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In-Kind Taxes, Behavior, and Comparative Advantage  
Casey B. Mulligan  
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**ABSTRACT**

This paper treats taxation in kind (IKT) as an example of price regulation, emphasizing IKT-avoidance behavior, and its interactions with the other costs of price controls. This emphasis fundamentally changes efficiency conclusions, and adds new ones. IKTs do not in fact randomly sample suppliers. Large-scale IKTs, and not small-scale ones, may have especially large average efficiency costs. Ransoms or “commutation fees” are an IKT policy option, but are only efficiency enhancing in specific situations: more heterogeneity among suppliers, and avoidance technologies that result in avoidance behaviors that are poor signals of a supplier’s opportunity cost. Avoidance behaviors are one reason why the social costs of wars and other public projects involving IKTs may have been underestimated.

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## I. Introduction

In-kind taxes – obligations of citizens owed in goods or services, rather than money – are some of the most important taxes in human history, and even in recent times are used in significant ways. For example, according to *The Military Balance*, 59 percent of countries in the world in 1995 obtained military manpower by conscription: forcing citizens into military service. More than six dozen countries, including the United States, have constitutional provisions for taking private land using the power of eminent domain. Eminent domain is also used to redistribute intellectual property, and may be employed more frequently in the future as that type of property becomes more valuable. In-kind “public service” labor payments to local governments can be a major part of the tax burden faced by the poor in developing countries. Another example: two dozen countries compel their citizens to participate in civic elections.<sup>1</sup>

In-kind taxes are administered with a price ceiling: otherwise the supply of goods and services would be voluntary. This is not to say that all price ceilings are in-kind taxes, but in-kind taxes might naturally result from price regulation as regulators become frustrated with a low level of supply. New York, Brookline, and Cambridge, for example, are among cities and towns that amended their rent control laws to prevent landlords from converting rental units to

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<sup>1</sup> On international comparisons of military recruitment, see International Institute for Strategic Studies (various issues). Van der Walt (1999) has a comparative analysis of constitutional property clauses. See Miceli (2011, p. 61) for a famous example and McClure (2007) on the evolving legal relationship between eminent domain and intellectual property. Olken and Singhal (2011) measure in-kind labor payments and other informal taxes in ten developing countries circa the year 2000. See Jackman (2001) on compulsory voting, which is another example of mandating civic duties rather than rewarding them through a voluntary labor market.

condominiums, keeping units vacant, or personally occupying units that they own.<sup>2</sup>

Although public finance deals extensively with the question of cash versus in-kind transfers, in-kind taxes are almost completely neglected. For example, neither of the public finance textbooks by Stiglitz (2000) and Rosen (2001) mentions in-kind taxes in general, or labor conscription in particular. The purpose of this paper is to examine the efficiency properties of in-kind taxation (hereafter, IKT), with special emphasis on avoidance behaviors.

Behaviors for avoiding the Vietnam War draft are still famous today. They include entry into protected occupations, obtaining political favors, moving to Canada, or embellishing medical conditions. Quantitative work on avoidance behaviors has shown that the Vietnam War draft induced a significant increase in college enrollments (Baskir and Strauss 1978, Card and Lemieux 2001). Desertion by conscripts can be rampant, and draftees are less likely than volunteers to reenlist when their required tour is finished.<sup>3</sup> Leon Friedman (1969, pp. 1545-6) describes evasion of the Union Army's draft, "enrolling officers ... were frequently lied to, avoided, and even physically attacked... new towns sprang up just across the northern borders in Canada ... some men maimed themselves in order to fail the physical requirements for the army." Landowners are known to modify their property in order to avoid being targeted for condemnation or other limits on land rights. Stroup (1997, p. 57) describes how landowners have reacted to the Endangered Species Act by "managing their land ... in a way that almost

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<sup>2</sup> See Fine (1980). For Cambridge specifically, where a vacant apartment can be taken "by power of eminent domain in order to restore the unit(s) to serve as housing for people with low and moderate incomes," see City of Cambridge (2015) and Cavellini (2001).

<sup>3</sup>On desertions, see Forest (1989) and Costa and Kahn (2003) and the references cited therein. Costa and Kahn cite high desertion rates as recently as World War II. On reenlistment, see Becker (1957) and Oi (1967).

assures that it will not be suitable for listed species.”<sup>4</sup>

Avoidance activities like these serve to restrict the quality and quantity of supply of resources to be taken. Nevertheless, the small literature on the economics of eminent domain and military conscription typically takes the supply as given, emphasizing instead the purported tendency of in-kind taxation to distort comparative advantage (i.e., that the public project fails to be supplied by those most suited to do it), even though many times it is technically feasible to have IKT without any such distortions.<sup>5</sup> This paper treats IKT as a price-regulation phenomenon – the public recruiter is a buyer who has coercive power over its suppliers – and explicitly models the social costs, and private benefits, of suppliers’ avoidance behaviors. Comparative advantage distortions are a result, not an assumption.

In-kind taxation has been implemented in a variety of ways. Supplier compensation is one variable. Another is the granting of an option (if any) for suppliers to substitute a monetary tax payment for their obligation to supply under the IKT. The price-control framework readily addresses various implementation options, offers new conclusions, and changes some old ones. Under some conditions, “fairer” IKTs – those that do not accept monetary payments and thereby widely distribute the IKT obligation – are more efficient than less fair IKTs. These results may help explain where and when various implementation options are exercised.

The IKT implementation options present a tradeoff between avoidance costs and

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<sup>4</sup>See also Innes (2000) on public land use.

<sup>5</sup> Some of the eminent domain literature addresses land investment incentives, which have many of the economic characteristics of eminent domain evasion. See Miceli and Segerson (2007, Section 5) for a discussion and citations. Part of the model in Turner, Haughwout and Van der Klaaw (2014) includes an effect of land regulation (a policy that effects the value of land to its owner: perhaps a metaphor for condemnation) on the supply of land to be regulated. They find that land regulation has a modest and statistically significant negative effect on the supply of land in a municipality. That supply effect is an important part of their overall welfare analysis of land regulation.

opportunity costs. IKT's are capable of realizing many of the gains from comparative advantage, even while controlling prices. This implication appears to match the reality in which the resources obtained through IKT are far from random. Even among men born 1950-53 whose military draft eligibility was chosen by a random draft lottery, military enlistment was by no means random. Angrist (1990, p. 315) refers to "the fact that armed forces selection criteria were not random ..." and reports that more than three-quarters of draft-eligible men in these cohorts did not serve in the military.<sup>6</sup> At the same time, roughly ten percent of those not draft eligible did serve. Although IKTs distort comparative advantage to some degree, the price-control framework suggests that comparative advantage distortions might enhance efficiency because they can alleviate incentives to avoid the tax.

Previous work on conscription has debated the nature of the relationship between monetary taxes and in-kind taxes. Lee and McKenzie (1992), Ross (1994), and Warner and Asch (1996) claim that economizing on treasury revenue, as in-kind taxation is supposed to do, is socially valuable because of the deadweight costs of collecting monetary taxes. However, these papers do not model the social costs of effort to avoid IKTs; real-world IKTs interact with income taxes, and the former may generate more deadweight costs because they are more concentrated. Birchenall and Koch (2014) use a mechanism-design framework to look at the two types of taxes simultaneously, and conclude that IKTs may reduce overall efficiency by raising the marginal deadweight cost of income taxes. This paper does not contribute to the money-

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<sup>6</sup>The U.S. Selective Service System's draft lottery assigned random sequence numbers to each birthday of the year. Angrist defines a young man to be draft eligible if his random sequence number fell below the draft-eligible ceiling set by the Defense Department according to its manpower needs. According to the Selective Service System, it was these draft-eligible men who "were called to report for possible induction" unless they were classified otherwise because of deferments for occupation, medical reasons, etc.

versus-IKT debate, and just assumes that in-kind taxation reacts not only to the efficiency considerations noted above, but also to social or political preferences to regulate prices paid to suppliers.<sup>7</sup>

Section II begins with the paper's conceptual point of departure: a model of avoidance behavior as a Tullock-style rent-seeking contest. A simple, but critical, result is that the social costs of avoidance are convex in the amount of avoidance. It then lays out the other dimensions of IKT policies, relates them to empirical observations of military recruitment schemes, and interprets them in an equilibrium context. Section III uses the model to offer a new reason why IKTs might reduce efficiency. Section IV looks at policy options for the mix of social costs, and suggests that comparative advantage distortions may not be the primary social cost of IKTs. Section V presents data on military conscription to begin to measure the importance of avoidance behaviors, the degree of selection under IKTs, and the magnitude of conscript pay. Section VI concludes.

