University of Wollongong
Economics Working Paper Series
2005

http://www.uow.edu.au/commerce/econ/wpapers.html

Deterrence Capacity, Relative Performance, Adjustment Costs, Hazard, Killing Aversion and the Optimal Enlistment Age

Amnon Levy

WP 05-01

February 2005

Deterrence Capacity, Relative Performance, Adjustment Costs, Hazard, Killing Aversion and the Optimal Enlistment Age

Amnon Levy

School of Economics and Information Systems
University of Wollongong

Abstract

Early-age enlistment increases a small country's potential army size and thereby its attack-deterrence capacity. However, physical and psychological injuries and, ultimately, death generate a loss of quality-adjusted life-years that reduces the net benefit from early-age enlistment. The net benefit from early or later age recruitment is also affected by the rise and decline of the individual's military performance and civilian productivity and by changes in his adjustment costs over the lifespan. The simulations of an optimization model incorporating these elements suggest that if the intensity of the rise and decline of the individual's military performance is sufficiently larger than the intensity of the rise and decline of his civilian productivity, there exists an interior optimal enlistment age greater than the commonly practiced eighteen. In such a case, most of the simulation results are closely scattered around twenty-one despite large parameter changes.

Keywords: ***Economics, enlistment-age, risk, cost and benefit, decision rule***

Author's address: Amnon Levy, Economics, School of Economics and Information Systems, University of Wollongong, Wollongong, NSW 2522, Australia

Author's e-mail address: amnon_levy@uow.edu.au

Author's telephone: + 61 2 42213658

Author's Fax: + 61 2 42213725

1. Introduction

Throughout the course of history countries engaged in external conflicts have maintained conscript armies with an early enlistment age—a legacy of a long agrarian past where life expectancy was short and boys were gradually conditioned to battle by looking after their clan's livestock and crops and by hunting. Early-age enlistment increases a small country's potential army size and thereby its deterrence capacity. However, the possibility of physical and psychological injuries and, ultimately, death and their associated loss of quality-adjusted life-years erode the expected benefits of early-age enlistment. The expected benefits from earlier or later age recruitment are also affected by the rise and decline of people's military performance and civilian productivity and by the changes in the costs of adjustment from civilian environment to military environment and back to civilian environment during the lifespan.

The most common enlistment age in the technologically advanced countries during the modern era has been eighteen. Males in these countries are likely to be swift and powerful at eighteen years of age, but their affluent upbringing has neither prepared them mentally to a close-range, interpersonal aggression nor to the destruction and killing capacity of long-range modern munitions. Drawing on interviews and first-person reports, Marshall (1978) has concluded that in World War II only fifteen to twenty percent of combat infantry soldiers fired their rifles at exposed enemy soldiers. According to Keegan and Holmes (1985), many of them fired harmlessly above their enemy heads. Grossman (1996, 2000) has argued that the exceptionally high firing rates in the Korean War (forty percent) and, in particular, the Vietnam War (ninety percent) were due to the introduction of Pavlovian and operant conditioning of American combat soldiers, rather than to a widespread inclination to kill, and led to a high rate of post-traumatic stress disorder among veterans. This explanation might be supported by Holmes' (1985) low assessment of the Argentine firing rates in the Falklands War.

Drawing on these and other firing rates, on the high percentage of Vietnam War veterans suffering from post-traumatic stress disorder, and on his own combat experience, Grossman (1996, 2000) has proposed that the majority of soldiers have innate resistance to killing. He has argued that in combat situations the primitive, midbrain portion takes control over soldiers' actions and, due to species-survival instinct, prevents them in most cases from destroying fellow human beings. This killing-aversion proposition challenges the morality of an early enlistment-age, in particular, for the following reasons. The first is associated with the psychological scars borne by soldiers engaged in killing. The earlier in life they are enlisted and participate in killing, the longer they bear these scars and the larger their loss of quality-adjusted life years. The second reason is related to the level of representation in decision-making. When conscription takes place at early age, most of the pre-service and service men do not have direct access to political power. Politically underrepresented, they have no strong direct influence on current recruitment laws that render them liable to participate in killing and, thereby, adversely affect their mental well being and hence quality of life from an early stage. This challenge can be strengthened by a positive association between proximity to graduating from school and intensity of the dissonance experienced by soldiers due to their current conditioning to kill and their earlier school education to indiscriminate, humanitarian sensitivity.

