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Military Draft and Economic Growth in OECD Countries

Katarina Keller
Susquehanna University

Panu Poutvaara
University of Helsinki and HECER

Andreas Wagener
University of Vienna

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HECER – Helsinki Center of Economic Research, P.O. Box 17 (Arkadiankatu 7), FI-00014 University of Helsinki, FINLAND, Tel +358-9-191-28780, Fax +358-9-191-28781,
E-mail info-hecer@helsinki.fi, Internet www.hecer.fi

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Abstract

Economic theory predicts that military conscription is associated with static inefficiencies as well as with dynamic distortions of the accumulation of human and physical capital. Relative to an economy with an all-volunteer force, output levels and growth rates should be lower in countries that rely on a military draft to recruit their army personnel. For OECD countries, we show that military conscription indeed has a statistically significantly negative impact on economic performance.

JEL Classification: H20, H57, J22, C68.

Keywords: Growth, military draft, augmented Solow model.

Katarina Keller

Department of Economics
Sigmund Weis School of Business
Susquehanna University
Selinsgrove, PA 17870
USA

keller@susqu.edu

Panu Poutvaara

Department of Economics
University of Helsinki
P.O. Box 17
00014 University of Helsinki
FINLAND

panu.poutvaara@helsinki.fi

Andreas Wagener

University of Hannover
Institute of Social Policy
Koenigsworther Platz 1
30167 Hannover
GERMANY

wagener@sopo.uni.hannover.de

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1 Introduction

To recruit military manpower, governments can rely on conscription (military draft), on voluntary enlistments, or on a combination of both. Military manpower systems differ considerably across time and space. A number of countries (like the United Kingdom and the United States) rely on all-volunteer forces while other countries traditionally recruit substantial fractions of their military staff through conscription. Many nations have changed their recruitment systems over time, even during periods of peace. Although proposals to (re-)establish a military draft surface from time to time even in traditionally nondrafting countries, the recent trend in military recruitment is moving toward professional armed forces. A number of countries (such as Belgium, the Netherlands, France, Spain, Portugal, Italy, Hungary, Romania, the Czech Republic and South Africa) have abolished or started to phase out conscription. Yet, 8 out of the 22 countries that belonged to the OECD already in 1985 and had a population over one million still (i.e., in 2008) use conscription, with draft spells ranging from 4 to 17 months. As a corollary to the military draft, most democratic countries offer conscientious objectors to bearing arms the option of an alternative service, typically to be delivered in the social sector.

Given its volume (the draft is generally intended to cover all able-bodied men in every cohort) and its duration (spells in the past typically were well above one and a half years), conscription can be expected to significantly impact economic performance. Naturally, the economic costs of an all-volunteer force are significant as well. Both systems rely on the government's power to tax, either by forcing young men and, although rarely, women to work in the military or by levying monetary and general taxes, the proceeds of which go to pay professional soldiers. Economists routinely argue that a military draft is the more costly way for a society to enlist military personnel. The extra costs of military conscription range from static deadweight losses to long-term distortions in the accumulation of human and physical capital (see the next section for a brief survey). Being of the same nature as military conscription, the use of conscientious objectors in the social sector causes similar efficiency losses.

Despite this clear verdict by economic theory, so far not much empirical evidence has been provided on the macroeconomic inferiority of a military draft, relative to an all-volunteer force. This paper establishes such evidence for OECD countries in the period between 1960 and 2000. Taking as our starting point the growth model by Mankiw et al. (1992), we empirically evaluate the hypothesis that, compared with a professional army, military conscription exerts negative and lasting impacts on aggregate output and growth. Our empirical results are in line with this hypothesis. To capture the effects of changes in military conscription on growth not only across countries but also over time, we then extend the analysis to a panel data model, which convincingly corroborates our cross-country regressions.

An important remaining concern is that the choice of manpower procurement method is endogenous. The elimination of conscription could be an endogenous response to rising income levels, rather than a cause of rising income levels (or higher growth). Furthermore, rising income levels may be associated with technological improvements that make military capital more productive, as suggested by Warner and Asch (1996).[1] In other words, high-income countries have a higher opportunity cost of providing for national defense via manpower than low-income countries. Therefore, causality could run from income levels to growth, rather than the other way round. To address this important concern, we have tested for Granger causality between conscription and growth. Our results indicate that for the statistically highly significant results, generally the length of conscription time Granger causes growth and the conscripts share causes the income level. However, we also find in some instances that the level of income Granger cause

[1] We are indebted to an anonymous referee for raising this point.

the length of conscription time. Therefore, our results still need to be interpreted with caution.

The rest of the paper is organized as follows: Section 2 briefly outlines the economic effects (which are mostly disadvantages) of military conscription. Section 3 reviews previous studies on the empirical relationships between conscription, military expenditures, and economic performance. None of these studies has, however, focused on the macroeconomic and long-term impacts of military draft. Section 4 introduces such a set-up in the form of an augmented Solow model. Section 5 reports our results and includes a sensitivity analysis, and Section 6 concludes.

2 Static and Dynamic Costs of the Draft

Adam Smith presented a clear case against conscription and found an "irresistible superiority which a well-regulated standing [=all-volunteer] army has over a militia [= conscription]" (Smith 1976 [1776], p. 701). Most economists have since been favoring professional soldiers over conscripted ones. They argue that, in spite of its lower budgetary cost for the government, a draft system imposes larger opportunity costs on society than an all-volunteer force. Most arguments in that discussion focus on static inefficiencies from which a draft system suffers (Hansen and Weisbrod, 1967; Fisher, 1969; Lee and McKenzie, 1992; Sandler and Hartley, 1995, Chapter 6; Warner and Asch, 2001, Poutvaara and Wagener, 2007):

- Military draft burdens conscripts with opportunity costs that exceed the fiscal costs by the maximum amount draftees are willing to pay to avoid compulsory service. These extra costs can be measured by the difference between the draftees' potential market income and the lower pay during the service plus the pecuniary value of the disutility from having to work in an occupation and under circumstances that draftees otherwise would not have chosen. This pecuniary disutility includes the extra risk of death or injury that military service may entail.

- Largely ignoring the draftees' productivity differences and comparative advantages, conscription involves an inefficient match between people and jobs and, thus, an avoidable output loss.
- The apparent cheapness of draftee labor leads to an excessive personnel-capital ratio in conscript armies.
- Shorter periods of training, lack of experience, higher turnover rates, and absence of motivation and incentives imply lower labor productivity for draftees than for professional soldiers.

There are a few exceptions on the widespread disapproval of military draft among economists: Lee and McKenzie (1992) and Warner and Asch (1995) argue that military draft with its in-kind finance can be socially less costly than a professional army if the latter's budgetary costs are financed through high and distortionary taxes.

Lau et al. (2004) argue that the draft involves, in addition to static inefficiencies, dynamic and long-term costs that do not arise with a professional army. These costs emerge through two channels from the specific timing and incidence of the draft. First, the military draft hits young men and, although rarely, women during a period of their lives that they would otherwise devote to the accumulation of human capital: education, studying, vocational training, or gathering first work experiences. The draft interrupts or postpones this investment process. Moreover, draftees see the human capital they accumulated before the draft depreciating during service – a point which was already stressed by von Thünen (1875, pp. 145ff.) when arguing that conscripted soldiers should be viewed as "capital goods" (see Kiker, 1969). Both effects imply a reduction in the economy's stock of human capital (also see Spencer and Woroniak, 1969). Second, the draft as an in-kind tax is one-sidedly levied on young people. Compared to "normal" monetary taxation (which then could, among other things, go to finance a professional army) the burden of the draft tax is higher, measured in terms of the present value of the reduction of taxpayers' lifetime incomes. The front-loaded reduction in lifetime income discourages saving and, thus, capital accumulation, leaving the physical capital stock in an economy with a military draft smaller than in an otherwise identical economy with a professional army.

