Optimal Enlistment Age: 
A Cost-Benefit Analysis and Some Simulations

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Abstract
Enlistment at the earliest viable age maximizes the country’s wartime army size and thereby the country’s attack-deterrence capacity. Injuries and death generate a loss of quantity and quality of life that reduces the benefit from early-age enlistment. The benefit from any age of recruitment is also affected by the rise and decline of the individual’s military performance and civilian productivity and by the changes in the individual’s adjustment costs over his lifecycle. The simulations of an optimization model incorporating these cost and benefit 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 that is 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-benefit analysis, decision rule

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1. Introduction

The objective of this paper is to construct a non *ad-hoc* enlistment-age rule for a country maintaining a conscript defensive army. The optimal enlistment-age is analytically derived by considering the effects of enlistment age on the country’s war-deterrence ability, on military performance, on foregone civilian output, on remunerations in the case of injuries, on remuneration in the case of death, and on the costs of adjustment to military environment and readjustment to civilian environment.

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. During the First World War a selective service law establishing conscription was passed in the United States in order to increase the size of its armed forces. On reaching the age of eighteen, all men in the United States had to register with their local Selective Service board where they were classified into categories of availability for military service based on their health, conscientious objection, studies, occupation, and residency status.1 Eighteen has also been the minimum age of enlistment during the two world wars in almost all of the participating nations. Early-age enlistment is still practiced in countries where military service is universal and compulsory – eighteen in Greece, Israel, Serbia and Sweden, and twenty in Switzerland.

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1 By 1976 the local Selective Service boards were phased out. In July 1980 the Selective Service System again became active. While enlistment under the all-volunteer armed forces was maintained and induction was not contemplated, all male citizens of the United States between ages sixteen and twenty-six and all males of this age resident in the country were required to register and were liable for training and service until they reach the age of thirty-five.
Based 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 enemies’ 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.

The killing-aversion proposition challenges the morality of an early enlistment-age. The earlier in life people are enlisted and potentially exposed to killing, the longer they might bear psychological scars and the larger their potential loss of quality of life. This psychological scars are deepened 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 injured or killed. In each of these events the duration and the quality of their lives and the quality of 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.²

Consistent with the lifecycle hypothesis, 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, for his relatives, for his friends and for 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. When the decline of the potential loss is weaker (stronger) than the rise, ceteris paribus, it is more desirable to set the enlistment age closer to the minimum (maximum) viable age for military service.

During the last hundred years the maximum viable age for military service has been increased by the rise in life expectancy, by the changes in warfare technology³ and by the transformation in the structure of households and in earning

² The number of quality adjusted life years (QALYs) is used in cost-benefit analyses of health investment projects as an index of people’s lifetime well-being. It combines the duration of life and health condition into a single utility index. The number of QALYs of a person who lives T years is given by \( \sum_{t=1}^{T} u(q_t) \), where \( q_t \) is the health condition in year t and \( u(q_t) \) is the present-value level of utility associated with his health condition in year t. For a discussion of the validity of this index, see Bleichrodt (1995) Bleichrodt and Quiggin (1999) and Bleichrodt and Pinto (2005).

³ As capital invested in warfare increases, the marginal productivity and thus the value of a human life increases. So, subjecting soldiers to physically more challenging tasks is not an optimal decision.
responsibilities. During the same period there has been a large increase in the number of years of schooling and, thereby, a pressure on the minimum viable age for military service to rise.

The aforementioned aspects are incorporated into the analysis and simulation of the optimal age of enlistment. Section 2 presents the relationship between the army size, deterrence capacity, probability of war and the enlistment age. Section 3 details the expected 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.

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

One of the main arguments in favor of an early enlistment age is that it allows a country to have a large military trained and assigned citizen reserve ready to back up the regular army and thereby increases the country’s war-deterrence potential and lowers its likelihood of being attacked.