In addition to the potential participation in killing, recruitment at early age exposes young people to a high risk of being physically and psychologically injured and, ultimately, killed. In each of these events the duration and the quality of their lives and the lives of their relatives and friends are adversely affected. Though the lower the enlistment age the larger the potential loss of years of life, aspects such as the individual's productivity and the number and ages of his dependents should be considered in assessing the overall loss of quality-adjusted life-years in the case of his death.[1] Consistent with the lifecycle hypothesis (cf. Ando and Modigliani, 1963; Modigliani, 1966) productivity and number of dependents tend to rise and then decline over the lifespan. It is therefore possible that the greatest potential loss of quality-adjusted life-years for a conscript and his relatives, friends and the society is not associated with the earliest recruitment age. It is rather likely that the potential loss of quality-adjusted life-years first rises and then declines with the enlistment age along the feasible age range. The stronger the rise and decline of this potential loss and the higher the probability of war and the probability of being killed in war, the more socially desired it is to set the enlistment age closer to one of the boundaries of the feasible enlistment-age range. When the decline of the potential loss is weaker (stronger) than the rise, *ceteris paribus*, it is more socially desirable to set the enlistment age closer to the lower-bound (upper-bound). During the last hundred years the upper-bound of feasible enlistment-age has been increased by the rise in life expectancy, by the changes in warfare technology[2] and by the transformation in the structure of households and in earning responsibilities. During the same period there

---

[1] The number of quality-adjusted life-years is used in a number of health economic studies as an index of lifetime well-being. See Bleichrodt and Quiggin (1999) for a discussion of its suitability and Levy (2005) for an application.
[2] From the perspective of soldiers, warfare has become less physically challenging.

has been a large increase in the number of years of schooling and, thereby, a pressure on the lower-bound of the feasible enlistment-age to rise.

In the absence of adequate, direct political representation, it took young people years of demonstrations and civil riots to end the draft in the United States by mid 1973.[3] Unlike the United States, small countries facing severe and close-to-home geopolitical risks cannot afford civil riots. Nor can they rely on an all-volunteer army. The earlier the enlistment age the larger their combined compulsory and reserve army and, thereby, its war-deterrence and defensive capacity. Responsibly, most of their young residents obey the existing recruitment rules. Nevertheless, a natural aversion to killing and a potential large loss of quality-adjusted life-years lend support to a revision of the enlistment age.

The construction of a non *ad-hoc* enlistment-age rule for a small country maintaining a conscript defensive army is the objective of this paper. The optimal enlistment-age is analytically derived by considering the effects of enlistment age on army size and war-deterrence, military performance, foregone civilian output, remunerations in the case of physical and psychological injuries and in the case of death, and costs of adjustment. The analysis is organized as follows. Section 2 presents the relationship between the army size, deterrence capacity, probability of war and the enlistment age. Section 3 details the expected national benefits and costs from enlisting at a given age. Section 4 derives the optimal enlistment-age and displays the numerical-simulation's results for a wide range of parameter-values as well as the effects of the model parameters on this enlistment age.

---

[3] This process and its outcome have a generated a large literature on the economic issues and the quantity and quality of servicepersons associated with the choice of a draft versus an all-volunteer force. See Oi (1967) Altman and Fechter (1967), Fisher (1969) Altman and Barro (1971), Lee and McKenzie (1992), Ross (1994) and Warner and Asch (1996, 2001).

2. Enlistment age, army size and war deterrence and probability

One of the main arguments in favor of an early enlistment age is that it allows a country facing geopolitical risks to enjoy a large reserve of trained soldiers. Consider a country in which military service is compulsory due to a geopolitical sate of hostility. The physically lower-bound on military service age is $t_{\min}$. The physically upper-bound on military service age coincides with the retirement age, $t_{\max}$. During a peaceful period, the army is a force of conscripts and its size is equal to the size of the currently enlisted cohort. At wartime the reserves are called. The reserves comprise all ex-conscripts up to $t_{\max}$ years of age. Hence, the country's wartime-army is

$$N(t) = \int_{t}^{t_{\max}} n(t)\,dt \tag{1}$$

where $t \in (t_{\min}, t_{\max})$ denotes the drafting age and $n(t)$ the size of the cohort aged t. Assuming, for tractability, that all cohorts have an identical size, *n*, then the wartime army size is

$$N(t) = (t_{\max} - t)n\,. \tag{2}$$

Suppose that the opponent is more populous, but possesses the same warfare technology. For simplicity, its wartime army, N^E, is fixed, yet always ready to match the smaller country's army:[4]

$$N^E = \max N(t) = (t_{\max} - t_{\min})n\,. \tag{3}$$

[4] A more elaborate, but greatly complicated, framework may consider reaction functions and a Stackelberg-type equilibrium.