With a lower stock of human and physical capital, the level and the growth rate of national income in an economy with a conscripted army tend to be lower than with an all-volunteer force. Simulations for a computational general equilibrium economy by Lau et al. (2004) demonstrate that these long-run costs of the draft can be sizeable: If the whole population was subject to a draft (i.e., everybody has to spend one year in military service at the age of 18), long-run GDP would be depressed by up to one percent, relative to an identical economy that has the same level of military output produced in an (equally efficient) all-volunteer army.

There is also some literature on how the use of draft is related to other country characteristics. Warner and Negrusa (2005) suggest that also differences in evasion costs could explain why some European countries have kept conscription, and others have abolished it. Mulligan and Shleifer (2005) relate the use of conscription to other government regulation. They argue that countries with a lot of other government regulation are also more likely to use draft. Their example of a typical such country is France, which actually abolished conscription in 2001. Moreover, based on cross-sectional data from 1980, Anderson et al. (1996) conclude that "warlike" states are more likely to employ conscription.

3 Empirical Studies

Virtually all empirical studies focus on the static efficiency losses of a draft system. These losses seem to be quite sizeable: Kerstens and Meyermans (1993) estimate that the social cost of the (now abolished) Belgian draft system amounted to twice the budgetary cost. Lutz (1996) reviews several studies from the 1980s and 1990s and reports that the annual monetarized utility losses of conscripts in the German army (which remain unaccounted for in the government budget) were between 2.2 and 6.7 billion euros (i.e., between 9 and 27 percent of German defense expenditure at that time).

A number of studies examine the impact of serving in the military on the lifetime earnings of ex-soldiers. Imbens and van der Klaauw (1995) observe substantial losses of up to 5 percent of lifetime earnings (compared to non-conscripts) for Dutch draftees in the 1980s and early 1990s. Effects are even larger during times of war: in the early 1980s, the earnings of white Vietnam War veterans were 15 percent lower than the earnings of comparable non-veterans (cf. Angrist, 1990). For Germany, Kunze (2002) finds that compulsory service leads to increases in wage income for men by 3.2 percent during the first year after conscription and depresses wage income beyond the first year, where the gap in wages increases with time. To the extent that earning differentials reflect differences in human capital formation, this empirical evidence thus corroborates that the military draft imposes dynamic costs in the form of a lower labor productivity. One should highlight that these estimated effects include any potential gains from skills learned during military service; the fact that the estimated effect of draft is negative reflects the extent to which such skills are less valuable than civilian education or on-the-job experiences. Holmlund and Liu (2006) estimate the effects of postponing university education in Sweden, whether due to military draft or other reasons. They find that postponing education by one (two) years reduces the average lifetime earnings of men by an amount equal to 21 (37) percent of annual earnings at the age of 40.

There is a substantial body of literature, initiated by Benoit (1973) and surveyed, e.g., by Ram (1995), Deger and Sen (1995), and Dunne et al. (2005), on the nexus between military expenditure and economic growth. By and large, military spending does not seem to contribute positively to economic well-being and growth. Some studies have found that especially at low levels of economic development military expenditure may go along with positive externalities (e.g., public infrastructure development, technology spillover effects) that promote economic growth (Crespo-Cuaresma and Reitschuler, 2003; Hooker and Knetter, 1997; Heo, 1998). These studies mainly employ the so-called Feder-Ram model; other studies, using mainstream growth models, do not identify a statistically significant effect of military expenditure on growth or even show clearly negative impacts (e.g., Knight et al., 1996). Reviewing the literature, Dunne et al. (2005) conclude that the Feder-Ram model suffers from serious problems. Dunne et al. (2005) advocate instead using mainstream growth models, like the augmented Solow model that we employ in our analysis.

As argued by Stroup and Heckelman (2001), the impact of the military's use of an economy's labor force on economic growth may be non-linear and depend on the overall quality of human capital: With higher educational attainment, the opportunity costs of displacing young men from the private sector workforce to the military is high, resulting in reduced economic prosperity. With low educational attainment of the young male workforce, spending a certain time in the military may increase the quality of human capital by providing training opportunities, e.g., self-discipline, communicative skills, or problem-solving techniques. Stroup and Heckelman (2001) indeed find empirical support using data for Africa and Latin America that recruitment to the military has higher and adverse effects on economic growth in countries with higher educational standards. However, they do not relate their estimates to whether the countries in question were running professional armies or used conscription.

A measure for the usage of the military draft is included in Haltiner (2003) which, for a sample of 15 Western European countries with military conscription between 1970 and 2000, finds a faint association between a country's GDP per capita and the share of conscripts among the active military personnel. However, this study excludes countries with all-volunteer armies and is based on a simple bivariate correlation analysis that does not control for any other factors that could influence either GDP or the recruitment scheme.

4 Model and Data

Our analysis to estimate the income and growth effects of military conscription builds on an augmented Solow growth model where the production process uses physical capital, human capital, and labor:

$$Y(t) = A(t, \mathbf{m}) \cdot K(t)^{\alpha} \cdot H(t)^{\beta} \cdot L(t)^{1-\alpha-\beta}.$$

All inputs receive a positive factor share, i.e., $\alpha, \beta, 1 - \alpha - \beta > 0$. For year t, $Y(t)$ denotes the gross domestic product, $K(t)$ and $L(t)$ represent the amounts of physical capital and non-augmented labor employed in the production, and $H(t)$ captures the stock of human capital. The variable $A(t, \mathbf{m})$ measures total factor productivity which depends on $\mathbf{m}$, a vector of military variables (see below). A similar Solow-type approach was used by Knight et al. (1996) to test for the impact of military spending on economic growth. We apply the augmented Solow model first to a cross-country analysis, extending Mankiw et al. (1992), as well as to a panel data analysis.

The labor force grows at an exogenous and constant rate n, and the technology parameter grows at constant rate g. Moreover, the economy is assumed to be on a balanced growth path where it devotes constant shares s_k and s_h of GDP to investments in physical and human capital. Assuming an equal rate δ of depreciation for human and physical capital, one obtains (for details see Mankiw et al. (1992)):

$$\begin{aligned}\ln[Y(t)/L(t)] &= \frac{1}{(1-\alpha-\beta)}\ln A(0,\mathbf{m}) + \frac{g\cdot t}{(1-\alpha-\beta)} \\ &\quad -\frac{(\alpha+\beta)}{(1-\alpha-\beta)}\cdot\ln(n+g+\delta) + \frac{\alpha}{(1-\alpha-\beta)}\cdot\ln(s_k) \\ &\quad +\frac{\beta}{(1-\alpha-\beta)}\cdot\ln(s_h). \qquad (1)\end{aligned}$$

As argued by Bernanke and Gürkaynak (2001), this framework can be used to evaluate essentially any growth model that admits a balanced growth path (also endogenous growth models).