Consider a country in which military service is compulsory due to a state of hostility. The minimum viable age for military service is \( t_{\text{min}} \). The maximum viable age for military service is assumed, for simplicity, to coincide with the retirement age, \( t_{\text{max}} \). During peaceful periods, the army is a force of conscripts and its size is equal to the size of the currently enlisted age group. At wartime the reserves are called. The reserves comprise all ex-conscripts up to \( t_{\text{max}} \) years of age. Assuming for simplicity that all soldiers are equally equipped and trained, the country’s wartime-army size is represented by the number of people under arms:
\[
N(t) = \int_{t_{\min}}^{t_{\max}} n(\tau) d\tau \quad (1)
\]

where \( t \in (t_{\min}, t_{\max}) \) denotes the drafting age and \( n(\tau) \) the number of men age \( \tau \).

Assuming, for tractability, that all age groups are of identical size, \( n \), the size of the wartime army is

\[
N(t) = (t_{\max} - t)n \quad (2)
\]

It is assumed 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:

\[
N^E = \max N(t) = (t_{\max} - t_{\min})n \quad (3)
\]

In the absence of warfare technological and training advantages, 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

\[
p(t) = p_{\max}[1 - \mu(N(t)/N^E)] \quad (4)
\]

where the scalar \( 0 < \mu < 1 \) is the army’s war-deterrent gradient, reflecting \((\mu \neq 1)\) that the probability of war cannot be eliminated, and where \( 0 < p_{\max} < 1 \) is a scalar denoting the maximum probability of war — the probability of war when the country is not armed.

Recalling equations (2) and (3) the probability of war is rendered as
\[ p(t) = p_{\text{max}} \left[ 1 - \mu(t_{\text{max}} - t)/(t_{\text{max}} - t_{\text{min}}) \right] \]
\[ = p_{\text{max}} \left[ 1 - \mu((t_{\text{max}} - t_{\text{min}}) - (t - t_{\text{min}}))/(t_{\text{max}} - t_{\text{min}}) \right] \]
\[ = (1 - \mu) p_{\text{max}} + \frac{\mu p_{\text{max}}}{t_{\text{max}} - t_{\text{min}}}(t - t_{\text{min}}) \]  \ (5)

The earlier the enlistment age the greater the country’s war-deterrence potential and the lower the probability of war. As will become apparent in the following sections, expressing the probability of war as function of \( t - t_{\text{min}} \) facilitates the derivation of the optimal enlistment age.

### 3. Expected net benefit and its determinants

The expected net benefit (\( \text{ENB} \)) from enlisting a person at \( t \in (t_{\text{min}}, t_{\text{max}}) \) 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 adjustment to military environment and readjustment to civilian environment when released (\( S \)),\(^4\) and his treatment costs and remuneration for loss of duration and 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 (\( R^D \)).\(^5\) Taking the probabilities of being injured or killed in war to be \( \theta \) and \( \phi \) (\( 0 < \theta, \phi < 1 \) and \( \theta + \phi < 1 \)), respectively, the expected net benefit from enlisting a person at \( t \) years of age is expressed as

\[ \text{ENB}(t) = M(t) - C(t) - S(t) - p(t)[\theta R^I(t) + \phi R^D(t)] \]  \ (6)

\(^4\) While only the costs of adjusting to military environment and readjusting to civilian environment are taken into account by the proposed model it is possible that learning how to switch occupations and adjust to different organizational cultures is a positive contribution of the armed service.

\(^5\) Since \( R^I \) and \( R^D \) are transfer payments from the rest of the public to a casualty or his beneficiaries they do not represent a loss for the society. Yet they should be considered in the determination of the optimal age of enlistment because their magnitudes depend on the casualty’s age.
where the relationship between the probability of war and the age of enlistment, $p(t)$, is given by equation (5), and where $M$, $C$, $S, R^I$ and $R^D$ are measured in present-value nominal units.$^6$