In the absence of warfare technological advantage, size is crucial: the greater the ratio of the country's wartime army to its rival's wartime army the higher the country's war deterrence. In formal terms, the probability of war breaking-out ($0 < p < 1$) is given by

$$p(t) = p_{\max}[1 - m(N(t)/N^{E})] \tag{4}$$

where the scalar $0 < m < 1$ is the army's war-deterrent gradient, reflecting (with $m \neq 1$) that the probability of war cannot be eliminated, and where $0 < p_{\max} < 1$ is a scalar denoting the (highest) probability of war when the country is unarmed. Recalling equation (2), the probability of war is rendered as

$$\begin{aligned} p(t) &= p_{\max}[1 - m(t_{\max} - t)/(t_{\max} - t_{\min})] \\ &= p_{\max}\{1 - m[(t_{\max} - t_{\min}) - (t - t_{\min})]/(t_{\max} - t_{\min})\} \\ &= (1-m)p_{\max} + \frac{mp_{\max}}{(t_{\max} - t_{\min})}(t - t_{\min}) \end{aligned} \quad .(5)$$

The earlier the enlisting age the greater the country's war-deterrence and the lower the probability of war. As will become apparent in the following sections, expressing the probability of war as function of $t - t_{\min}$ facilitates the derivation of the optimal enlistment age within a framework that takes into account a person's military contribution, foregone civilian production, adjustment costs and expected remunerations to him and his beneficiaries for a loss of quality-adjusted life-years due to injury, or death, and the effects of these factors on the expected net national benefit from enlisting that person at age t.

3. Expected net national benefit and its determinants

The expected net national benefit (*ENNB*) from enlisting a person at $t \in (t_{\min}, t_{\max})$ years of age is the difference between that person's military contribution (*M*) and the sum of his foregone civilian output (C), his costs of adjusting to military environment and readjusting to civilian environment when released (*S*), and his treatment costs and remuneration for loss of quality of life in the event of being physically and/or psychologically injured in war (R^I), or the remuneration to his beneficiaries in the event of his death in war (R^D). Taking the probabilities of being injured or killed in war to be q and f ($0 < q, f < 1$ and $q + f < 1$), respectively, and the probability of war to be given by equation (5), the expected net national benefit from enlisting a person at *t* years of age is expressed as

$$ENNB(t) = M(t) - C(t) - S(t) - p(t)[qR^I(t) + fR^D(t)] \tag{6}$$

where *M*, *C*, *S*, R^I and R^D are measured in present-value nominal units.

Consistent with the life-cycle hypothesis, a person's military contribution and civilian output are assumed to be twice differentiable and single-peaked in the interval $(t_{\min}, t_{\max})$, depicting an inverted U-shaped relationship between productivity and age.[5] Similarly, the remuneration paid to beneficiaries for a conscript killed in war at age *t* is taken to be twice differentiable and single-peaked in the interval $(t_{\min}, t_{\max})$ so as to reflect a growing loss up to a critical age as the number of dependents and

[5] Age-earning profiles estimated from cross-sectional data are usually quadratic, hump-shaped for males (Irvine, 1981). In his seminal study on this issue, Miller (1965) has observed that the relative increases in income associated with economic growth are greater in the early years of working life than in the later years. He has argued that young workers tend to benefit more than older ones due to greater mobility, better training and employers' preferences.