## II. The selection of suppliers

A public recruiter is to obtain a specific amount  $M$  of a good or service. The goods and services may be obtained in a market, where  $i \in [0,1]$  indexes potential suppliers in order of their opportunity cost. A policy option is to put a binding ceiling on the price  $w$  paid by the recruiter, but in these cases at least some of the suppliers will have to be forced to supply.

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<sup>7</sup>The paper does, in the spirit of Birchendall and Koch (2014), include features of the IKT that can be interpreted as income-tax consequences of the choices made by citizens potentially subject to IKTs.

## II.A. A Tullock contest represented as a cost function

Suppliers are selected by a compound lottery. The first lottery is a Tullock-style contest (Tullock 1980) that determines their eligibility to supply. Potential supplier  $i$ 's probability  $a_i$  being classified as ineligible is a function of the resources  $x_i \geq 0$  that he spends avoiding selection and the resources spent by the other potential suppliers:

$$a_i = \frac{x_i^\rho}{1 + \int_0^1 x_j^\rho dj} \quad (1)$$

with the constant  $\rho \in [0,1)$ . Note that (1) is a bit different than a Tullock (1980) contest because it is not entirely a zero-sum game. More aggregate avoidance effort by all will increase aggregate avoidance.

An individual's avoidance probability can be written as:

$$a_i = (1 - \bar{a})x_i^\rho \quad (2)$$

where  $\bar{a}$  is the average ineligibility or "avoidance" rate.

An individual's cost of attaining an avoidance probability  $a$  is therefore:

$$c(a, \bar{a}) = \left( \frac{a}{1 - \bar{a}} \right)^{\frac{1}{\rho}} \quad (3)$$

The more that the other suppliers avoid, the more likely supplier  $i$  is to be deemed eligible for selection. The other suppliers' avoidance also raises  $i$ 's marginal cost of avoiding, which is:



$$c_1(a, \bar{a}) = \frac{(1 - \bar{a})^{\frac{1}{\rho}} a^{\frac{1-\rho}{\rho}}}{\rho} = \frac{c(a, \bar{a})}{\rho a} \quad (4)$$

As a result, the marginal private and social costs of evasion are convex in the amount of evasion. The convexity of costs drives a number of the results.<sup>8</sup>

## II.B. The policy lottery

The second lottery is a matter of policy, with  $1-\lambda$  of the eligibles selected to supply (or pay a ransom; more on the ransom below). Suppliers may opt to skip this lottery by “volunteering,” with all eligible volunteers enlisted (that is, supplying the good or service to the public recruiter). It is also a policy option to forgo this lottery altogether, in the sense that  $\lambda$  can be set to zero. This option permits us to examine whether and how policy lotteries might affect efficiency.

The constant  $\lambda \in [0,1]$  is the same for all non-volunteering suppliers and thereby independent of their avoidance efforts at the eligibility stage. Let  $p_i$  denote supplier  $i$ 's compound probability of being selected to supply, which is the joint probability of being deemed eligible and having “bad” luck in the policy lottery:

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<sup>8</sup> Warner and Negrusa (2005) assume a constant marginal cost of evasion and find that draft evasion has a lot in common with a commutation fee. As shown below, the results are quite different with convex evasion costs.

$$p_i = \begin{cases} 1 - a_i & \text{if } i \text{ volunteers} \\ (1 - \lambda)(1 - a_i) & \text{otherwise} \end{cases} \quad (5)$$

Hereafter I refer to  $p_i$  as “the selection probability.” As shown below, the two sources of avoidance have different efficiency properties, because  $\lambda$  has no direct resource cost, whereas  $a_i$  may help to reveal supplier-specific information. Both sources have been used in practice, as with U.S. military conscription in the Vietnam War where (after 1969) young men were selected by lottery and then enlisted based on their location, activities, and medical situations.

The lotteries represented by  $a$ ,  $\lambda$  and  $p$  can be taken literally, with each supplier either fully (to his capacity) supplying the public recruiter, or not supplying at all, as determined by chance. Given that my model is static,  $p$  can also be interpreted as a fraction of a supplier’s capacity that is dedicated to production for the public recruiter. In the case of military conscription, a low value for  $p$  could represent time until desertion, or until failure to re-enlist. It could also represent short-duration service obligations imposed on a broad population, as some of the Western European countries did as they reduced the size of their militaries after the fall of the Soviet Union.<sup>9</sup>

### II.C. Supplier costs

A variety of IKT schemes are actually used. Table 1 illustrates with the case of military conscription. In 1995, a non-trivial number of countries allowed draftees to substitute a

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<sup>9</sup> Take Portugal, which required 20 months of service from draftees in 1985, and less than 12 months in 2000. Over that time frame, the size of the conscripted force fell from 48,900 to less than 10,000 (International Institute for Strategic Studies various issues).

monetary payment for their service in the military.<sup>10</sup> More than half of countries with a draft allowed young men to reduce or avoid their service by, among other things, enrolling in college.

In order to represent much of this variety, my model presents suppliers with three IKT policy parameters: a policy lottery rate  $\lambda \in [0,1]$ , a conscript compensation rate  $w$  (assumed to be no greater than the rate that would yield  $M$  suppliers as volunteers), and a ransom rate  $b \geq 0$ . A supplier's decision is made in three stages. First, avoidance effort  $x$ , if any, is made. Second, the supplier decides whether to volunteer. Third, if not volunteering, supplier  $i$  responds to its selection by either (i) supplying one unit of the good at cost  $r_i$  and receiving compensation  $w$  or (ii) paying the designated ransom  $b$ , whichever is cheaper.<sup>11</sup>

Because avoidance effort often works by degrading the value of the property sought by the public recruiter, the avoidance effort potentially serves two purposes: (probabilistically) evading the in-kind tax according to equation (1), or reducing monetary tax obligations. Supplier  $i$ 's expected net cost is therefore:

$$z_i = (1 - \lambda + \lambda v_i)(1 - a_i) \min\{b, r_i - w\} + c(a_i, \bar{a}) - \alpha a_i \quad (6)$$

where  $v_i$  is an indicator variable for volunteering and  $\alpha \geq 0$  is a constant. The first term on the right-hand side denotes the expected losses from being selected. The parentheses terms therein

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<sup>10</sup> Olken and Singhal (2011) find that Vietnamese taxpayers may hire a substitute to satisfy their public service obligations, but do not mention ransom-like options in any of the other nine countries they studied. According to War Resisters' International (1998), four of those nine countries (Albania, Guatemala, Indonesia, Philippines) had a military draft circa 1996. Among the four, provisions for substituting a monetary payment for military service were legal in Albania and commonplace in Guatemala.

<sup>11</sup> In practice, the ransom is typically referred to as a penalty for non-compliance or, in the military recruitment context, a "commutation fee" or a "purchase of a false medical certificate."

are the components of the compound lottery probability and the min term is the cost conditional on being selected. The  $c$  term denotes the avoidance costs shown previously. The final term is shorthand for net private benefits of avoidance in terms of avoiding monetary taxes. Presumably the benefit coefficient  $\alpha$  is increasing in the rate of monetary taxation and the degree to which the two types of avoidance can be jointly produced.<sup>12</sup>

$M \in (0,1)$  is the amount of supply to be obtained by the public recruiter. Given in-kind tax policy parameters  $b$ ,  $w$ , and  $M$ , and a profile of opportunity costs  $\{r_i\}$ , an equilibrium is four scalars  $V \in [0,M]$ ,  $B \in [0,1-M]$ ,  $\lambda \in [0,1]$  and  $\bar{a} \in [0,1]$ , and an avoidance probability profile  $\{a_i\}$ , such that:<sup>13</sup>

- (i) each  $a_i$  minimizes the cost (6) on the domain  $[0,1]$  given  $\lambda$ ,  $b$ ,  $r_i$ ,  $w$ ,  $c(\cdot)$ ,  $\alpha$ , and  $\bar{a}$ ;
- (ii)  $\bar{a}$  is consistent with the avoidance profile:  $\bar{a} = \int_0^1 a_i di \in [0,1]$ ;
- (iii)  $V$  is the fraction of potential suppliers for whom volunteering minimizes (6);
- (iv)  $B$  is the fraction of potential suppliers for whom  $r_i > b + w$ ; and
- (v) total supply equals the amount  $M$  required:

$$M = \int_0^V (1 - a_i) di + (1 - \lambda) \int_V^{1-B} (1 - a_i) di \quad (7)$$

For some of the policy parameters, an equilibrium does not exist because more than  $1-M$  suppliers are ineligible. For example,  $b = 0$  means that only volunteers can be enlisted, and  $w <$

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<sup>12</sup> The formulation (6) assumes that both types of avoidance are subject to the same congestion effects. If, say, monetary tax avoidance were without congestion effects, then the  $\alpha a_i$  term should be replaced by  $\alpha a_i / (1 - \bar{a})$ .