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 $(t_{\text{min}}, t_{\text{max}})$, depicting an inverted U-shaped relationship between productivity and age. 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 $(t_{\text{min}}, t_{\text{max}})$ in order to reflect a growing loss up to a critical age as the person’s number of dependents and stock of human capital increase and then decrease. The following second-order polynomials display such relationships:

$$M(t) = M_{t_{\text{min}}} + \alpha(t - t_{\text{min}}) - \tilde{\alpha}(t - t_{\text{min}})^2 \quad (7)$$

$$C(t) = C_{t_{\text{min}}} + \beta(t - t_{\text{min}}) - \tilde{\beta}(t - t_{\text{min}})^2 \quad (8)$$

$$R^D(t) = R^D_{t_{\text{min}}} + \gamma(t - t_{\text{min}}) - \tilde{\gamma}(t - t_{\text{min}})^2 \quad (9)$$

where, $M_{t_{\text{min}}}$, $C_{t_{\text{min}}}$ and $R^D_{t_{\text{min}}}$ are the military contribution and civilian output of a $t_{\text{min}}$ year old person and the remuneration to beneficiaries for the loss of such a person, respectively, and $(\alpha, \tilde{\alpha}), (\beta, \tilde{\beta}), (\gamma, \tilde{\gamma})$ are pairs of positive scalars, expressed in present-value nominal units, reflecting the intensities of the rise and decline of a

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$^6$ Improvements in the army’s protective gear, weapons and tactics reduce both $\theta$ and $\phi$ for its servicemen. Improvements in the field medical treatment and in the evacuation of injured personnel from the battlefield to hospitals further reduce $\phi$ for servicemen. Improvements in the enemy’s weapons, ammunition and tactics increase both $\theta$ and $\phi$ for servicemen.
man’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 man 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, then

\[
M'(t_m^*) = \alpha - 2\tilde{\alpha}(t_m^* - t_{\min}) = 0
\]

(10)

\[
C'(t_c^*) = \beta - 2\tilde{\beta}(t_c^* - t_{\min}) = 0
\]

(11)

\[
R^D(t_d^*) = \gamma - 2\tilde{\gamma}(t_d^* - t_{\min}) = 0
\]

(12)

and implying

\[
\tilde{\alpha} = \frac{0.5\alpha}{t_m^* - t_{\min}}
\]

(13)

\[
\tilde{\beta} = \frac{0.5\beta}{t_c^* - t_{\min}}
\]

(14)

\[
\tilde{\gamma} = \frac{0.5\gamma}{t_d^* - t_{\min}}.
\]

(15)

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

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\( t_d^* \) is determined by a combination of the number of life-years lost and the number and age composition of dependents.
his foregone civilian output by

$$C(t) = C_{t_{\text{min}}} + \beta(t - t_{\text{min}}) - \frac{0.5 \beta}{t_{c}^{*} - t_{\text{min}}} (t - t_{\text{min}})^2$$  \hspace{1cm} (17)$$

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

$$R^D(t) = R^D_{t_{\text{min}}} + \gamma(t - t_{\text{min}}) - \frac{0.5 \gamma}{t_{d}^{*} - t_{\text{min}}} (t - t_{\text{min}})^2.$$  \hspace{1cm} (18)$$

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

It is assumed that physical and psychological scars (Cf., Grossman and Siddle, 1999) can prevail and adversely affect earning capacity and social interaction over the rest of the individual’s lifetime. Thus, the earlier an injury occurs in one’s life the greater its cost. This assumption is formally represented by adding an annuity \( \delta \geq 0 \) (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 and compensating the injured soldier. The sum of the treatment cost of, and the compensation to, a person injured at age \( t \) is given by
The costs of adjustment to military environment and readjustment to civilian environment for a person conscripted at \( t \) years of age are represented by

\[
S(t) = S_{\text{min}} + \lambda (t - t_{\text{min}}) \quad (20)
\]

where \( S_{\text{min}} \) is the adjustment and readjustment costs for a person enlisted at the minimum viable age and \( \lambda \) is the adjustment-readjustment cost coefficient. Two opposite factors affect the sign of \( \lambda \): enthusiasm and 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, \( \lambda \) 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 benefit from recruiting a person to military service at age \( t \) is given by:
\[ ENB(t) = \left[ M_{t_{\text{min}}} - C_{t_{\text{min}}} - S_{t_{\text{min}}} - (1 - \mu) p_{\text{max}} (\theta R_{t_{\text{min}}} + \phi R_{t_{\text{min}}}) \right] \]