human capital rises and then a decline. The following second-order polynomials display such relationships:

$$M(t) = M_{t_{\min}} + a(t - t_{\min}) - \tilde{a}(t - t_{\min})^2 \tag{7}$$

$$C(t) = C_{t_{\min}} + b(t - t_{\min}) - \tilde{b}(t - t_{\min})^2 \tag{8}$$

$$R^D(t) = R^D{}_{t_{\min}} + g(t - t_{\min}) - \tilde{g}(t - t_{\min})^2 \tag{9}$$

where, $M_{t_{\min}}$, $C_{t_{\min}}$ and $R^D{}_{t_{\min}}$ are the military contribution and civilian output of a $t_{\min}$ year old person and the remuneration to beneficiaries for the loss of such a person, respectively, and $(a,\tilde{a}),(b,\tilde{b}),(g,\tilde{g})$ are pairs of positive scalars, expressed in present-value nominal units, reflecting the intensities of the rise and decline of the individual's potential military performance and civilian productivity and of the rise and decline of the remuneration to beneficiaries for their forgone quality of life in the event of that person being killed, respectively.

Let $t_m^* \in (t_{\min}, t_{\max})$ and $t_c^* \in (t_{\min}, t_{\max})$ be the prime ages as regards military contribution and civilian output, respectively, and $t_d^* \in (t_{\min}, t_{\max})$ the age of death associated with maximum remuneration to beneficiaries,[6] then

$$M'(t_m^*) = a - 2\tilde{a}(t_m^* - t_{\min}) = 0 \tag{10}$$

$$C'(t_c^*) = b - 2\tilde{b}(t_c^* - t_{\min}) = 0 \tag{11}$$

---

[6] t_d^* may be determined by a combination of the number of life-years lost and the number and age composition of dependents.

$$R^{D}{}'(t_d^*) = g - 2\tilde{g}(t_d^* - t_{\min}) = 0 \tag{12}$$

and implying

$$\tilde{a} = \frac{0.5a}{t_m^* - t_{\min}} \tag{13}$$

$$\tilde{b} = \frac{0.5b}{t_c^* - t_{\min}} \tag{14}$$

$$\tilde{g} = \frac{0.5g}{t_d^* - t_{\min}} . \tag{15}$$

Consequently, the military contribution of a t year-old person is given by

$$M(t) = M_{t_{\min}} + a(t - t_{\min}) - \frac{0.5a}{t_m^* - t_{\min}}(t - t_{\min})^2 \tag{16}$$

his foregone civilian output by

$$C(t) = C_{t_{\min}} + b(t - t_{\min}) - \frac{0.5b}{t_c^* - t_{\min}}(t - t_{\min})^2 \tag{17}$$

and the remuneration to his beneficiaries in the event of being killed at t is

$$R^D(t) = R^D{}_{t_{\min}} + g(t - t_{\min}) - \frac{0.5g}{t_d^* - t_{\min}}(t - t_{\min})^2 . \tag{18}$$

The larger a , b and g the greater the intensity of the rise and decline of the potential military performance, civilian productivity and death remuneration, respectively, over the period $(t_{\min}, t_{\max})$. Furthermore, the shorter it takes to reach the highest level in each of these categories, the steeper the decline.

Injury in battle can be physical and/or psychological. Psychological injuries are inflicted by being violently assaulted, by losing comrades and by killing fellow human beings. Killing-aversion is manifested in post-traumatic stress disorder, loss of sense of self-innocence, loss of trust in human beings and institutions and loss of belief in the benevolence of human kind. (Cf., Grossman and Siddle, 1999) It is assumed that physical and psychological scars can prevail and adversely affect earning capacity and social interaction over the rest of the individual lifetime. Thus, the earlier the injury occurs in one's life the greater can its cost. This assumption is formally represented by adding an annuity $d \geq 0$ (in present value), which is paid to the injured person and his beneficiaries over his potential remaining life expectancy had there been no injury $(T - t)$, to the initial nominal cost $\hat{R}^I$ (in present value) of treating the injury. The sum of the treatment cost of, and the compensation to, a person injured at age t is given by

$$R^I(t) = \hat{R}^I + d(T-t) = \underbrace{[\hat{R}^I + d(T - t_{\min})]}_{R^I_{t_{\min}}} - d(t - t_{\min}) = R^I_{t_{\min}} - d(t - t_{\min})\,. \quad (19)$$

The scalar d can be further interpreted as the level of the terminal incapacitation caused by the injury and measured in terms of foregone pecuniary and non-pecuniary opportunities per annum. When the initial treatment leads to complete recovery, $d = 0$. In any other case, $d > 0$.