<sup>13</sup> My notation convention is to use upper-case letters to denote population fractions:  $B$ ,  $M$ ,  $V$ .

$r_m$  means that the number of volunteers would be insufficient. Below I further describe the boundaries of the set of parameters for which an equilibrium exists.

$w$  and  $b$  are transfers. The equilibrium aggregate cost of recruitment,  $SC$ , is therefore just the aggregate costs of avoidance plus the aggregate opportunity cost of the enlisted suppliers:

$$SC(b, w, M) \equiv \int_0^1 c(a_i, \bar{a}) di + \left[ \int_0^V (1 - a_i) r_i di + (1 - \lambda) \int_V^{1-B} (1 - a_i) r_i di \right] \quad (8)$$

The square bracket term is the aggregate opportunity costs. I refer to “comparative advantage distortions” as the degree that this term exceeds what it would be under an all-volunteer system ( $b = 0$  and  $w$  set large enough that  $\lambda = 1$ ).

The Appendix to this paper displays the general algebraic representation of the equilibrium conditions. The main text of the paper discusses results in the context of specific examples.

### III. Another efficiency argument against in-kind taxation

*If a very large fraction of the young men of the relevant age groups are required ... the advantages of a voluntary army become very small.* (Friedman 1967, p. 5)

The small literature on in-kind taxation, dealing especially with military recruitment by conscription and land procurement by eminent domain, does not model avoidance behaviors and

therefore considers only the square-bracketed term in equation (8).<sup>14</sup> Many of the studies conclude that the primary extra social cost of in-kind taxation is its failure to fully select suppliers according to comparative advantage and thereby its failure to minimize the square-bracketed term. Friedman's quote is describing the  $M = 1$  instance of the IKT that might not significantly distort comparative advantage because all of the young men are presumed to be engaged in the same activity: serving in the military.

At the same time, it is claimed that, regardless of the amount  $M$  to be enlisted by the public recruiter, IKTs do not have to distort comparative advantage because, in theory, the ransom rate can be set low enough to induce suppliers to sort themselves.<sup>15</sup> The fact that IKTs often fail to include a low ransom rate suggests that the claim needs to be qualified, or that IKTs have significant costs beyond comparative-advantage distortions, or both.<sup>16</sup> Perhaps it is simply that ransoms have an "unfairness" cost. But, to the degree that avoidance makes ransoms a costly policy option, modeling the use of that option a result rather than an assumption contradicts Friedman's assertion and changes other conclusions.<sup>17</sup>

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<sup>14</sup> See Amacher et al (1973), Hermalin (1995), Friedman (1967), and Warner and Asch (2001). Oi (1967) has estimates of aggregate opportunity costs for U.S. enlistment circa 1965, assuming little effect of the recruitment method on comparative advantage. Amacher et al. (1973) and Munch (1976) model opportunity costs without avoidance costs, but do mention a variety of avoidance activities. Warner and Asch (2001, p. 174) note that "individuals expend resources to avoid the draft" but claim that such resources are socially well spent from the perspective of reducing opportunity costs (Warner and Negrusa (2005) formally derive a result like this).

<sup>15</sup> See Warner and Asch (2001, pp. 172-3).

<sup>16</sup> At first glance, it might seem that a system of substitutes would fully eliminate comparative advantage distortions, but a substitutes system depresses the private return to suppliers (compared to an all-volunteer system) and the Tullock eligibility contest drives a wedge between private and social incentives. As a result, the substitutes system has too few eligible low-cost suppliers who might take the place of high-cost suppliers.

<sup>17</sup> See also Mulligan and Shliefer (2005), who emphasize yet another type of costs: political and administrative costs of setting up, enforcing, and maintaining complex recruitment

These two results are seen most easily by assuming, as in this section, that all suppliers are identical  $r_i = r$ . In this special case, social cost is:

$$SC(b, w, M)|_{r_i=r} = c(\bar{a}, \bar{a}) + Mr \quad (9)$$

where the product  $Mr$  is the same opportunity cost as the all-volunteer system.

Although it is no surprise that in-kind taxation might be less efficient due to avoidance costs, the efficiency costs of in-kind taxation are first order, even in the neighborhood of the all-volunteer system. Take any  $w \in [0, r)$  and, for the moment,  $b > r + w$  so that  $B = 0$  suppliers pay the ransom. From (6) and (7), we get the equilibrium condition:

$$\frac{(r - w)M + (1 - \bar{a})\alpha}{1 - \bar{a}} = \frac{1}{\rho} \left( \frac{\bar{a}}{1 - \bar{a}} \right)^{\frac{1-\rho}{\rho}} \frac{1}{1 - \bar{a}} \quad (10)$$

The right-hand side is the equilibrium marginal cost of avoidance and is increasing in avoidance  $\bar{a}$  – the social costs of avoidance are convex. Raising the volunteer wage therefore has a first-order effect on avoidance.

It matters how much the supplier-compensation rate  $w$  is depressed below the all-volunteer case. The social costs (9) are convex in  $(r-w)$ : a lot of efficiency would be lost by setting  $w$  all the way to the zero. Unless the gains (whatever they are) from depressing  $w$  are even more convex, the convexity of avoidance costs helps explain why, even in the absence of significant gains from trade among suppliers, actual IKTs are usually paying rates that are

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systems.

attractive to a significant fraction of the suppliers.

The left-hand side of (10) is the marginal benefit of avoidance. It includes the term  $(r-w)M$ , which is the expected value of the amount extracted by the IKT. The all-volunteer system sets this term to zero, regardless of the amount  $M$  of supply to be enlisted. The equilibrium avoidance costs under the all-volunteer system are independent of  $M$ , and less than they would be with IKTs ( $r > w$ ), *especially* if  $M$  is large. We therefore have an example in which the opposite of Friedman's conclusion holds.<sup>18</sup>

The left-hand side of (10) also includes an  $\alpha$  term.  $\alpha > 0$  represents the assumption that monetary taxes by themselves discourage suppliers from maximizing the social value of their product, and instead encourage them to engage in avoidance behaviors. Avoidance therefore has a first-order effect on social cost even in the all-volunteer limit  $w = r$ .

Equation (10) is derived under the assumption that  $b > r + w$ . If instead  $b = w + m$ , each supplier is indifferent between paying the ransom and supplying the public recruiter. This case does not have a unique equilibrium  $\lambda$  or  $B$ . The possible range for  $\lambda$  goes from zero – with the maximum number of ransom payers – to the value of  $\lambda$  consistent with  $B = 0$  (see above). In all of the cases with  $B > 0$ , equilibrium avoidance and social cost is greater than the case considered above because each supplier's expected payment is  $(r-w)[M+(1-a)B] > (r-w)M$ . We at least have an example in which, given  $w$ ,  $B = 0$  is efficient because ransom payments add to avoidance costs and do not sufficiently reduce comparative-advantage distortions.

Another reason that low ransom rates might not add much, if anything, to efficiency, is

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<sup>18</sup> See Birchenall and Koch (2014) for another example. In their model, large  $M$  makes it especially important to keep high earners in the civilian sector, where they pay lots of income tax, and (without avoidance or ransoms in the model) an all-volunteer system is the only way to do so.



that avoidance behaviors by themselves can signal information about a supplier's comparative advantage, albeit imperfectly. As shown in the next section, the sum of the two comparative advantage terms in (8) may not be as low as it would be with all-volunteer enlistment, but is still far from its level under pure random selection, and perhaps too low from a constrained efficiency perspective.

#### IV. Mechanisms for realizing gains from comparative advantage

##### V.A. Policy options for the mix of costs

In the case of identical suppliers the existence of ransom payers  $B > 0$  can only increase social cost by encouraging suppliers to avoid enlistment and ransom payments, rather than just avoiding enlistment (recall that  $B$  denotes the fraction of potential suppliers that would prefer the ransom to supplying with compensation  $w$ ). In the more general case with supplier heterogeneity, the social costs are of two types: avoidance and forgone gains from comparative advantage.<sup>19</sup> For some values of the model parameters  $\{\alpha, \rho, w, r(\cdot)\}$ , it is possible that setting  $B > 0$  can reduce both comparative advantage distortions and avoidance costs by giving the highest-cost suppliers an alternative to supplying at their high cost. To see this, take cases with zero volunteers and  $\rho = 1/2$ . This case has a couple of intuitive properties: (i) avoidance costs are quadratic in avoidance, (ii) average avoidance costs depend only on the cross-section average and variance of avoidance rates, and (iii) equilibrium average avoidance depends on the average burden that the in-kind tax places on the population:

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<sup>19</sup> By comparative advantage distortions, I mean the excess of the square-bracketed term in equation (8) as compared to what it would be under the all-volunteer system.

$$2 \frac{a_i}{(1 - \bar{a})^2} = (1 - \lambda) \min\{b, r_i - w\} + \alpha \quad (11)$$

where the average burden is the cross-section average of the first term on the right-hand side.