Following Mankiw et al. (1992), we approximate the above equation by a Taylor expansion around the steady-state and solve the resulting differential equation. We then obtain the following estimable equation for the growth of per-capita GDP:

$$\begin{aligned}\ln[Y(t)/L(t)] - \ln[Y(0)/L(0)] &= (1-e^{-\lambda t})(\ln A(0,\mathbf{m}) + g\cdot t) \\ &\quad +(1-e^{-\lambda t})\frac{\alpha}{1-\alpha-\beta}\ln(s_k) \\ &\quad +(1-e^{-\lambda t})\frac{\beta}{1-\alpha-\beta}\ln(s_h) \\ &\quad -(1-e^{-\lambda t})\frac{\alpha+\beta}{1-\alpha-\beta}\ln(n+g+\delta) \\ &\quad -(1-e^{-\lambda t})\ln[Y(0)/L(0)] \qquad (2)\end{aligned}$$

where $\lambda := (1-\alpha-\beta)(n+g+\delta)$ is the rate of convergence.

We use data for the group of 21 OECD[2] countries, also used in Mankiw et al. (1992). While Mankiw et al. (1992) analyze the time period from 1960 to 1985, our time period spans from 1960 to 2000. In the cross-country regressions, the dependent variable is the natural logarithm of real per-working-age-person

[2]These are: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Greece, Ireland, Italy, Japan, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States. Germany is omitted due to its reunification.

GDP in 2000 for the analysis of income levels and the difference in the logarithm of GDP per working-age person between 2000 and 1960 for growth regressions. Data sources are listed in the Appendix.

In the growth regressions, the natural logarithm of initial real GDP per working-age person in 1960 is held constant. We proxy s_h by the average share of the working-age population in secondary education over this time, i.e., the ratio of those enrolled in secondary education to those of high school age times the share of the working-age population of high school age.

Following Mankiw et al. (1992), Nonneman and Vanhoudt (1996), and Bernanke and Gürkaynak (2001), we estimate $(n + g + \delta)$ by adding 0.05 (of which the technology growth rate is 0.02 and the depreciation rate is 0.03) to the average annual growth rates of the working-age populations between 1960 and 2000.

As suggested by theory, military recruitment and expenditures may impact output and growth. Here, we hypothesize that they affect growth of GDP per person of working age. In particular, we include the following alternative measures of military conscription, one at a time: a dummy for whether conscription was enforced or not, the number of conscripts as a share of the labor force, the duration of conscription (in years), each measured for the year 1985, and the duration of alternative service for as early as available.[3] While growing over time, the fraction of recruited draftees who actually deliver alternative service has been rather low in most countries.[4] Yet, we include the length of alternative service as

[3]When the time of service varies between the different branches of the military, the share of conscripts in each branch is calculated (or if unavailable, the share of each branch, assuming that conscripts are proportionally distributed) and then multiplied with the respective time of service.

[4]For the countries in our sample, WRI (2005) reports shares between 3 and 10 percent for the 1990s, with exceptions including Austria (more than 20 percent) and Italy (more than 50 percent). In Spain, about 75 percent of eligible men claimed conscientious-objector status by 2001 when the draft ended (and beyond our sample, in 2006, Germany had more men entering alternative service than conscription. See Gilroy and Williams, 2006).

a regressor. In most countries, alternative service has been considerably longer than ordinary military service. Moreover, there is a selection effect that the better educated people may be more likely to opt for alternative service, rendering the impact of alternative service more important than the population share of those choosing such service suggests. In addition to features of military conscription, we include the size of the military sector in the analysis, captured by the logarithm of military expenditures as a share of GDP.

The panel regressions are estimated analogously, however, by decade instead of the whole 1960-2000 time period. Averages are taken over each of the four decades separately. To improve the reliability of each estimate, the conscription variables are average values for the initial year and the middle year of each decade (as available).[5] We also report estimates for a pooled least squares model and a fixed-effects model with country-specific dummy variables as well as discuss panel regressions with period dummy variables.

Table 1 summarizes descriptive statistics on the use of conscription and military expenditures. There has been a steady decline in the use of conscription: in 1965, 16 out of 21 OECD countries (apart from Germany) used conscription.

[5] For example, the value for the 1980s is an average of the values for 1980 and 1985. As averages of the initial and middle years of the decades are used, in a few cases some countries receive 0.5 for their dummy variables when conscription was changed between those years. Moreover, as New Zealand's military service until at least 1980 was "voluntary, supplemented by Territorial service of 12 weeks for the Army" (Military Balance, 1980-1981, p.73), which by 1985 was reduced to "7 weeks basic [training], 20 days per year" (Military Balance, 1985-6, p.130), its conscription dummy is set to 0.5. For Austria, we use the general conscription time, ignoring the possibility for conscripts to voluntarily extend their service in certain army units. As the Military Balance does not provide 1965 conscription data for Austria and Finland, the values for the conscription dummy and the service time are extended backward from 1970 by corresponding information from Austria's Ministry of Defense (personal communication) and FINLEX (2006). The Republic of Ireland (which is also missing in the Military Balance) has never used conscription (see Irish Defence Forces, 2006). Data on alternative service is not sufficiently available for a panel.

The number of countries with conscription decreased to 14 in 1975 and 1985, and 13 in 1995. Alternative service has generally been longer and was on average almost 14 months in 2000 (or earliest available information), excluding Turkey which did not allow for alternative service. The average share of the labor force drafted has also decreased over time from 1.4 percent of the labor force in 1965 to 0.9 percent in 1995.

As seen in Table 1, countries with conscription on average had a lower real GDP during the whole time period 1960 to 2000. According to the hypothesis of conditional convergence, we would expect them to catch up and – they did indeed grow faster in the early decades. However, in the last decades, the countries with conscription have been growing at a lower rate than those without, thus falling further behind. Their consistently lower investment in human capital is likely to have contributed to this inferior economic performance. Their initially slightly higher investment in physical capital tapered off to equal levels over this time.

[INSERT TABLE 1 HERE.]

5 Results

5.1 Cross-country Analysis

When estimating eqs. (1) and (2), we extend the cross-country growth model by Mankiw et al. (1992) by adding four alternative variables measuring the use of conscription. For the sake of comparison, we report growth regressions without conscription variables for the same time period. As inflation often has been shown to negatively affect economic growth, we add inflation as an additional control variable (Tables 3 and 5). In all specifications, our analysis suggests that military conscription negatively impacts both the level and the growth of GDP per working-age person in OECD countries.

Tables 2 and 3 report OLS regression results for income levels. Enforcing the military draft depresses income, although not statistically significantly so at conventional levels once inflation is added. When interpreting this result, one should notice that high inflation is more likely in countries that are not able to collect enough taxes by direct means. As countries may also resort to conscription when there is a high deadweight loss of taxation, inflation and conscription are likely to be correlated. For our regressions, the conscripts share and inflation are highly correlated usually at the 1 percent level.[6] The number of conscripts as a share of the labor force, the length of conscription spells and the duration of alternative service have statistically highly significant negative impacts on income levels (at the 1- or 5-percent levels).

[INSERT TABLES 2 AND 3 HERE.]

Tables 4 and 5 show the results of growth regressions. Running a draft scheme turns out to hamper growth statistically significantly (at the 1- or 5-percent level). However, when inflation is included, the conscription dummy variable loses statistical significance at standard levels. As with income levels, the conscripts share, and the time spent in military service or in alternative service have statistically highly significant negative effects also on economic growth. The coefficient of the conscripts share of the labor force is the largest in both the income and growth regressions, thus indicating a strong negative relationship between countries' conscripts share and their income levels and its growth. In extensions of our analysis, we observed a statistically significant and high correlation between inflation and conscription variables. This may explain why the inclusion of inflation as a regressor in income and growth regressions reduces the significance of the conscription variables.

[6] Warner and Negrusa (2005) argue that the end of the Cold War reduced the necessity of high military capacities which, given that deadweight costs of normal taxes had been high, reduced European countries' inclination towards conscription. Shleifer and Mulligan (2005), however, show that a high deadweight loss of taxation is not able to explain the use of conscription.