The costs of adjustment to military environment and readjustment to civilian environment for a person conscripted at t years of age are represented by

$$S(t) = S_{t_{\min}} + l(t - t_{\min}) \quad (20)$$

where $S_{t_{\min}}$ is the adjustment and readjustment costs at age $t_{\min}$ and l is the adjusting-readjusting cost coefficient. There are two opposing factors affecting the sign of l : enthusiasm versus experience. While a greater level of eagerness to learn about organizations and systems and their operation might be associated with youth, a higher level of familiarity with organizations and systems is enjoyed in mature age. Hence, l is positive, zero, or negative, if the foregone enthusiasm is larger than, equal to, or smaller than, the experience gained as the age of enlistment rises.

By substituting equations (16) to (20) and equation (5) into equation (6), the expected net national benefit from recruiting a person to military service at age t is given by:

$$
\begin{aligned}
ENNB(t) = {} & \underbrace{\left[M_{t_{\min}} - C_{t_{\min}} - S_{t_{\min}} - (1-m)\,p_{\max}(qR^{I}_{t_{\min}} + fR^{D}_{t_{\min}})\right]}_{A_0} \\
& + \underbrace{\left[a - b - l + (1-m)\,p_{\max}(dq - gf) - \frac{mp_{\max}(qR^{I}_{t_{\min}} + fR^{D}_{t_{\min}})}{t_{\max} - t_{\min}}\right]}_{A_1}(t - t_{\min}) \\
& - \underbrace{\left[\frac{0.5a}{t^{*}_{m} - t_{\min}} - \frac{0.5b}{t^{*}_{c} - t_{\min}} - \frac{0.5g(1-m)fp_{\max}}{t^{*}_{d} - t_{\min}} - \frac{mp_{\max}(dq - gf)}{t_{\max} - t_{\min}}\right]}_{A_2}(t - t_{\min})^2 \\
& + \underbrace{\left[\frac{-0.5gmp_{\max}}{(t_{\max} - t_{\min})(t^{*}_{d} - t_{\min})}\right]}_{A_3}(t - t_{\min})^3
\end{aligned}
$$

.(21)

4. Optimal enlistment-age and numerical simulations

The optimal enlistment age is taken to be $t^{o} \in (t_{\min}, t_{\max})$ that maximizes $ENNB$. Recalling equation (21), the necessary and sufficient conditions for interior solution are:

$$A_3(t^o - t_{\min})^2 - A_2(t^o - t_{\min}) + A_1 = 0 \tag{22}$$

$$\{2A_3(t^o - t_{\min}) - A_2 < 0\} \Rightarrow \{t^o < t_{\min} + 0.5(A_2 / A_3)\} \tag{23}$$

and the optimal enlistment-age is given by either

$$t_1^o = t_{\min} + \frac{A_2 + \sqrt{A_2{}^2 - 4A_3A_1}}{2A_3} \tag{24}$$

or

$$t_2^o = t_{\min} + \frac{A_2 - \sqrt{A_2{}^2 - 4A_3A_1}}{2A_3} \tag{25}$$

satisfying the second-order condition (23).[7] If neither t_1^o nor t_2^o satisfies condition (23), the optimal enlistment age is the earliest feasible age if $ENNB(t_{\min}) > ENNB(t_{\max})$, the latest feasible age if $ENNB(t_{\min}) < ENNB(t_{\max})$, or any of these bounds if $ENNB(t_{\min}) = ENNB(t_{\max})$.

The numerical simulations of the optimal enlistment-age consider a likely benchmark scenario where $t_{\min} = 18$ years, $t_{\max} = 65$ years, $T = 80$ years, $R^D_{t_{\min}} = \$\,1{,}000{,}000$, $R^I_{t_{\min}} = \$\,500{,}000$, $\hat{R}^I = \$\,190{,}000$ and in recalling equation (19), $d = (R^I_{t_{\min}} - \hat{R}^I)/(T - t_{\min}) = \$\,5000$. In the absence of a clear assessment of the relationship between the costs of adjustment and age, the benchmark value of l was set to be equal to zero. Interior solution could only be obtained with

[7] Where A_1, A_2, and A_3 are the coefficient associated with $(t^o - t_{\min})$, $(t^o - t_{\min})^2$ and $(t^o - t_{\min})^3$ in equation (21), respectively.