Setting  $B > 0$  can both reduce average avoidance and its variance. With  $B = 0$ , the min part of the average burden is just the amount that the price  $w$  is fixed below the average opportunity cost. By allowing ransom payments (that is, reducing  $b$  enough that  $b+w$  is within the support of the opportunity cost distribution), the average min term is reduced, but the *ex poste* fraction  $1-\lambda$  of the population paying the in-kind tax is increased (the enlistment constraint requires that somebody else supply in the place of each ransom payer), with an ambiguous overall affect on average avoidance. The size of the first effect increases with the gap between the highest-cost suppliers and the average supplier. The size of the second effect increases with the size of the opportunity cost of suppliers that do not pay ransom, and would be essentially zero if the suppliers not paying ransom were on the margin of volunteering.  $B > 0$  also reduces the cross-section variance of the min term – it reduces the burden for the suppliers with the greatest burden – and can thereby reduce the average (quadratic) costs of avoidance.

Other values for the model parameters  $\{\alpha, \rho, w, r(\cdot)\}$  feature a policy tradeoff between opportunity and avoidance, as shown in Figure 1. The chart's horizontal axis measures the avoidance cost term  $c$  from equation (8) (copied below for the reader's convenience), net of what the costs are under an all-volunteer system. The vertical axis measures the comparative advantage distortion term, which is the square bracket term net of what it would be under an all-volunteer system. The all-volunteer system is at the origin in Figure 1.

$$SC(b, w, M) \equiv \int_0^1 c(a_i, \bar{a}) di + \left[ \int_0^V (1 - a_i) r_i di + (1 - \lambda) \int_V^{1-B} (1 - a_i) r_i di \right] \quad (8)$$

For the values of the model parameters  $\{\alpha, \rho, w, r(\cdot)\}$  that feature a policy tradeoff between the two types of costs, the  $B = 0$  policy has the least avoidance cost because there are no ransom payers and only  $M$  suppliers ultimately pay an IKT (apart from the avoidance costs). The policy lottery  $\lambda$  is permitting the most avoidance at this point, but comparative advantage distortions are at their maximum because the policy lottery does not discriminate on the basis of comparative advantage. The other extreme of the frontier has  $\lambda = 0$  and the maximum number of ransom payers consistent with enlisting  $M$ . Here avoidance costs are at their maximum, but comparative advantage distortions at their minimum.

### V.B. “Fairness” is sometimes efficient

Depending on the values of the model parameters  $\{\alpha, \rho, w, r(\cdot)\}$ , the magnitude of the slope of the (potentially nonlinear) frontier can be greater or less than one. A steep (flat) frontier means that the IKT policy maximizing (minimizing)  $B$ , respectively, has the minimum total social cost at a given  $w$ . If we describe  $B = 0$  as the most “fair” policy option among the various ways to regulate supplier compensation  $w$ , then fairness can be efficient. One determinant of the frontier’s slope is the scope for gains from trade among suppliers, measured perhaps as the cross-section variance of opportunity costs. When the scope is low, as in the identical-suppliers case examined in Section IV, it is efficient to be fair. If instead some of the suppliers have a particularly high cost, the policy that encourages ransom payments may minimize total costs

because its reduction of comparative advantage distortions is not sufficiently offset (if at all) by added avoidance costs.

The technology for avoidance, as parameterized by the constant  $\rho$ , is also relevant for determining whether the fair IKT is also more efficient than other IKTs. Figure 2 displays two equilibrium cross-section profiles for avoidance for the  $B = 0$  case. The profiles achieve the minimum of each supplier's net cost (6):

$$a_i = \rho^{\rho/(1-\rho)}(1 - \bar{a})^{1/(1-\rho)} \begin{cases} 0 & \text{if } r_i \leq w - \alpha \\ [r_i - w + \alpha]^{\rho/(1-\rho)} & \text{if } r_i \in (w - \alpha, w] \\ [(1 - \lambda)(r_i - w) + \alpha]^{\rho/(1-\rho)} & \text{if } r_i > w \end{cases} \quad (12)$$

Both profiles correspond to the same values for the model parameters  $\{\alpha, w, r(\cdot)\}$  except that they have different  $\rho$ 's. As  $\rho$  approaches 1, a supplier's avoidance is more sensitive to his opportunity cost. In effect, avoidance alone achieves some of the gains from comparative advantage and thereby reduces the potential for ransoms, which increase the overall level of avoidance, to reduce comparative-advantage distortions.

An equilibrium, of course, has too much avoidance on average, but it also has an avoidance profile that is too steep among the non-volunteers. Note that high-cost suppliers are not avoiding the IKT with the purpose of achieving gains from trade. The private benefit when supplier  $i$  avoids depends on  $r_i - w$ . The social benefit is  $r_i$  minus the opportunity cost of the supplier who replaces him, and is less than the private benefit because the *IKT* is by definition not compensating suppliers according to their opportunity cost.

For example, take  $\alpha = 0$  and  $w > 0$  and consider perturbing the equilibrium avoidance for

a supplier with opportunity cost  $r_h$  and using the extra enlistment by increasing avoidance for a supplier with opportunity cost  $r_L < r_h$ . The perturbation reduces aggregate avoidance costs according to the ratio  $(r_h-w)/(r_L-w)$  because the high-cost supplier had been avoiding more. But the perturbation reduces aggregate opportunity costs by only  $r_h/r_L < (r_h-w)/(r_L-w)$ . This is another reason why the no-ransom-payers policy might be more efficient than IKTs with ransom payers: the former has more of the avoidance in the policy lottery that is independent of opportunity cost. The equilibrium already has an inefficient mix of avoidance costs and comparative-advantage distortions, and accepting ransom payments further exacerbates this inefficiency.

## V. Avoidance and Selection with Military Conscription

Above I argue that avoidance behaviors are a natural consequence of IKTs, that a side effect of avoidance is that suppliers are selected in relation to their opportunity costs, and that suppliers are paid enough under IKTs that much of the supply is voluntary. The case of military conscription offers enough data to begin to measure the importance of avoidance behaviors, the degree of selection under IKTs, and the magnitude of conscript pay.

Table 2's data from the Union Army shows that evasion and exemptions were common in the American Civil War. The top line of the table shows that 776,829 men were drafted but, as shown toward the bottom of the table, the draft only delivered 162,535 recruits.<sup>20</sup> 41 percent of those drafted were exempted. Many others did not report. Of those who were held to service, 81

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<sup>20</sup> To put these numbers in perspective, note that the U.S. population today is 14 times greater than the population of the Union in 1861 (National Park Service 2015).

percent made a monetary payment (a “commutation fee” or hiring a substitute) rather than serving in person.

Figure 3 shows the importance of exemptions in the modern U.S. wartime drafts: 1944 (World War II), 1952 (Korea), and 1970 (Vietnam). For these drafts, male civilian citizens had to register at age 18 with the Selective Service System. The registered men were classified as available for military service (with or without restrictions) or according to the reason for his exemption or disqualification.<sup>21</sup> The figure, based on U.S. Census Bureau (2006), shows the distribution of registrants by classification. The various exemptions and disqualifications are combined into a single category, with the exception of those who are classified exempt because they are serving or already served. In all three wars, exemptions were a nontrivial fraction of those registered. In Vietnam, exemptions were a majority and exceeded the number who served. Indeed, Card and Lemieux’s (2001) estimates for 1965-69 imply that about two men were enrolled in college *because of the draft* (that is, beyond the number normally enrolled) for every one that was inducted into the military via the draft. Sjaastad and Hansen (1970) attempted to estimate the overall amount of draft avoidance costs circa 1969 and (as summarized by (President's Commission on an All-Volunteer Armed Force 1970) found them to be 1.5 times the amount that the military was saving on payroll expenses relative to an all-volunteer force, which suggests that avoidance costs could be quite a bit larger than comparative-advantage distortions. Table 2 and Figure 3 therefore suggest that a realistic model of suppliers must look at their options for avoiding the IKT.

It would be remarkable if those inducted through the draft were representative of the

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<sup>21</sup> Commutation fees and offering substitutes were not options for draftees in World War II, Korea, or Vietnam.

population of registrants, especially when the former is a small fraction of the latter. For example, we must presume that there were draftees in the Civil War who could not afford the commutation fee or to hire a substitute. College students were allowed to defer their service during the Vietnam War. Of course, college students are not representative of the general population their age, with better grades in high school and higher parental incomes, among other things.