[INSERT TABLES 4 AND 5 HERE.]

There is little evidence that military expenditures *per se* statistically significantly impact income levels or their growth (Tables 3 and 5). This is in line with the inconclusive evidence on the relationship between defense expenditure and growth that emerges from similar growth models (see Dunne et al., 2005).

Overall, the augmented Solow model with conscription variables explains much of per-working-age-person GDP and its economic growth for OECD countries with adjusted R^2s varying between 53 and 87 percent in the income regressions and between 77 and 86 percent in the growth regressions. Remarkably, adding conscription variables improves the adjusted R^2 in all cases, and often substantially. Moreover, conscription variables have in many cases a higher statistical significance than the traditional explanatory variables for economic growth. Together, these patterns suggest that military conscription indeed has a statistically significant negative impact on economic growth.

5.2 Panel Data Analysis

For the panel data analysis, we use four 10-year periods and report results both for pooled least squares (PLS) regressions with a common constant and for a fixed-effects model with country dummy variables. Panel regressions use 84 variables (four decades with 21 countries each) except for those with Conscripts/Labor Force as a regressor. Here, only 73 observations are available. The baseline scenario (without conscription) for these samples has been accordingly adjusted.[7]

Our panel data analysis confirms the negative and statistically significant impact of conscription on income and economic growth that already arises from the

[7]Moreover, regressions with time-period dummy variables exhibit qualitatively similar results and are available upon request. The regressions with a common constant extend the cross-country regressions by Mankiw et al. (1992) to a dynamic panel data model. In this context, Islam (1995) advocates a fixed-effects model with country-specific differences in the aggregate production function.

cross-country analysis. The negative impact on income is statistically significant at the 1-percent level for the share of conscripts in the labor force and for the duration of military service, and at the 10-percent level for the conscription dummy variable (Table 6). Adding inflation (see Table 7) decreases the statistical significance somewhat. However, only the conscription dummy becomes insignificant. Similarly, the conscription coefficients are negative and statistically significant to growth at the 1- or 5-percent level (Table 8), while including inflation leads to insignificance of the conscript share (Table 9).[8] However, this variable generally has the largest negative coefficient. Adding conscription variables to the standard model by Mankiw et al. (1992), and alternatively including also inflation, generally increases the explanatory power, with the adjusted R^2 now ranging from 0.457 to 0.664 for the income regressions and 0.427 to 0.709 for the growth regressions.

[INSERT TABLES 6 TO 9 HERE.]

The fixed-effects regressions (reported in Tables 10 to 13) yield qualitatively similar results to the PLS regressions. The explanatory power generally improves, with the adjusted R^2 ranging from 0.735 to 0.795 for income levels and 0.532 to 0.770 for growth, when including the conscription variables. Conscription statistically significantly depresses income and its growth (according to Tables 10 to 13 generally at the 1- or 5-percent level). However, the conscripts share loses its significance once inflation is added to the income regressions and is insignificant in these growth regressions with country-specific effects. Including country-specific effects removes the important cross-country differences in panel data, and relies instead on the within-country time-series aspect. Moreover, adding conscription

[8] The statistically significant correlation between inflation and the conscription variables persists in a panel framework, and is especially strong for the conscripts share. This may again be the reason why the statistical significance of the conscription variables is affected when inflation is included in these regressions.

variables, inflation or country-specific effects boosts the estimated rate of convergence (the implied λ) in almost all of our growth regressions.

[INSERT TABLES 10 TO 13 HERE.]

Our different panel regressions corroborate the statistically significant negative impact of conscription on income and growth. To consider the magnitudes of these effects for the numerical conscription variables, if the duration of military service or the conscripts share were decreased by one standard deviation (0.66 and 0.01 respectively), growth over a 10-year period would increase by on average 4.61 or 4.32 percentage points.[9] These effects are quite large. They conform to the intuition that the more intensely conscription is enforced, the more labor is diverted from endeavors of higher productivity in the economy, and the lower is output and its growth.

A complementary explanation might originate from Mulligan and Shleifer (2005) who show that conscription is especially salient in countries with extensive bureaucracies and government regulations. Hence, the negative effects captured by conscription could reflect not just misallocations and distortions caused by the military recruitment system, but of state intervention more generally.[10] However, when we test for this by adding government spending (without education expenditures) to the regressions in our tables, the highly significantly negative signs of the conscription variables generally remain. In a few cases, the consciption variables obtain even higher levels of significance. E.g., the conscription dummy variable gains significance at the 5 percent level in Table 6. In Table 7, conscription duration becomes significant at the 5 percent level, and the share of conscripts at the 1 percent level. An exception is the fixed effects model for

[9]Based upon efficient estimators. The length of military service is estimated from the fixed effects growth regression with inflation, which has a higher explanatory power. The conscripts share estimate is based on the PLS regressions without inflation where a common constant is accepted and where the variable is of high statistical significance.

[10]We are grateful to an anonymous referee for offering this interpretation.

growth without inflation (Table 12), where the conscription variables lose significance at standard levels (although by a narrow margin). However, they regain the same significance levels as in Table 13 once inflation is included.[11] Hence, it does not appear that the conscription variables are capturing the effects of overall government spending.

5.3 Sensitivity Analysis and Extensions

Causality. An important concern related to our analysis is that the use of conscription is an endogenous variable. Previous contributions by Warner and Asch (1996), Warner and Negrusa (2005) and Mulligan and Shleifer (2005) have aimed at explaining why some countries use military draft while others do not. More specifically, it could be that poorer countries use draft and richer countries professional armies, in which case the causality would run reversely from income levels to conscription variables.[12] Growth rates are often used in the growth literature because it is less prone to reverse causality problems than income levels, and half of our regressions are using growth rates as the dependent variable, following Mankiw et al. (1992). Using lagged variables reduces reverse causality

[11]The variable for government expenditure generally has a positive sign to income and a negative sign to growth, and is usually insignificant in the cross-country regressions and to growth. The significant positive sign to income levels in the shorter time spans of the panel regressions could be a sign of reverse causality where richer countries spend a larger share of their GDP on government expenditures. Tables that report the numerical results for these regressions are available upon request.

[12]In an analysis of the causes of conscription, Mulligan and Shleifer (2005) do not find any statistical significance for an impact of a country's per-capita income on the choice of military recruitment systems. Rather the choice of conscription seems to be largely driven by countries' ability to cope with the high administrative burden of organizing a system of military draft; Mulligan and Shleifer argue that this ability is positively correlated with a French, civil-law legal origin. Moreover, both countries with conscription and all-volunteer forces have downsized their militaries since the end of the Cold War (Gilroy and Williams, 2006).

problems as well, and we use conscription variables from 1985 or from early in the decade.

To investigate the possibility of reverse causality, we estimate Granger causality between conscription and income or its growth, using 5-year intervals of our data for each country. We test for causality in both ways (with one and two lags, representing 5 and 10 years, respectively).[13] For many countries the null hypothesis of no Granger causality in either direction cannot be rejected at the 5-percent confidence level. This finding is not at odds with the previously estimated negative effect of conscription on income levels and growth as Granger causality tests omit other explanatory variables for income levels and growth, like investment in physical and human capital. Moreover, the tests do not take into account the cross-country aspect of the panel data. Nevertheless, we find that quite often the length of conscription (highly significantly for Austria, France and Greece) and the share of conscripts in the labor force Granger cause growth. However, in Sweden, growth causes the duration of military service, and in Switzerland, growth causes the conscripts share. While we observe high statistical significance from conscription variables (especially the conscripts' share in the labor force for Greece and the Netherlands) to income levels, there are also some indications of reverse causality from income levels to conscription variables, especially to the duration of conscription (for Italy, Portugal and Sweden). Moreover, in Sweden income Granger causes the conscripts share.