$t_2^o = t_{\min} + (\mathrm{A}_2 - \sqrt{\mathrm{A}_2{}^2 - 4\mathrm{A}_3\mathrm{A}_1}) / 2\mathrm{A}_3$ and as long as the parameter (a) governing the intensity of the rise and decline of the individual's military performance over the feasible period is at least 16.666 percent larger than the parameter (b) governing the intensity of the growth and decline of his civilian productivity over the same period. If $a < 1.1666b$, the optimal enlistment age coincides with the lower-bound and commonly used enlistment age—eighteen.

Table 1 can be inserted here

The benchmark simulation leading to an interior solution is presented in bold numbers by the central column of Table 1. The effects of the model parameters on the interior optimal enlistment age can be assessed by inspecting the columns on each side of the central one. The entries in these columns are computed by changing the value of one parameter at a time below and above its benchmark level while holding the rest of the parameters at their benchmark levels. These sensitivity analyses suggest that the optimal enlistment age first rises and then declines with the level of the highest probability of war ($p_{\max}$), declines with the probability of being killed in war (f) and with the probability of being injured in war (q), rises and then declines with the army's war-deterrence gradient (m), rises with the prime-age of military performance, declines with the prime-age of people's civilian production (t_c^*), strongly declines with the age of death associated with maximum remuneration to beneficiaries (t_d^*), rises with the parameter (a) governing the intensity of the rise and decline of the individual's military performance, declines with the parameter (b) governing the intensity of the growth and decline of the individual's civilian productivity, rises with the parameter (g) governing the rise and decline of the death remuneration, rises with the annual remuneration extended to injured soldiers (d), strongly declines with the correlation between costs of adjustment and age (l), rises with the minimum recruitment age ($t_{\min}$) and declines with the maximum recruitment age ($t_{\max}$).

5. Concluding remarks

Early-age enlistment increases the potential army size and thereby the deterrence capacity of a small country facing geopolitical risks. However, the possibility of physical and psychological injuries and, ultimately, death and their associated loss of quality-adjusted life-years erode the expected net benefit from early-age enlistment. The expected net benefit from early, or late, age recruitment are also affected by growth and decline of military contribution and civilian output and changes in adjustment costs over the life cycle. The optimal enlistment-age was analytically derived by considering the effects of enlistment age on army size and deterrence of war, military performance, foregone civilian output, remunerations in the case of physical and psychological injuries or death, and costs of adjustment. The numerical simulations, performed with an *ad hoc* assessment of the likely parameters values, suggest that if the rise and decline of military performance is sufficiently steeper than the rise and decline of civilian productivity over the lifespan, there exists an interior optimal enlistment age that is greater than the commonly practiced eighteen. Despite large parameter changes, most of the simulation results in such a case are at the vicinity of twenty-one—an age that allows a completion of a first-degree college program in many disciplines, gaining work experience, participating in voting and politics and hence having direct influence on terms of service prior to enlistment. Furthermore, the simulations associated with the possible effect of age on adjustment costs suggest that if the experience effect dominates the enthusiasm effect, a much more mature enlistment age is optimal. The optimality of a much more mature enlistment age is also suggested when the death-remuneration peaks at young age. However, the numerical simulations also suggest that if the rise and decline of military performance is not, or insufficiently, steeper than the rise and decline of civilian productivity over the lifespan, the optimal enlistment age is the lower-bound of the feasible recruitment age interval—the commonly practiced eighteen or even earlier.

References

Altman, S.H. and Barro, R.J., 1971, "Officer Supply—The Impact of Pay, the Draft, and the Vietnam War," *American Economic Review* 61:4, 649-64.

Altman, S.H. and Fechter, A.E., 1967, "The Supply of Military Personnel in the Absence of a Draft," *American Economic Review* 57:2, 19-31.

Ando, A. and Modigliani, F., March 1963, "The 'Life Cycle' Hypothesis of Saving: Aggregate Implications and Tests," *American Economic Review.*

Bleichrodt, H. and Quiggin, J., 1999, "Life-cycle preferences over consumption and health: when is cost-effectiveness analysis equivalent to cost-benefit analysis?" *Journal of Health Economics* 18 6, pp. 681–708.