\[ \times \left( \frac{A_0}{M_{t_{\text{min}}} - C_{t_{\text{min}}} - S_{t_{\text{min}}} - (1 - \mu) p_{\text{max}} (\theta R_{t_{\text{min}}} + \phi R_{t_{\text{min}}})} \right) \]

\[ + \left[ \alpha - \beta - \lambda + (1 - \mu) p_{\text{max}} (\delta \theta - \gamma \phi) - \frac{\mu p_{\text{max}} (\theta R_{t_{\text{min}}} + \phi R_{t_{\text{min}}})}{t_{\text{max}} - t_{\text{min}}} \right] (t - t_{\text{min}}) \]

\[ - \left[ \frac{0.5 \alpha - 0.5 \beta}{t^*_{m} - t_{\text{min}}} - \frac{0.5 \gamma (1 - \mu) \phi p_{\text{max}}}{t^*_{d} - t_{\text{min}}} - \frac{\mu p_{\text{max}} (\delta \theta - \gamma \phi)}{t_{\text{max}} - t_{\text{min}}} \right] (t - t_{\text{min}})^2 \]

\[ + \left[ \frac{-0.5 \gamma \mu p_{\text{max}}}{(t^*_{m} - t_{\text{min}})(t^*_{d} - t_{\text{min}})} \right] (t - t_{\text{min}})^3 \]

\[ = (21) \]

4. Optimal enlistment-age and some numerical simulations

The optimal enlistment age is taken to be \( t^o \in (t_{\text{min}}, t_{\text{max}}) \) that maximizes \( ENB \).

Recalling equation (21), the necessary and sufficient conditions for interior solution are:

\[ A_3 (t^o - t_{\text{min}})^2 - A_2 (t^o - t_{\text{min}}) + A_1 = 0 \]

\[ \{2A_3 (t^o - t_{\text{min}}) - A_2 < 0\} \Rightarrow \{t^o < t_{\text{min}} + 0.5(A_2 / A_3)\} \]

(23)

and the optimal enlistment-age is given by either

\[ t^o_1 = t_{\text{min}} + \frac{A_2 + \sqrt{A_2^2 - 4A_3A_1}}{2A_3} \]

(24)

or

\[ t^o_2 = t_{\text{min}} - \frac{A_2 + \sqrt{A_2^2 - 4A_3A_1}}{2A_3} \]
\[ t_2^o = t_{\text{min}} + \frac{A_2 - \sqrt{A_2^2 - 4A_3A_1}}{2A_3} \]  

(25)

satisfying the second-order condition (23). If neither \( t_1^o \) nor \( t_2^o \) satisfies condition (23), the optimal enlistment age is: the minimum viable age when \( ENB(t_{\text{min}}) > ENB(t_{\text{max}}) \), the maximum viable age when \( ENB(t_{\text{min}}) < ENB(t_{\text{max}}) \), or any of these bounds when \( ENB(t_{\text{min}}) = ENB(t_{\text{max}}) \).

The numerical simulations of the optimal enlistment-age consider a likely benchmark scenario where \( t_{\text{min}} = 18 \) years, \( t_{\text{max}} = 65 \) years, \( T = 80 \) years, \( R_{\text{min}}^D = $1,000,000 \), \( R_{\text{min}}^I = $500,000 \), \( \hat{R}^I = $190,000 \), and in recalling equation (19), \( \delta = (R_{\text{min}}^I - \hat{R}^I)/(T - t_{\text{min}}) = $5000 \). In the absence of a clear assessment of the relationship between the costs of adjustment and age, the benchmark value of \( \lambda \) was set to be equal to zero. Interior solution could only be obtained with \( t_2^o = t_{\text{min}} + (A_2 - \sqrt{A_2^2 - 4A_3A_1})/2A_3 \) and as long as the parameter \( (\alpha) \) governing the intensity of the rise and decline of the individual’s military

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

9 As mentioned in the introduction, the minimum recruiting age has been eighteen in many countries. It coincides with the ordinary age of completing high-school studies.