[13]Granger causality is appropriate for stationary data. This is somewhat problematic to verify as the appropriate unit-root tests generally require at least 20 observations. We nevertheless ran them (alternating between including a constant, a constant and a linear trend, or neither), and find that the null of non-stationarity is typically rejected for the conscription variables of most countries. Only for four countries (Austria, Belgium, Greece and the Netherlands) is the null always accepted. In the remaining cases the null is rejected for the duration of military service except for Switzerland. The results are highly significant for France, Portugal, Spain and Turkey. The null is often rejected also for the conscripts share (for Denmark, Norway, Sweden, Switzerland and Turkey, highly significantly, except for Norway.).

As an additional test for causality, we set up the regressions in reverse, regressing conscription variables on past values of income levels and growth, respectively. These regressions have much lower explanatory power, and income and its growth are generally insignificant to subsequent conscription variables. In the panel regressions, past income levels show statistical significance to the duration of conscription at the end of the decade, however, with much reduced adjusted R-squared (about 30 percent). The statistical significance of income levels on the conscript shares disappears once inflation is added. Similarly, growth is highly significant to the conscription dummy until inflation is included, after which it is significant at the 10 percent level. These regressions explain about 20 percent of the variation in the conscription variables. In the cross-country regressions, past values of income and growth are never statistically significant to any of the conscription variables in 2000.

Sensitivity analysis. In addition to causality tests, we also checked the robustness of our results with an extensive sensitivity analysis. To reduce the influence of potential outliers, we conducted least median of squares (LMS) regressions and least absolute value (LAV) (or least absolute deviation) regressions for the models in Tables 2 to 9. Moreover, to exclude that the effects of conscription would reflect just the general military situation, we ran regressions that added military expenditures and the share of military personnel in the total labor force. Following Nonneman and Vanhoudt (1996), we also extended the model to include R&D expenditure as a regressor. All additional regressions confirm, at high levels of statistical significance, our conclusion that military conscription has a negative and sizeable impact on income and economic growth.[14]

[14]Detailed material on the sensitivity analysis and extensions is available upon request.

6 Conclusion

Economic theory predicts that military conscription is associated with static inefficiencies as well as with dynamic distortions of the accumulation of human and physical capital. Relative to an economy with an all-volunteer force, output levels and growth rates are expected to be lower in countries that rely on military draft to recruit their army personnel. For OECD countries, we show that military conscription indeed has a statistically significant negative impact on economic performance. Thus, the losses in individual lifetime earnings, which a number of microeconometric studies observe for former conscripts, indeed translate into substantial reductions in income and growth on the macroeconomic level, rendering military conscription a socially unnecessarily costly way of military recruitment.

The result that military conscription has a negative impact on GDP per working-age person and on its growth is robust in various specifications. We measure the impact of conscription by a dummy variable, by the labor force share of conscripts, and by the duration of conscription or of alternative service. With all these variables, conscription has a consistently negative and usually statistically significant effect. In line with previous studies (see Section 3), we find that military expenditure as such is generally insignificant. The negative impact of compulsory military service also consistently emerges when the sample is treated as decade-wise panel data regressions. Granger causality tests indicate that generally causality runs from conscription to income levels and growth, rather than the other way round. We hope that future research, perhaps being able to draw from longer time-series data, as well as larger samples, will help to clarify this complex relationship in greater detail than we have been able to do with our limited panel data.

Overall, the estimated effects of military draft on income levels and growth appear quite large (ranging between 4.3 and 4.6 percentage points over a decade). Even if our estimates suggest that causality is more likely to run from conscription to income levels and growth than the other way round, reverse causality cannot altogether be excluded. Therefore, and due to the simplicity of our approach, our estimates should be viewed with some caution. On the other hand, the dynamic costs of military conscription indeed seem to be sizeable: In a calibrated CGE model (that is crafted to be favorably biased towards military draft), Lau et al. (2004) estimate that conscription may cost an economy up to one percent of GDP. In an empirical study on Italy, Cippolone and Rosolia (2007) estimate that the abolition of military draft leads to an increase in male high-school graduation rates by between two and four percentage points – where each point would permanently raise per capita GDP by about 0.25 percent.

To conclude, as our estimates show that conscription substantially reduces economic growth, at least OECD countries would be ill advised to rely on a military draft.[15] The main reasons why the benefits to growth appear to be quite large, are likely because of the misallocations of human and physical capital rendered especially from conscription taking time away from education.

References

Anderson, Gary M., Dennis Halcoussis, and Robert D. Tollison, 1996. Drafting the competition: Labor unions and military conscription. *Defense and Peace Economics* 7, 189 – 202.

Angrist, Josh D., 1990. Lifetime earnings and the Vietnam era draft lottery: Evidence from Social Security Administration records. *American Economic Review* 80, 313 – 335.

Benoit, Emile, 1973. *Defense and Economic Growth in Developing Countries.* Lexington, Lexington Books.

Bernanke, Ben S., and Refet S. Gürkaynak, 2001. Is growth exogenous? Taking

[15]As with other inefficient policies, inefficiency alone does not imply that the abolition of military draft is politically viable. For a discussion of the political economy of military conscription, see Poutvaara and Wagener (2007).

Mankiw, Romer, and Weil seriously. *NBER Macroeconomics Annual* 16, 11 – 57.

Choi, Seung-Whan, and Patrick James, 2003. No professional soldiers, no militarized interstate disputes? A new question for Neo-Kantianism. *Journal of Conflict Resolution* 47, 796 – 816.

Cipollone, Piero, and Alfonso Rosolia, 2007. Social interactions in high school: Lessons from an earthquake. *American Economic Review* 97, 948 – 965.

Crespo-Cuaresma, Jesùs, and Gerhard Reitschuler, 2003. A non-linear defence-growth nexus? Evidence from the US economy. *Defence and Peace Economics* 15, 71 – 82.

Deger, Saadet, and Somnath Sen, 1995. Military expenditures and developing countries. In: Keith Hartley and Todd Sandler (eds.), *Handbook of Defense Economics*, Vol. 1. Elsevier, Amsterdam, pp. 275 – 307.

Dunne, J. Paul, Ron P. Smith, and Dirk Willenbockel, 2005. Models of military expenditure and growth: A critical review. *Defence and Peace Economics* 16, 449 – 461.

EBCO, 2001. European Union without compulsary military service: Consequences for alternative service - A comparative study on the policies in EU-member states, EU-Study Paper No.1, European Bureau for Conscientious Objection and Heinrich Böll Foundation: Brussels. Online at http://www.ebco-beoc.org/Documents/boell_study2001.PDF

FINLEX, 2006. Asevelvollisuuslaki(Finnish law on conscription), 1950 and 1998. Online at http://www.finlex.fi/fi/laki/alkup/1950/19500452 and http://www.finlex.fi/fi/laki/alkup/1998/19980019 (in Finnish).

Fisher, Anthony C., 1969. The cost of the draft and the cost of ending the draft. *American Economic Review* 59, 239 – 254.

Gilroy, Curtis L., and Cindy Williams (eds.), 2006, *Service to Country: Personnel Policy and the Transformation of Western Militaries.* MIT Press, Cambridge etc.

Haltiner, Karl W., 2003. The decline of the European mass armies. In: Guiseppe Caforio (ed.), *Handbook of the Sociology of the Military.* Kluwer Academic/Plenum Publishers, New York etc., pp. 361 – 384.