The results of Kriner and Shen (2010) permit some quantitative comparisons of civilian and military populations across wars, two with a draft (Korea and Vietnam) and one with an all-volunteer force. They obtained records on each military death during the wars, including the place where the person had been living prior to entering the military. Using these records, they compared the casualty rates across counties grouped in population-weighted deciles by the median family income in the county. Figure 4 shows some of their results.<sup>22</sup> The vertical axes measure the percentage of casualties in each decile and would be essentially ten for every decile if selection into the military and selection into activities within the military were random. Instead, each war's chart shows a downward-sloping pattern with county income, which means that young men in high-income counties were less likely to die in the war than young men in low-income counties were. Some of the differences among counties occur because a greater fraction of young men in high income counties avoid the draft. Some of them occur because of the types of military service performed.

Also of interest is the fact that deviations from random casualties in Iraq (fought entirely with volunteers) are not that different from the pattern for Korea (27 percent of military

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<sup>22</sup> Kriner and Chen have results for World War II, but the results are not comparable because they were unable to classify counties by income.

personnel had been drafted) and Vietnam (20 percent; most of them were inducted prior to the use of a random lottery).<sup>23</sup> If county income or college attendance is positively correlated with comparative advantage in civilian occupations, then Figure 4 suggests that the comparative advantage distortions during Korea and Vietnam were less than they would have been with purely random selection.

At the same time, comparative advantage distortions were probably not zero. The military's demographic composition changed after the draft ended in 1973. Drafted military personnel were more likely white and less schooled than the military would have been if recruited on a purely volunteer basis: see Sider and Cole (1984) and Kane (2005). Kriner and Shen (2010, p. 75) find the Vietnam casualty-income relationship to be significantly weaker after 1969 when a random lottery became part of the selection process.

In practice militaries recruiting with a draft simultaneously recruit large numbers of volunteers.<sup>24</sup> Table 1 shows that every country with the draft had a significant number of volunteer soldiers too, and typically those volunteers are almost half of military personnel. Figure 5 measures the prevalence of volunteers in several U.S. wars, showing that volunteers have been a significant percentage and many times outnumbered those inducted through the draft.

Undoubtedly some of the so-called volunteers enlisted in order to avoid being drafted. Oi (1967) refers to them as "reluctant volunteers." For the Vietnam War (circa 1965), he estimated that reluctant volunteers to be 38 percent of total volunteers, leaving about half of the force as

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<sup>23</sup> In Korea and Vietnam, the prevalence of draftees in combat areas was higher than the overall percentages cited in the text.

<sup>24</sup> In the eminent domain context, I expect that volunteers are common in jurisdictions where compensation is closely tied to market value, although I do not have systematic data on this.



“true volunteers.” His estimate is also shown in Figure 5 (black triangle). Although reluctant volunteers were not absent from the wars before Vietnam, they were probably less prevalent because volunteering sometimes put a person a greater risk rather than less. Whereas volunteers during the Vietnam War were less likely than draftees to serve in the combat zone and were less likely to die in service (Kriner and Shen 2010, p. 77, The Veterans Hour 2015), volunteering for the Confederate Army may have been more dangerous because volunteers were targeted for conscription after their volunteer tour of duty ended (Weigley 1984, p. 205).<sup>25</sup>

The important conclusion is that public recruiters are often paying rates that are attractive to a significant fraction of the suppliers. The Civil War payments are vivid examples. Table 3 shows that 24 percent of the War Department spending 1861-5, which amounted to more than three months of the Union’s GNP, was devoted to extra bonus or “bounty” payments to volunteers (U.S. Census Bureau 2006, Kriedberg and Henry 1955, Williamson 1974). The model in this paper is a start at explaining why, and how much, payers of the IKT are compensated.

## VI. Conclusions

This paper treats taxation in kind (IKT) as an example of price regulation.<sup>26</sup> The government values possession of a particular good or service and IKTs offer a range of alternatives to purchasing in an unregulated market. The alternatives exacerbate the social

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<sup>25</sup> To the extent that reluctant volunteers do serve at less cost, my model can be readily extended to include them by adding a third “occupation” that supplies the government at lower cost and in doing so obtains an exemption from the IKT; joining the third occupation would be an example of the avoidance behaviors modeled in this paper.

<sup>26</sup> See also Becker (2008) who treats (apartment) rent regulation and military conscription in the same lecture about “non-price rationing.”

problems of determining who supplies the good, and coordinating the two sides of the market. This paper emphasizes the additional problem of limiting tax-avoidance behavior, and its interactions with the other two.

This emphasis fundamentally changes efficiency conclusions, and adds new ones. Ransoms permit high-cost suppliers to opt out, but they also increase the aggregate burden because somebody has to supply in their place. The fact that IKT policies many times do not make use of ransom-like policy instruments that would reduce comparative advantage distortions suggests that other costs are decisive: those other costs may be avoidance costs. If so, large-scale IKTs, and not small-scale ones, may have especially large average costs. Indeed, because of avoidance behaviors, large-scale recruitment may only be possible without price regulation, or at least requires a ceiling that is pretty close to the unregulated rate.

The other side of the coin is that some situations warrant ransoms and relatively high supply prices that would mitigate comparative-advantage distortions. These situations include more heterogeneity among suppliers, and avoidance technologies that result in avoidance behaviors that are poor signals of a supplier's opportunity cost.<sup>27</sup>

Previous studies estimated the burden of in-kind taxes by looking only at the suppliers actually transacting with the public recruiter, and highlighted the hidden tax they paid as a consequence of the price control.<sup>28</sup> In the notation of this my model, the previous studies take the hidden burden to be  $(r-w)M$ , where  $M$  is the amount of supply taken by IKT,  $w$  is the

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<sup>27</sup> Another consideration, not addressed in this paper, is that policymakers are not fully aware of the social costs of recruitment and that IKTs obscure the costs, especially when the IKT does not include monetary options. See Dougan and Thomas (2014) for an application of this idea in another regulatory context.

<sup>28</sup> See Becker (1957), Oi (1967), Amacher et al. (1973), Goldin and Lewis (1975) and, more recently, Olken and Singhal (2011).

compensation paid, and  $r$  is the average opportunity cost of the  $M$  suppliers transacting with the government pursuant to the IK. This would also be the hidden burden in my model if there were no avoidance and no ransom payments.<sup>29</sup> But in fact there is avoidance and sometimes ransoms too, which are burdens for suppliers not making IKT payments. In the context of the military draft, a number of draft-aged civilian men are not in the military precisely because they incurred some of the various avoidance costs noted in this paper. Inclusive of ransoms and other avoidance costs, the total burden among suppliers exceeds  $(r-w)M$  by a factor of  $[1 - (1 - \rho)\bar{a}]/[(1 - \bar{a})(1 - B)]$  where  $\bar{a}$  is the average ineligibility or “avoidance” rate and  $\rho \in [0,1)$  indicates the ratio of average avoidance costs to marginal avoidance costs. As shown in Table 2, this factor is, depending on  $\rho$ , between 1.5 and 4.8 for the Union Army in the Civil War.<sup>30</sup> This is one reason why the costs of wars involving the draft have been underestimated.<sup>31</sup>

According to this paper’s definition of social cost, it is minimized with all-volunteer recruitment. In order to explain the fact that in-kind taxes exist, one can, for the purposes of predicting actual policymaking, put extra weight in social cost on payments to the suppliers. The

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<sup>29</sup> For simplicity, this paragraph takes the avoidance-benefit parameter  $\alpha$  to be zero and treats all suppliers as identical.

<sup>30</sup> From Table 2, 1.5 and 4.8 are the ratios of 776,829 and 249,259, respectively, to 162,535. At the lower bound, all of the costs beyond  $(r-w)M$  are the fees for substitutes or commutation. For the years 1965-69 (U.S. Vietnam War prior to the draft lotteries), the upper bound on the ratio is 10.8 because at least 15.4 million men aged 18.5-26 were both draft registered and hadn’t served in the military but only 1.4 million of them were inducted into military service (see also Section V).

In the model with identical suppliers and  $B > 0$ , the marginal benefit of avoidance effort is  $(1 - \lambda)(r - w)$ , which rationalizes average avoidance costs of  $(1 - \lambda)(r - w)\rho$ . Each supplier therefore pays  $(1 - \lambda)(r - w)\rho\bar{a}$  for sure and  $(1 - \lambda)(r - w)$  with probability  $(1 - \bar{a})$ . The resource constraint requires that  $(1 - \lambda)(1 - \bar{a})(1 - B) = M$ , and thereby gives the factor cited in the main text.