10 As mentioned in section 2, \( t_{\text{max}} \) is set, for simplicity, to coincide with the age of retirement. Sixty-five is usually perceived as the traditional age of retirement.

11 Roughly the life expectancy in many technologically advanced countries.

12 As can be seen from equation 9, \( R_{\text{min}}^D \) is the lump sum remuneration to beneficiaries (parents and siblings most likely) in the case of death of a minimum-age (eighteen year old) recruit. Assuming that the average annual rate of return on a risk-free investment is four percent, a lump-sum compensation of 1,000,000 dollars generates a steady annual income that is similar to the current per capita income in some of the countries indicated in the introduction – United States, Switzerland and Sweden.

13 It is assumed that the average injured soldier is fifty percent incapacitated. The average cost of treating and compensating a minimum-age soldier incapacitated by an injury, \( R_{\text{min}}^I \), is subsequently set to be half the remuneration in the case of his complete incapacitation — death. It is further assumed that 38 percent of this sum is spent on initial treatment and compensation (\( \hat{R}^I \)).
performance over the feasible period is at least 16.666 percent larger than the parameter ($\beta$) governing the intensity of the growth and decline of his civilian productivity over the same period. If $\alpha < 1.1666\beta$, the optimal enlistment age coincides with the commonly applied one — eighteen.

The benchmark simulation leading to an interior solution is presented by the bold numbers in 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 leads to the following conclusions.

The optimal enlistment age first rises and then declines with the value of the maximum probability of war ($p_{\text{max}}$).

The optimal enlistment age declines with the probability of being killed ($\phi$) and with the probability of being injured ($\theta$). The underline rationale is that since the expected compensation for a casualty is assumed to gradually rise and peak at forty years of age, the increase in the expected compensation generated by the rise of the probabilities of becoming a casualty is moderated by lowering the age of enlistment.

The optimal enlistment age rises and then declines with the war-deterrence gradient ($\mu$).

The optimal enlistment age rises with the prime-age of military performance and declines with the prime-age of people’s civilian production ($t^*_C$).
The optimal enlistment age strongly declines with the age of death associated with maximum remuneration to beneficiaries \((t^*_{d})\).

The optimal enlistment age rises with the parameter \((\alpha)\) governing the intensity of the rise and decline of the individual’s military performance.

The optimal enlistment age decreases with the parameter \((\beta)\) governing the intensity of the growth and decline of the individual’s civilian productivity.

The optimal enlistment age rises with the parameter \((\gamma)\) governing the rise and decline of the death remuneration.

The optimal enlistment age rises with the annual remuneration extended to injured soldiers \((\delta)\).

The optimal enlistment age strongly declines with the correlation between costs of adjustment and age \((\lambda)\).

The optimal enlistment age rises with the minimum recruitment age \((t_{\text{min}})\) and declines with the maximum recruitment age \((t_{\text{max}})\).

5. Concluding remarks

Enlistment at the earliest viable age maximizes the country’s wartime army size and thereby the country’s war-deterrence capacity. However, the possibility of injuries and death and their associated loss of quantity and quality of life erode the expected net benefit from early-age enlistment. The expected net-benefit from early, or later, age recruitment is also affected by the growth and decline of military contribution and civilian output and by the changes in adjustment costs over the life cycle.
The optimal enlistment-age was analytically derived by considering the effects of the enlistment age on the wartime army size and war-deterrence, military performance, foregone civilian output, remunerations in the case of physical and psychological injuries or death, and costs of adjustment and readjustment to military and civilian life.

The numerical simulations 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, and participating in voting and politics and hence having direct influence on the terms of service, prior to enlistment.

Furthermore, the simulations associated with the possible effect of age on the adjustment costs suggest that if the experience effect dominates the enthusiasm effect, a much more mature enlistment age is optimal. The underlying rationale is that when the experience effect dominates the enthusiasm effect the adjustment costs for mature-age recruits are lower than those for young recruits. The optimality of a much more mature enlistment age is also advocated in the (unlikely) cases where the death-remuneration, or the civilian output, peaks at a very young age.