Hansen, W. Lee, and Burton A. Weisbrod, 1967. Economics of the military draft. *Quarterly Journal of Economics* 81, 395 – 421.

Heo, Uk, 1998. Modeling the defense-growth relationship around the globe. *Journal of Conflict Resolution* 47, 637 – 657.

Heston, Alan, Robert Summers, and Bettina Aten, 2000. Penn World Table Version 6.1.Center for International Comparisons at the University of Pennsylvania (CICUP).

Holmlund, Bertil and Qian Liu, 2006. Mind the gap? Estimating the effects of postponing higher education. CESifo Working Paper 1792.

Hooker, Mark A., and Michael M. Knetter, 1997. The effect of military spending on economic activity: Evidence from state procurement spending. *Journal of Money, Credit, and Banking* 29, 400 – 421.

Imbens, Guido, and Wilbert van der Klaauw, 1995. Evaluating the cost of conscription in The Netherlands. *Journal of Business and Economic Statistics* 13, 207 – 215.

IISS, 1985. *The Military Balance: 1985-1986*. International Institute for Strategic Studies, London.

Irish Defence Forces, 2006. History. Online at `http://www.military.ie/introduction/history.htm`.

Islam, Nazrul, 1995. Growth empirics: A panel data approach. *Quarterly Journal of Economics* 110, 1127 – 1170.

Kerstens, Kristiaans, and Eric Meyermans, 1993. The draft versus an all-volunteer force: Issues of efficiency and equity in the Belgian draft. *Defence Economics* 4, 271 – 284.

Kiker, B.F., 1969. Von Thünen on human capital. *Oxford Economic Papers* 21, 339 – 343.

Knight, Malcolm, Norman Loayza, and Delano Villanueva, 1996. The peace dividend: Military spending cuts and economic growth. *IMF Staff Papers* 43, 1 – 37.

Lau, Morten I., Panu Poutvaara, and Andreas Wagener, 2004. Dynamic costs of the draft. *German Economic Review* 5, 381 – 406.

Lee, Dwight R., and Richard B. McKenzie, 1992. Reexamination of the relative efficiency of the draft and the all-volunteer army. *Southern Economic Journal*

59, 646 – 654.

Lutz, Dieter S., 1996. Ist eine Freiwilligen-Streitkraft billiger? (Are all-volunteer forces cheaper?) in: Gross, Jürgen and Dieter S. Lutz (eds.), Hamburger Beiträge zur Friedensforschung und Sicherheitspolitik. Hamburg. 39 – 54.

Mankiw, N. Gregory, David Romer, and David N. Weil, 1992. A contribution to the empirics of economic growth. *Quarterly Journal of Economics* 107, 407–437.

Mulligan, Casey and Andrei Shleifer, 2005. Conscription as regulation. *American Law and Economics Review* 7, 85 – 111.

Nonneman, Walter, and Patrick Vanhoudt, 1996. A further augmentation of the Solow model and the empirics of economic growth for OECD countries. *Quarterly Journal of Economics* 111, 943 – 953.

OMHROI.gr, 2005. Conscription in Europe. Online at `http://www.omhroi.gr/`.

Poutvaara, Panu, and Andreas Wagener, 2007. Conscription: Economic costs and political allure. *Economics of Peace and Security Journal* 2, 6 – 15.

Ram, Rati, 1995. Defense expenditure and economic growth. In: Keith Hartley and Todd Sandler (eds.). *Handbook of Defense Economics*, Vol. 1, Elsevier, Amsterdam, pp. 251 – 273.

Ross, Thomas W., 1994. Raising an army: A positive theory of military recruitment. *Journal of Law and Economics* 37, 109 – 131.

Sandler, Todd, and Keith Hartley, 1995. *The Economics of Defense*, Cambridge University Press, Cambridge.

Smith, Adam, 1976 [1776]. *An Inquiry into the Nature and Causes of the Wealth of Nations*. Clarendon Press, Oxford.

Spencer, Daniel L., and Alexander Woroniak, 1969. Valuing transfer of military-acquired skills to civilian employment. *Kyklos* 22, 467 – 492.

Stroup, Michael D., and Jack C. Heckelman, 2001. Size of the military sector and economic growth: A panel data analysis of Africa and Latin America. *Journal of Applied Economics* 4, 329 – 360.

Thünen, Johann Heinrich von, 1875. *Der isolierte Staat in Beziehung auf Landwirtschaft und Nationalökonomie*. 3rd edition, Wiegandt, Hempel & Parey, Berlin.

United Nations, 2003. World population prospects: The 2002 revision, population division, Department of Economic and Social Affairs.

WRI, 2005. Refusing to bear arms: A world survey of conscription and conscientious objection to military service, War Resisters' International, London. Online at `http://www.wri-irg.org/co/rtba/index.html`.

WRI, 1998. Italy (1998 report), War Resisters' International, London. Online at `http://www.wri-irg.org/co/rtba/archive/italy.htm`

Warner, John T., and Beth J. Asch, 1995. The economics of military manpower. In: Keith Hartley and Todd Sandler (eds.), *Handbook of Defense Economics*, Vol. 1, Elsevier, Amsterdam, pp. 348 – 398.

Warner, John T., and Beth J. Asch, 1996. The economic theory of a draft reconsidered. *Defense and Peace Economics* 7, 297 – 315.

Warner, John T., and Beth J. Asch, 2000. The record and prospects of the all-volunteer military in the United States. *Journal of Economic Perspectives* 15, 169 – 192.

Warner, John T., and Sebastian Negrusa, 2005. Evasion costs and the theory of conscription. *Defense and Peace Economics* 16, 83 – 100.

World Bank, 2003. WDI Online, World Development Indicators, World Bank: Washington D.C.

World Bank, 2004. World Development Indicators 2004 CD-ROM, World Bank: Washington D.C.

Appendix: Data Sources

Unless stated otherwise below, data is taken from World Bank (2003).

Variables	Source
Real GDP	Heston et al. (2000)
Working age population (high school age, 15-19)	United Nations (2003)
Military Expenditures as a share of GDP	World Bank (2004)
Share of military staff in total labor force	World Bank (2004)
Other military variables	IISS (1985); and various issues.
Alternative service time	OMHROI.gr (2005); Italy: WRI (1998); Belgium, the Netherlands, Spain, France: EBCO (2001).

Table 1: Descriptive Statistics (Means)[a]

		All Countries	With Conscription[b]	Without Conscription[b]
Military Variables:				
Length of Military Service:	1965		1.426 ys	
	1975		1.226 ys	
	1985		1.083 ys	
	1995		0.915 ys	
Length of Alternative Service[c]			1.160 ys	
Conscripts/Labor Force:	1965		0.014	
	1975		0.015	
	1985		0.012	
	1995		0.009	
Military Staff/LaborForce[d]		0.017	0.020	0.009
Military Expenditures/GDP[d]		0.026	0.026	0.026
Economic Variables, full period:				
GDP/working-age person	1960	12961	11838	15208
	2000	34049	32151	37844
Growth[e]	1960-2000	1.016	1.040	0.967
Investment/GDP	1960-2000	0.236	0.244	0.219
Population Growth + 0.05	1960-2000	0.059	0.057	0.062
Education	1960-2000	0.107	0.102	0.115
Inflation	1960-2000	0.079	0.089	0.058

(continued overleaf)

Table 1 (ctd.)