<sup>31</sup> Some of the studies of the cost of war only attempt to estimate the “direct” costs akin to monetary tax payments, without attempting to quantify the “indirect” costs of avoiding either monetary or in-kind taxes. Even so, the point here is that the ratio of indirect to direct costs may have been higher for military conscription than it is for monetary taxes.

efficiency comparative statics in this paper would be comparative statics as to IKT policy implementation, holding fixed the “extra weight.” This is essentially the approach of Ross (1994), Warner and Asch (1996) and others who interpret the extra weight as reflecting the deadweight costs of monetary taxes, although Birchenall and Koch (2014) dispute the conclusion that deadweight costs of monetary taxes are enough to justify IKT as efficiency-enhancing. Perhaps the extra weight reflects supplier pricing distortions, as with the “hold out” phenomenon featured in the eminent domain literature or the monopoly distortions sometimes cited as justifications for price ceilings (Galbraith 1980). Or it may reflect political factors such as overlaps between regional and federal tax bases, or the importance to certain parties of wielding the power to grant exemptions. Clearly more work is needed to improve positive theories of price controls.

## VII. Appendix: Algebraic Representation of the Equilibrium Conditions

The enlistment constraint, definition of average, and optimal avoidance conditions are:

$$M = \int_0^V (1 - a_i) di + (1 - \lambda) \int_V^{1-B} (1 - a_i) di \quad (13)$$

$$\bar{a} = \int_0^V a_i di + \int_V^{1-B} a_i di + B a_1 \quad (14)$$

$$\frac{a_i^{(1-\rho)/\rho}}{(1-\bar{a})^{1/\rho\rho}} = \max\{0, (1-\lambda + \lambda v_i) \min\{b, r_i - w\} + \alpha\} \quad (15)$$

Where  $V$  and  $B$  are shorthand for the fraction of suppliers with opportunity cost less than or equal to  $w$ , or greater than  $b+w$ , respectively.  $V$  is connected with  $w$  because a volunteer decision  $v_i = 1$  is minimizing (6) if and only if  $r_i \leq w$ . The expression (14) for the definition of average avoidance already reflects the condition that all ransom payers make the same avoidance efforts  $a_i$ , even if their opportunity costs vary. Substituting (15) into (13) and (14),

$$\begin{aligned} M = & \lambda V + (1-\lambda)(1-B) \\ & - \rho^{\rho/(1-\rho)}(1-\bar{a})^{1/(1-\rho)} \left\{ \int_0^V [\max\{0, r_i - w + \alpha\}]^{\rho/(1-\rho)} di \right. \\ & \left. + (1-\lambda) \int_V^{1-B} [(1-\lambda)(r_i - w) + \alpha]^{\rho/(1-\rho)} di \right\} \end{aligned} \quad (16)$$

$$\begin{aligned} \bar{a} = & \rho^{\rho/(1-\rho)}(1-\bar{a})^{1/(1-\rho)} \left\{ \int_0^V [\max\{0, r_i - w + \alpha\}]^{\rho/(1-\rho)} di \right. \\ & \left. + \int_V^{1-B} [(1-\lambda)(r_i - w) + \alpha]^{\rho/(1-\rho)} di + B[(1-\lambda)b + \alpha]^{\rho/(1-\rho)} \right\} \end{aligned} \quad (17)$$

An equilibrium is thereby represented as the solution to two nonlinear equations in two unknowns  $(\bar{a}, \lambda)$ , taking as given the in-kind tax policy parameters  $b$ ,  $w$ , and  $M$ , and the profile of opportunity costs  $\{r_i\}$ .

### **Table 1. Varieties of Military Recruitment**

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Among countries with conscription circa 1995:

14% Had legal provisions for buying out of service obligation.

59% College students had easier terms of service (e.g., exemption, deferral, or fewer months).

100% At least one quarter of the force was drafted.

18% At least three quarters of the force was drafted.

0% At least 95% of the force was drafted.

56% Average percentage of force that was drafted.

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*Sources* : The first two percentages are from Mulligan and Shleifer's (2005, p. 98) 138-country sample (95 drafting). The remaining percentages are from International Institute for Strategic Studies (various issues), with 55 countries both drafting and with non-missing values for number of persons drafted.

**Table 2. Ransoms and Recruitment by the Union Army, 1863-65**

776,829	Drafted, of which
	161,244 did not report (21%)
	315,509 exempted (41%)
	50,817 others not held to service (7%)
249,259	Drafted and held to service, of which
	86,724 paid commutation fee (35%)
	116,188 supplied a substitute (47%)
	46,347 served in person (19%)
162,535	Enlisted through conscription (includes substitutes)
2,504,464	Direct volunteers
2,666,999	Total Union Army Enlistment

*Sources* : Murdock (1967, p. 13) and Weigley (1984, p. 210)

**Table 3. Federal & State Union Army (& Navy) Bounties**

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\$ millions	\$750
% of War Department spending 1861-5	24%
months of GNP	3.1

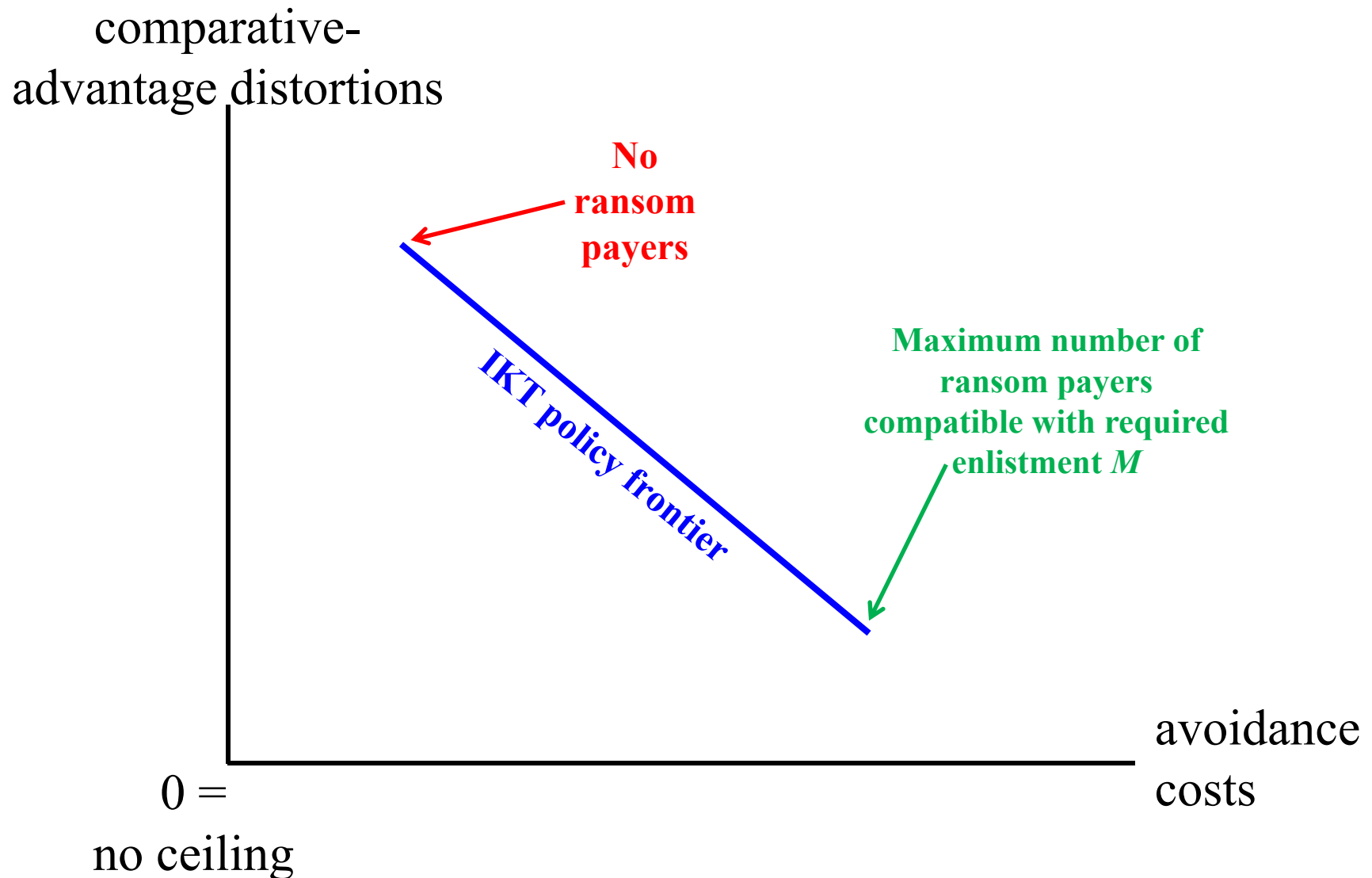
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Sources: Census Bureau *Historical Statistics: Millenium Edition*, Williamson (1974), Kriedberg and Henry (1955)