Fisher, A.C., 1969, "The Cost of the Draft and the Cost of Ending the Draft" *American Economic Review* 59:3, 239-54.

Grossman, D., 1996, *On Killing: The Psychological Cost of learning to Kill in War and Society*, New York: Back Bay Books.

Grossman, D., 2000, "Aggression and Violence," in *Oxford Companion to American Military History*, Oxford Press.

Grossman, D. and Siddle, B.K., 1999, "Psychological Effects of Combat", *Encyclopedia of Violence, Peace, and Conflict*, Academic Press.

Holmes, R., 1985, *Acts of war: the behavior of men in battle*, New York: The Free Press.

Irvine, I.J., 1981, "The Use of Cross-Section Microdata in Life Cycle Models: An Application to Inequality Theory in Nonstationary Economics", *Quarterly Journal of Economics* 96.

Keegan, J. and Holmes, R., 1985, *Soldiers*, London: Hamish Hamilton.

Lee, D. and McKenzie, R., 1992, "A Reexamination of the Relative Efficiency of the Draft and the All-Volunteer Army," *Southern Economic Journal* 59, 646-54.

Levy, A., 2005, "A Decision-Rule for Transplanting Non-Cadaveric Organs", *European Journal of Operational Research* 164/2 pp. 548-554.

Marshal, S. L.A., 1978, *Men against Fire*, Gloucester, MA: Peter Smith.

Miller, H., 1965, "Lifetime Income and Economic Growth", *American Economic Review* 55.

Modigliani, F., 1966, "The Life Cycle Hypothesis of Saving, the Demand for Wealth and the Supply of Capital," *Social Research*, 33:2.

Oi, W.Y., 1967, "The Economic Cost of the Draft," *American Economic Review* 57:2, 39-62.

Ross, T. W., 1994, "Raising an Army: A Positive Theory of military Recruitment," *Journal of Law and Economics* 37:1, 101-31.

Warner, J.T. and Asch, B.J., 1996, "The Economic Theory of a Military Draft Reconsidered," *Defence and Peace Economics* 7, 297-311.

Warner, J.T. and Asch, B.J., 2001, "The Record and Prospects of the All-Volunteer Military in the United States," *Journal of Economic Perspectives* 15:2, 169-192.

Table 1: Numerical simulations' results

Parameter & Enlisting age	**Much below the benchmark**	**Below the benchmark**	**The benchmark**	**Above the benchmark**	**Much above the benchmark**
$p_{\max}$ t^o (years)	0.1 18.209	0.25 19.087	**0.50** **21.014**	0.75 21.906	0.95 20.418
f t^o (years)	0.01 22.351	0.025 21.860	**0.05** **21.014**	0.075 20.131	0.1 19.206
q t^o (years)	0.01 21.553	0.05 21.319	**0.10** **21.0**	0.15 20.621	0.2 20.350
m t^o (years)	0.1 18.240	0.25 19.195	**0.5** **21.0**	0.75 21.057	0.9 19.079
t_m^* (years) t^o (years)	25 18.847	30 19.743	**35** **21.0**	40 22.784	45 25.062
t_c^* (years) t^o (years)	30 32.301	40 21.672	**45** **21.0**	50 20.676	60 20.334
t_d^* (years) t^o (years)	25 45.13	30 27.733	**40** **21.0**	50 19.448	55 19.089
a (dollars) t^o (years)	3500 18.248	3750 19.862	**4000** **21.014**	4500 22.610	5000 23.696
b (dollars) t^o (years)	2000 24.331	2500 22.908	**3000** **21.0**	3250 19.778	3500 18.222
g (dollars) t^o (years)	1000 18.140	2500 18.826	**5000** **21.0**	7500 24.206	9000 26.483
d (dollars) t^o (years)	1000 20.404	2500 20.630	**5000** **21.0**	7500 21.405	9000 21.643
l (dollars) t^o (years)	-5,000 39.347	-2,500 31.544	**0** **21.0**	250 19.651	500 18.187
$t_{\min}$ t^o (years)	16 18.776	17 19.894	**18** **21.014**	19 22.135	20 23.257
$t_{\max}$ t^o (years)	55 21.583	60 21.335	**65** **21.014**	67.5 20.852	70 20.696