		All Countries	With Conscription[b]	Without Conscription[b]
Economic Variables, decadewise:				
GDP/working-age person	1960	12961	11838	15208
	1970	19044	18234	20662
	1980	23447	22917	24507
	1990	28041	27030	30064
	2000	34049	32151	37844
Growth[e]	1960-1970	0.420	0.457	0.346
	1970-1980	0.220	0.240	0.180
	1980-1990	0.180	0.167	0.206
	1990-2000	0.195	0.176	0.234
Investment/GDP	1960-1970	0.242	0.260	0.206
	1970-1980	0.247	0.261	0.219
	1980-1990	0.227	0.229	0.222
	1990-2000	0.230	0.230	0.230
Population Growth + 0.05	1960-1970	0.060	0.058	0.065
	1970-1980	0.060	0.058	0.065
	1980-1990	0.059	0.059	0.061
	1990-2000	0.056	0.055	0.060
Education	1960-1970	0.081	0.073	0.097
	1970-1980	0.103	0.097	0.115
	1980-1990	0.109	0.106	0.115
	1990-2000	0.112	0.108	0.121
Inflation	1960-1970	0.040	0.042	0.038
	1970-1980	0.111	0.115	0.104
	1980-1990	0.101	0.115	0.072
	1990-2000	0.066	0.086	0.025

Notes:

[a] Calculations based on WDI data are published with permission from the World Bank.

[b] Out of 21 countries, 16 used conscription in 1965, 14 in 1975 and 1985, and 13 in 1995. Belgium and the Netherlands are counted as countries with conscription, the U.S. and Australia as countries without.

[c] Year 2000, or as early as available.

[d] Late 1980s.

[e] Log of difference in GDP/working-age person for the given time interval

Table 2: Income Levels and Military Conscription

Dependent Variable: Log-GDP per working-age person in 2000

Constant	11.777 (1.556)***	9.570 (1.565)***	10.298 (1.348)***	9.662 (1.495)***	10.058 (1.461)***
Investment/GDP	0.520 (0.278)*	0.631 (0.296)**	0.544 (0.236)**	0.555 (0.264)*	0.672 (0.273)**
Population Growth +0.05	−0.718 (0.558)	-1.284 (0.453)**	-0.769 (0.370)*	-1.111 (0.400)**	-1.375 (0.500)**
Education	1.182 (0.379)***	0.754 (0.331)**	0.491 (0.227)**	0.614 (0.259)**	1.088 (0.291)***
Conscription Dummy		-0.290 (0.137)**			
Conscripts/Labor Force			-22.382 (4.913)***		
Length of Military Service				-0.312 (0.086)***	
Length of Altern. Service					-0.179 (0.045)***
$\bar{R}^2$	0.411	0.525	0.727	0.704	0.553
F-stat.	5.645***	6.530***	14.337***	12.866***	7.178***

Note: *(**)[***] denotes significance at the 10% (5%) [1%] level; standard errors in parentheses; 21 observations.

Table 3: Income Levels, Military Variables, Inflation, and Conscription

Dependent Variable: Log-GDP per working-age person in 2000

Constant	9.544 (1.533)***	9.055 (1.514)***	10.305 (1.233)***	9.819 (1.318)***	9.706 (1.256)***
Investment/GDP	-0.130 (0.237)	-0.019 (0.270)	0.203 (0.252)	0.168 (0.242)	0.175 (0.212)
Population Growth +0.05	−0.156 (0.298)	-0.404 (0.333)	-0.325 (0.293)	-0.488 (0.345)	-0.613 (0.376)
Education	0.445 (0.249)*	0.362 (0.252)	0.384 (0.235)	0.431 (0.221)*	0.595 (0.249)**
Inflation	-0.521 (0.077)***	-0.476 (0.086)***	-0.332 (0.104)***	-0.357 (0.092)***	-0.426 (0.076)***
Mil. Expenditure/GDP	0.055 (0.073)	0.065 (0.073)	0.126 (0.069)*	0.120 (0.072)	0.142 (0.072)*
Conscription Dummy		-0.108 (0.079)			
Conscripts/Labor Force			-12.958 (5.168)**		
Length of Military Service				-0.170 (0.074)**	
Length of Altern. Service					-0.115 (0.042)**
$\bar{R}^2$	0.831	0.838	0.869	0.866	0.865
F-stat.	20.657***	18.275***	23.154***	22.536***	22.304***

Note: *(**)[***] denotes significance at the 10% (5%) [1%] level; standard errors in parentheses; 21 observations.

Table 4: Growth and Conscription

Dependent Variable: Log-difference in GDP per working-age person; 1960-2000

Constant	6.471	5.573	7.372	6.827	6.283
	(1.674)***	(1.690)***	(1.147)***	(1.279)***	(1.419)***
Initial GDP 1960	-0.592	-0.634	-0.731	-0.717	-0.649
	(0.100)***	(0.076)***	(0.076)***	(0.073)***	(0.097)***
Investment/GDP	0.370	0.458	0.436	0.437	0.473
	(0.230)	(0.175)**	(0.167)**	(0.175)**	(0.197)**
Population Growth +0.05	-0.843	-1.199	-0.832	-1.039	-1.177
	(0.340)**	(0.396)***	(0.280)***	(0.347)***	(0.365)***
Education	0.776	0.538	0.492	0.560	0.782
	(0.265)***	(0.229)**	(0.203)*	(0.197)**	(0.230)***
Conscription Dummy		-0.189			
		(0.072)**			
Conscripts/Labor Force			-13.699		
			(2.242)**		
Length of Military Service				-0.187	
				(0.043)***	
Length of Altern. Service					-0.096
					(0.029)***
$\bar{R}^2$	0.740	0.789	0.821	0.814	0.771
F-stat.	15.227***	15.976***	19.291***	18.483***	14.484***
Implied λ	0.0224	0.0251	0.0328	0.0316	0.0262

Note: *(**)[***] denotes significance at the 10% (5%) [1%] level; standard errors in parentheses; 21 observations.

Table 5: Growth, Military Expenditure, Inflation, and Conscription

Dependent Variable: Log-difference in GDP per working-age person; 1960-2000

Constant	8.042 (1.742)***	7.400 (1.890)***	9.366 (1.364)***	8.860 (1.572)***	8.886 (1.775)***
Initial GDP 1960	-0.859 (0.119)***	-0.849 (0.133)***	-0.919 (0.111)***	-0.913 (0.117)***	-0.925 (0.115)***
Investment/GDP	-0.049 (0.251)	0.077 (0.272)	0.217 (0.261)	0.188 (0.237)	0.185 (0.216)
Population Growth +0.05	-0.348 (0.317)	-0.629 (0.404)	-0.419 (0.306)	-0.573 (0.363)	-0.664 (0.385)
Education	0.461 (0.260)*	0.374 (0.247)	0.400 (0.250)	0.443 (0.238)*	0.587 (0.263)**
Inflation	-0.398 (0.151)**	-0.340 (0.169)*	-0.279 (0.159)	-0.298 (0.145)*	-0.371 (0.131)**
Mil. Expenditure/GDP	0.019 (0.086)	0.028 (0.084)	0.098 (0.082)	0.091 (0.087)	0.114 (0.095)
Conscription Dummy		-0.115 (0.077)			
Conscripts/Labor Force			-11.683 (4.419)**		
Length of Military Service				-0.153 (0.071)**	
Length of Altern. Service					-0.102 (0.043)**
$\bar{R}^2$	0.832	0.844	0.861	0.859	0.855
F-stat.	17.528***	16.454***	18.705***	18.336***	17.848***
Implied λ	0.0490	0.0473	0.0628	0.0610	0.0648

Note: *(**)[***] denotes significance at the 10% (5%) [1%] level; standard errors in parentheses; 21 observations.