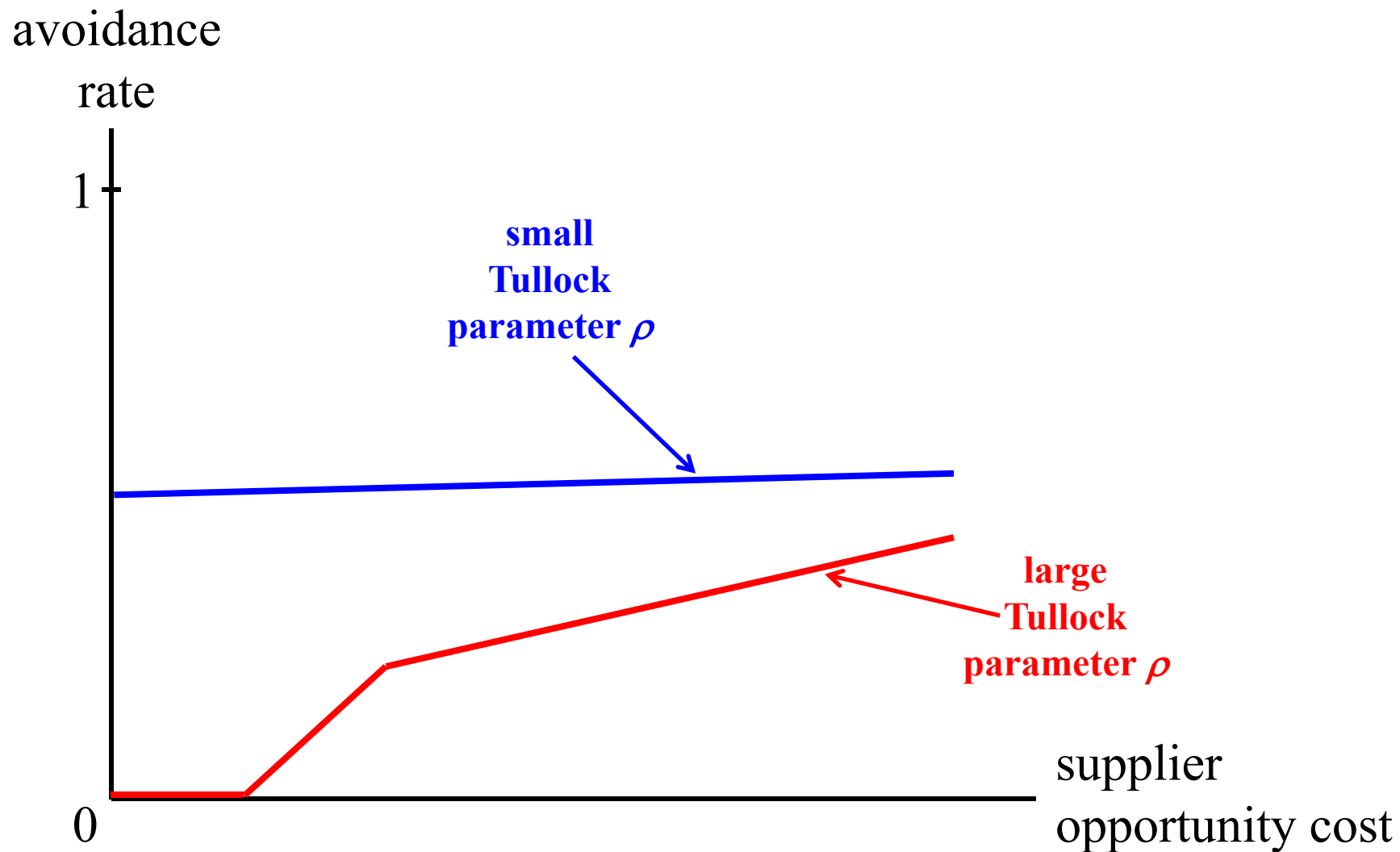
## Figure 1. IKT Policy and the Mix of Social Costs

Holds constant: the enlistment amount  $M$ , the distribution of opportunity costs  $r(\cdot)$ , the ceiling  $w$  on supplier compensation, and technology parameters  $(\alpha, \rho)$ .

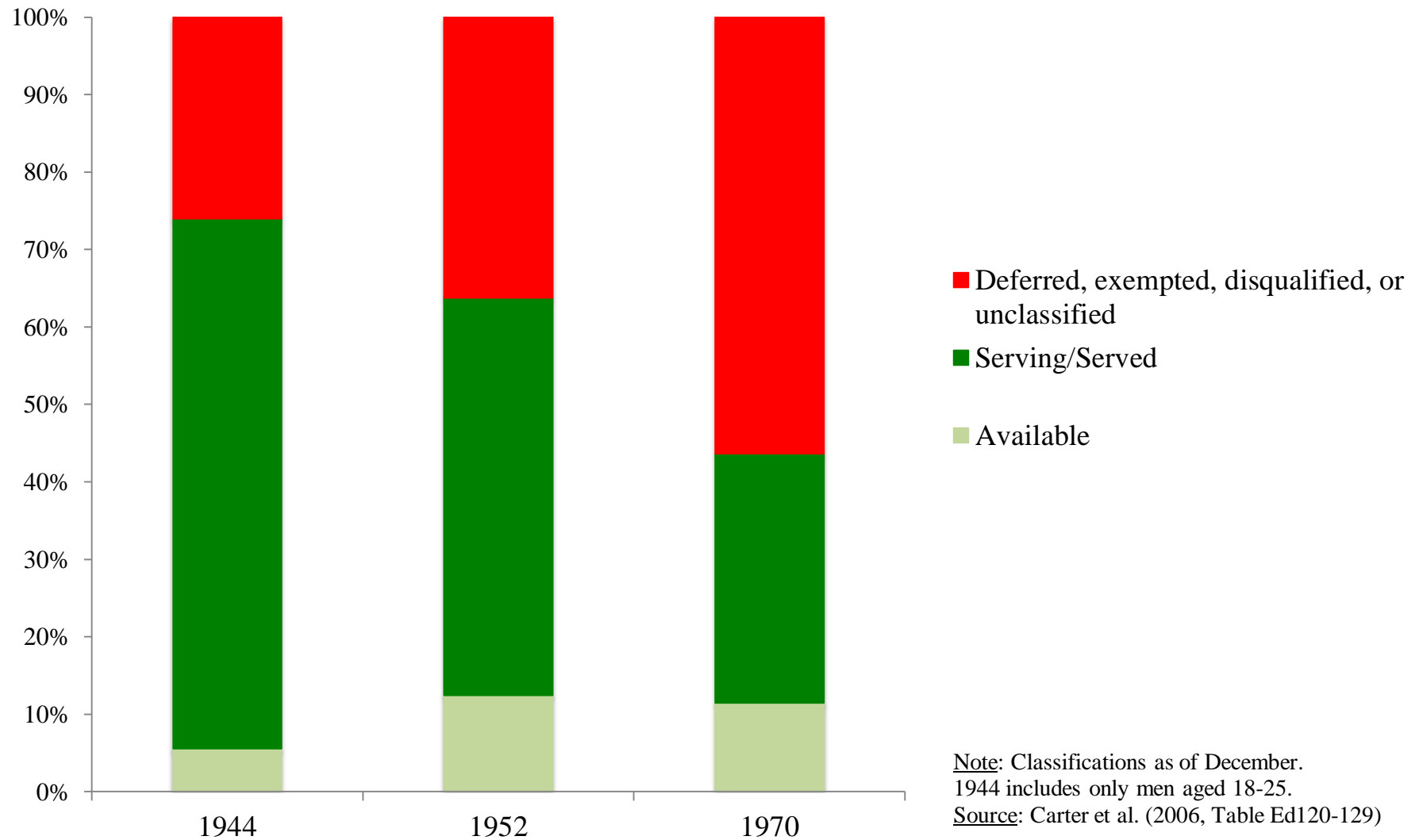


## Figure 2. Cross-section Avoidance Profiles, by Avoidance Technology

No ransom payers. Holds constant: the enlistment amount  $M$ , the distribution of opportunity costs  $r(\cdot)$ , the ceiling  $w$  on supplier compensation, and the technology parameter  $\alpha$ .