The numerical simulations also suggest that if the rise and decline of the military performance is not, or insufficiently, steeper than the rise and decline of the civilian productivity over the lifespan, the optimal enlistment age is the minimum viable age — the commonly practiced eighteen or even earlier.
References


Table 1: Numerical simulations’ results

<table>
<thead>
<tr>
<th>Parameter &amp; Enlisting age</th>
<th>Much below the benchmark</th>
<th>Below the benchmark</th>
<th>The benchmark</th>
<th>Above the benchmark</th>
<th>Much above the benchmark</th>
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</thead>
<tbody>
<tr>
<td>$p_{\text{max}}$</td>
<td>0.1 18.209</td>
<td>0.25 19.087</td>
<td><strong>0.50 21.014</strong></td>
<td>0.75 21.906</td>
<td>0.95 20.418</td>
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<td>$\phi$</td>
<td>0.01 22.351</td>
<td>0.025 21.860</td>
<td><strong>0.05 21.014</strong></td>
<td>0.075 20.131</td>
<td>0.1 19.206</td>
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<td>$\theta$</td>
<td>0.01 21.553</td>
<td>0.05 21.319</td>
<td><strong>0.10 21.0</strong></td>
<td>0.15 20.621</td>
<td>0.2 20.350</td>
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<td>$\mu$</td>
<td>0.1 18.240</td>
<td>0.25 19.195</td>
<td><strong>0.5 21.0</strong></td>
<td>0.75 21.057</td>
<td>0.9 19.079</td>
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<td>$t_m$ (years)</td>
<td>25 18.847</td>
<td>30 19.743</td>
<td><strong>35 21.0</strong></td>
<td>40 22.784</td>
<td>45 25.062</td>
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<tr>
<td>$\psi$ (years)</td>
<td>30 32.301</td>
<td>40 21.672</td>
<td><strong>45 21.0</strong></td>
<td>50 20.676</td>
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</tr>
<tr>
<td>$\zeta$ (years)</td>
<td>25 45.13</td>
<td>30 27.733</td>
<td><strong>40 21.0</strong></td>
<td>50 19.448</td>
<td>55 19.089</td>
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<tr>
<td>$\alpha$ (dollars)</td>
<td>3500 18.248</td>
<td>3750 19.862</td>
<td><strong>4000 21.014</strong></td>
<td>4500 22.610</td>
<td>5000 23.696</td>
</tr>
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<td>$\beta$ (dollars)</td>
<td>2000 24.331</td>
<td>2500 22.908</td>
<td>3000 21.0</td>
<td>3250 19.778</td>
<td>3500 18.222</td>
</tr>
<tr>
<td>$\gamma$ (dollars)</td>
<td>1000 18.140</td>
<td>2500 18.826</td>
<td>5000 21.0</td>
<td>7500 24.206</td>
<td>9000 26.483</td>
</tr>
<tr>
<td>$\delta$ (dollars)</td>
<td>1000 20.404</td>
<td>2500 20.630</td>
<td>5000 21.0</td>
<td>7500 21.405</td>
<td>9000 21.643</td>
</tr>
<tr>
<td>$\lambda$ (dollars)</td>
<td>-5000 39.347</td>
<td>-2500 31.544</td>
<td>0 21.0</td>
<td>250 19.651</td>
<td>500 18.187</td>
</tr>
<tr>
<td>$t_{\text{min}}$ (years)</td>
<td>16 18.776</td>
<td>17 19.894</td>
<td><strong>18 21.014</strong></td>
<td>19 22.135</td>
<td>20 23.257</td>
</tr>
<tr>
<td>$t_{\text{max}}$ (years)</td>
<td>55 21.583</td>
<td>60 21.335</td>
<td><strong>65 21.014</strong></td>
<td>67.5 20.852</td>
<td>70 20.696</td>
</tr>
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