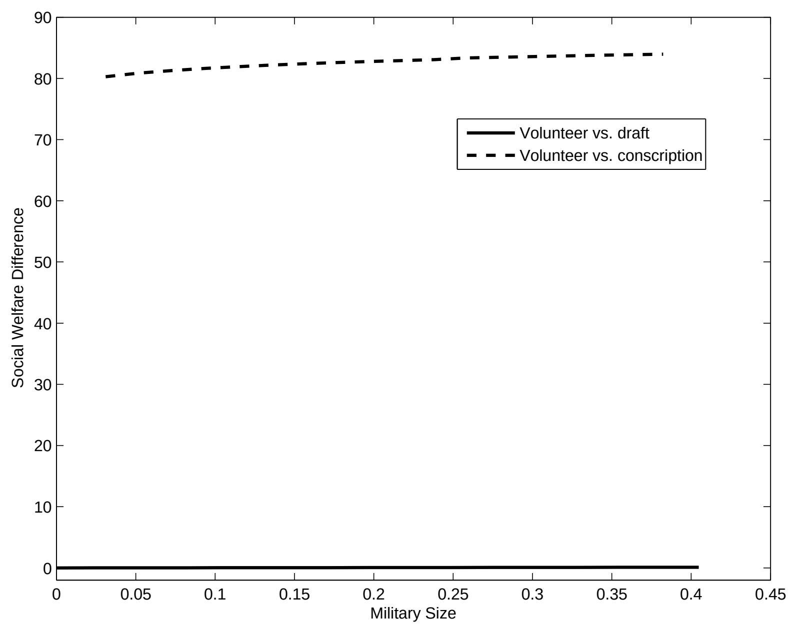


Figure 7: Conscription with utilitarian social welfare, log-normal wage distribution

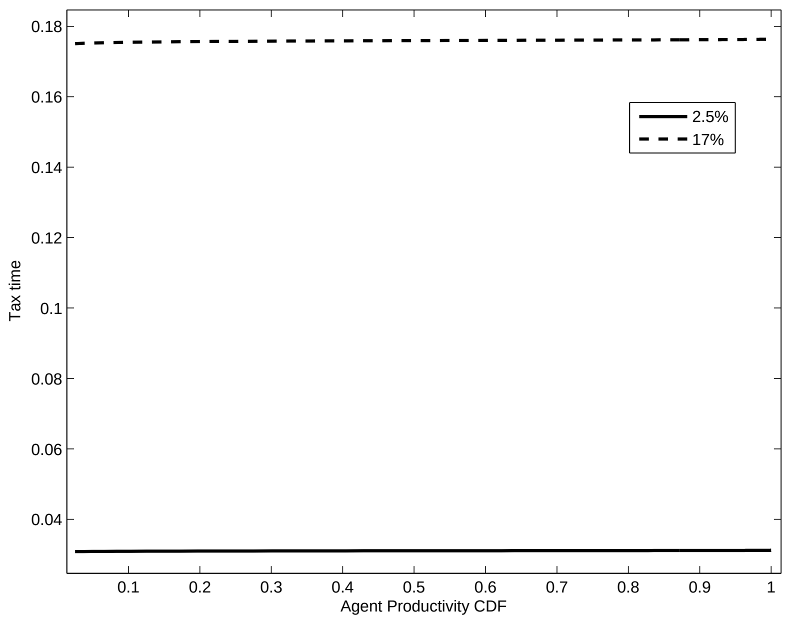


Table 1: Robustness results for alternative model specifications

	Military size	Average tax at ability percentile				% Who Prefer Draft
		5th		95th		
		Draft	Volunteer	Draft	Volunteer	
A. Baseline results	2.5	−1.34	−1.08	0.26	0.25	5.84
	17	−0.96	–	0.31	0.25	0
B. Social Welfare Function	2.5	−8.78	−9.02	0.41	0.41	0
($\xi = 1$)	17	−6.94	–	0.47	0.42	0
C. More elastic	2.5	−1.21	−0.82	0.17	0.16	12.5
labor supply	17	−0.69	–	0.21	0.15	2.49

Table 2: Robustness results for alternative civilian ability distributions

	Military size	Average tax at ability percentile: 5th Draft	5th Volunteer	95th Draft	95th Volunteer	% Who Prefer Draft
A. Pareto tail on the ability distribution	5	−12.45	−7.31	0.34	0.32	0
	18	−10.23	–	0.40	0.32	0
B. Increase mean ability ten percent	2.5	−1.26	−0.98	0.26	0.25	6.70
	17	−0.89	–	0.31	0.25	1.90
C. Decrease mean ability ten percent	2.5	−0.83	−0.83	0.24	0.24	2.25
	17	−0.53	–	0.29	0.25	3.53
D. Increase standard deviation of ability ten percent	2.5	−0.60	−0.60	0.29	0.29	2.25
	17	−0.36	–	0.33	0.29	3.53
E. Decrease standard deviation of ability ten percent	2.5	−0.82	−0.67	0.22	0.21	7.81
	17	−0.52	–	0.28	0.22	0