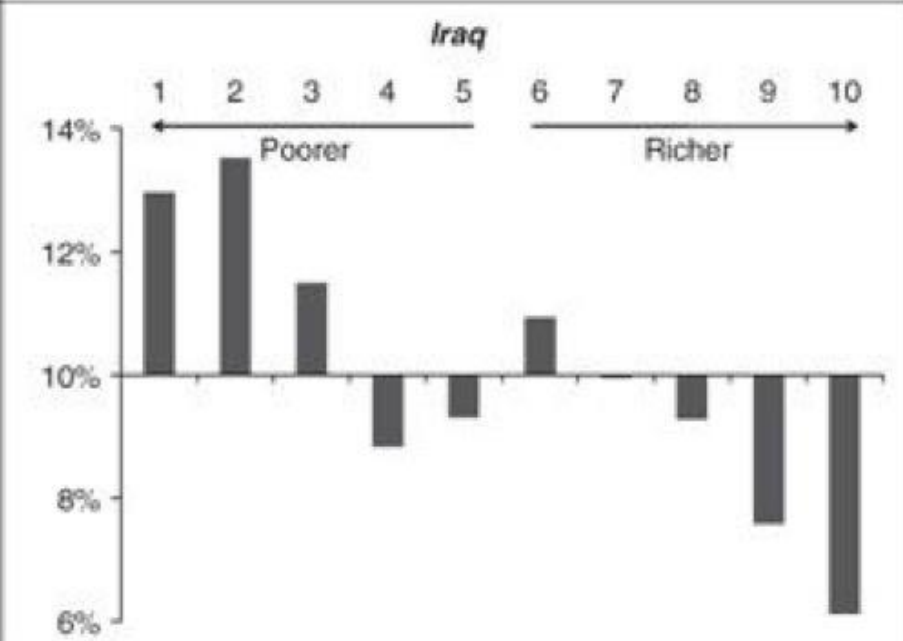
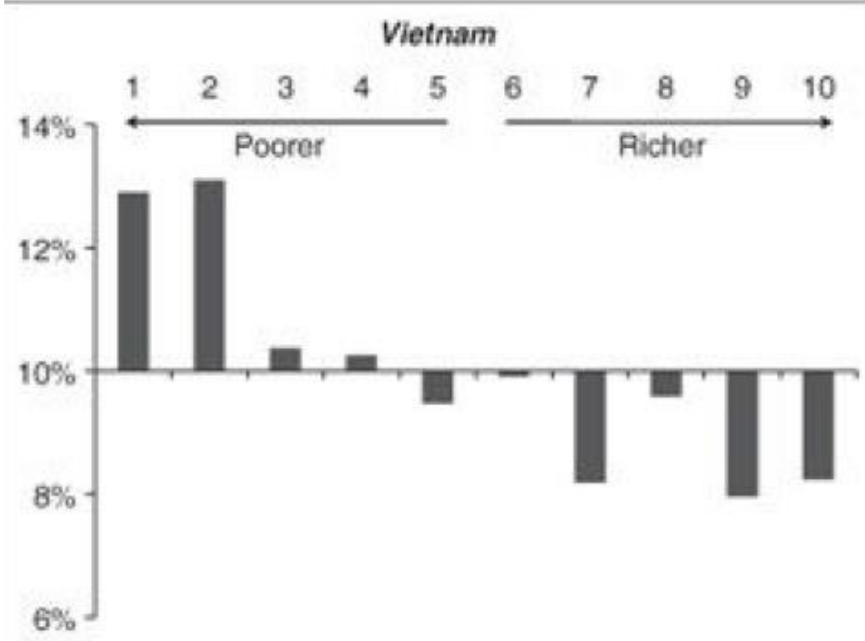
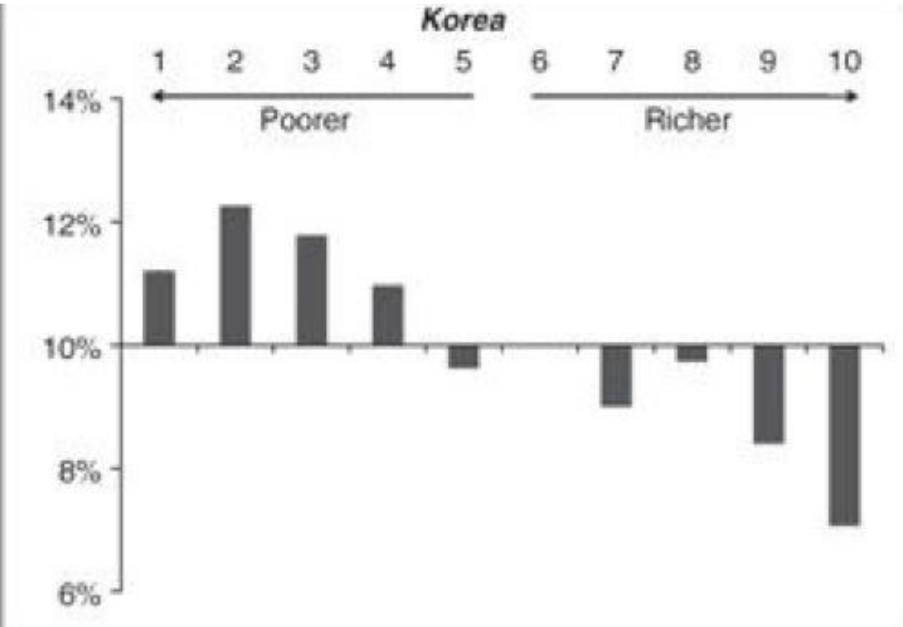
**Figure 3. U.S. Wartime Draft Classifications of Registered Men, Ages 18-26**



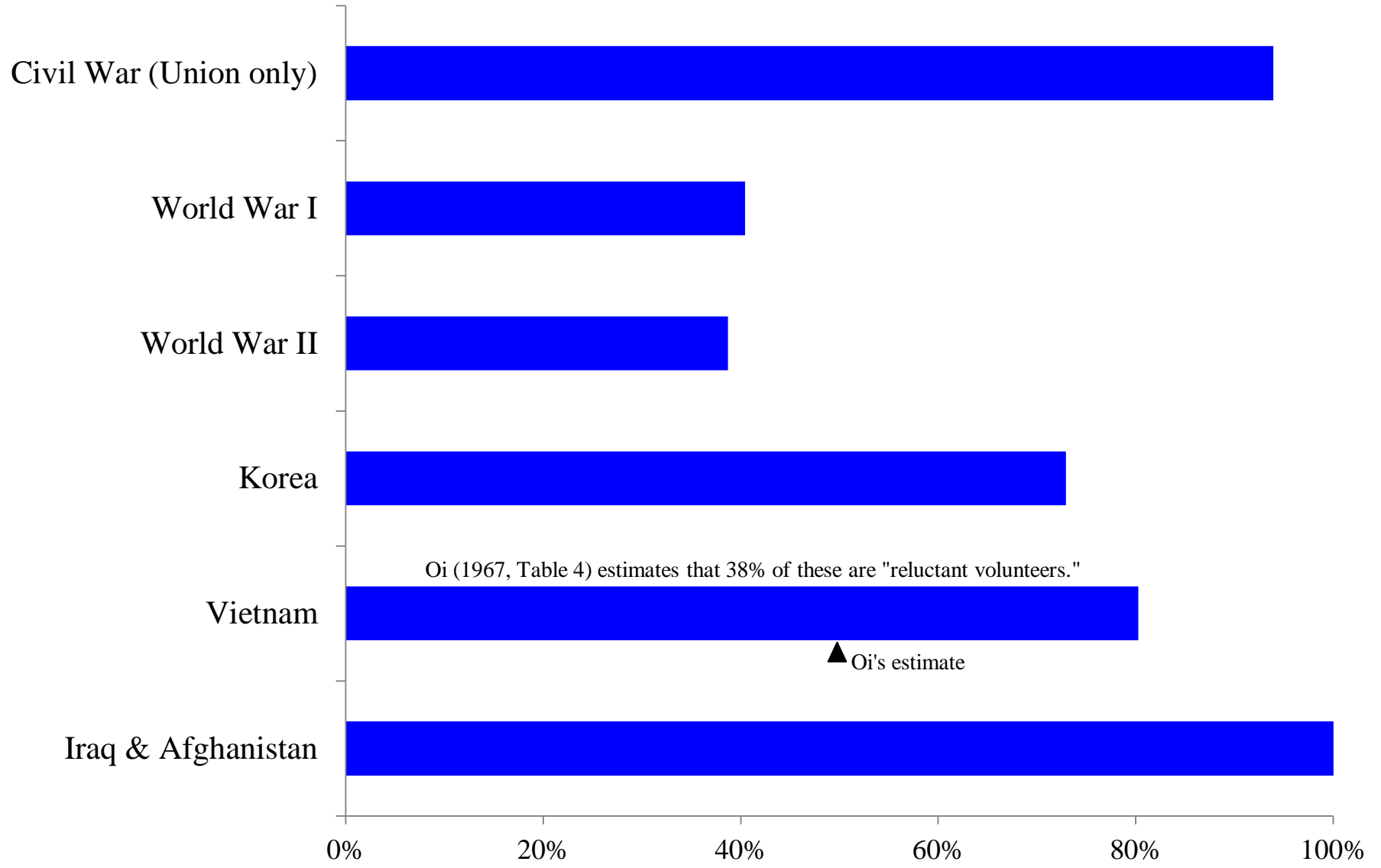
# Figure 4: Not Random: Casualties by War and Income

Casualty shares by county-income decile (random = 10%)

From Kriner & Shen (2010)  
*The Casualty Gap*



**Figure 5. Volunteer Rate by War**



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