Table 6: Income Levels and Military Conscription (Panel)

Dependent Variable: Log-GDP per working-age person by decade

Constant	10.198 (1.144)***	9.940 (1.177)***	10.144 (1.165)***	7.785 (1.088)***
Investment/GDP	0.358 (0.181)*	0.412 (0.192)**	0.411 (0.192)**	0.375 (0.181)**
Population Growth +0.05	−0.823 (0.349)**	-0.916 (0.347)**	-0.760 (0.344)**	-1.319 (0.296)***
Education	0.819 (0.144)***	0.744 (0.151)***	0.624 (0.154)***	0.284 (0.220)
Conscription Dummy		-0.139 (0.082)*		
Length of Military Service			-0.166 (0.058)***	
Conscripts/Labor Force				-17.816 (3.167)***
$\bar{R}^2$	0.443	0.457	0.501	0.510
F-stat.	23.026***	18.452***	21.832***	19.727***

Note: *(**)[***] denotes significance at the 10% (5%) [1%] level; standard errors in parentheses; 84 observations (4 time periods times 21 countries), except for Conscripts/Labor Force (73 observations).

Table 7: Income Levels, Conscription, and Inflation (Panel)

Dependent Variable: Log-difference in GDP per working-age person by decade

Constant	10.608 (1.082)***	10.512 (1.091)***	10.527 (1.075)***	8.387 (0.903)***
Investment/GDP	0.263 (0.165)	0.283 (0.166)*	0.305 (0.171)*	0.190 (0.136)
Population Growth +0.05	-0.398 (0.316)	-0.442 (0.313)	-0.412 (0.307)	-0.772 (0.258)***
Education	0.796 (0.136)***	0.773 (0.139)***	0.683 (0.137)***	0.296 (0.163)*
Inflation	-0.208 (0.031)***	-0.202 (0.031)***	-0.183 (0.031)***	-0.217 (0.032)***
Conscription Dummy		-0.044 (0.070)		
Length of Military Service			-0.099 (0.051)*	
Conscripts/Labor Force				-6.982 (2.646)**
$\bar{R}^2$	0.585	0.582	0.601	0.664
F-stat.	30.238***	24.073***	25.980***	29.494***

Note: *(**)[***] denotes significance at the 10% (5%) [1%] level; standard errors in parentheses; 84 observations (4 time periods times 21 countries), except for Conscripts/Labor Force (73 observations).

Table 8: Growth and Military Conscription (Panel)

Dependent Variable: Log-difference in GDP per working-age person by decade

Constant	2.662 (0.757)***	2.566 (0.640)***	2.869 (0.688)***	2.847 (0.754)***
Initial GDP	-0.259 (0.044)***	-0.267 (0.038)***	-0.282 (0.042)***	-0.269 (0.062)***
Investment/GDP	0.2372 (0.056)***	0.273 (0.0626)***	0.258 (0.060)**	0.248 (0.070)**
Population Growth +0.05	-0.209 (0.104)**	-0.276 (0.100)***	-0.207 (0.102)***	-0.211 (0.118)*
Education	0.042 (0.077)	0.001 (0.065)	0.001 (0.065)	0.062 (0.090)
Conscription Dummy		-0.090 (0.031)***		
Length of Military Service			-0.055 (0.0243)**	
Conscripts/Labor Force				-4.987 (2.069)**
$\bar{R}^2$	0.554	0.605	0.590	0.427
F-stat.	26.748***	26.394***	24.940***	11.729***
Implied λ	0.0300	0.0311	0.0331	0.0313

Note: *(**)[***] denotes significance at the 10% (5%) [1%] level; standard errors in parentheses; 84 observations (4 time periods times 21 countries), except for Conscripts/Labor Force (73 observations).

Table 9: Growth, Conscription, and Inflation (Panel)

Dependent Variable: Log-difference in GDP per working-age person by decade

Constant	3.426 (0.655)***	3.287 (0.581)***	3.491 (0.610)***	3.581 (0.690)***
Initial GDP	-0.318 (0.040)***	-0.317 (0.036)***	-0.327 (0.038)***	-0.344 (0.059)***
Investment/GDP	0.208 (0.050)***	0.234 (0.054)***	0.222 (0.053)***	0.190 (0.057)***
Population Growth +0.05	-0.084 (0.089)	-0.139 (0.087)	-0.092 (0.085)	-0.114 (0.107)
Education	0.094 (0.071)	0.062 (0.065)	0.066 (0.065)	0.089 (0.080)
Inflation	-0.085 (0.017)***	-0.077 (0.016)***	-0.079 (0.016)***	-0.083 (0.020)***
Conscription Dummy		-0.058 (0.026)**		
Length of Military Service			-0.033 (0.018)*	
Conscripts/Labor Force				-2.141 (1.704)
$\bar{R}^2$	0.691	0.709	0.701	0.560
F-stat.	38.038***	34.629***	33.456***	16.265***
Implied λ	0.0383	0.0381	0.0396	0.0422

Note: *(**)[***] denotes significance at the 10% (5%) [1%] level; standard errors in parentheses; 84 observations (4 time periods times 21 countries), except for Conscripts/Labor Force (73 observations).

Table 10: Income Levels and Conscription (Country Fixed Effects)

Dependent Variable: Log-GDP per working-age person by decade

Constant	8.350 (1.716)***	9.101 (1.874)***	9.364 (1.919)***	5.643 (1.556)***
Investment/GDP	-0.065 (0.229)	-0.094 (0.213)	-0.079 (0.214)	-0.133 (0.213)
Population Growth +0.05	-1.173 (0.527)**	-0.953 (0.578)	-0.783 (0.613)	-1.825 (0.449)***
Education	0.717 (0.125)***	0.699 (0.120)***	0.618 (0.124)***	0.336 (0.204)
Conscription Dummy		-0.295 (0.141)**		
Length of Military Service			-0.185 (0.078)**	
Conscripts/Labor Force				-7.648 (3.375)**
$\bar{R}^2$	0.724	0.735	0.744	0.736
F-stat.	10.458***	10.571***	11.067***	9.349***

Note: *(**)[***] denotes significance at the 10% (5%) [1%] level;
standard errors in parentheses; 84 observations (4 time periods times 21 countries), except for Conscripts/Labor Force (73 observations);
all regressions estimated with individual constants for each country (not reported).

Table 11: Income Levels, Conscription, and Inflation (Country Fixed Effects)

Dependent Variable: Log-GDP per working-age person by decade

Constant	9.786 (1.724)***	10.610 (1.857)***	10.840 (1.909)***	7.453 (1.586)***
Investment/GDP	0.065 (0.221)	0.038 (0.201)	0.053 (0.205)	0.057 (0.224)
Population Growth +0.05	-0.696 (0.549)	-0.452 (0.588)	-0.291 (0.625)	-1.213 (0.483)**
Education	0.818 (0.126)***	0.800 (0.121)***	0.717 (0.125)***	0.441 (0.187)**
Inflation	0.118 (0.044)***	-0.121 (0.043)***	-0.120 (0.044)***	-0.144 (0.045)***
Conscription Dummy		-0.311 (0.131)**		
Length of Military Service			-0.188 (0.075)**	
Conscripts/Labor Force				-3.839 (3.897)
$\bar{R}^2$	0.755	0.768	0.777	0.795
F-stat.	11.635***	11.974***	12.568***	12.170***

Note: *(**)[***] denotes significance at the 10% (5%) [1%] level;
standard errors in parentheses; 84 observations (4 time periods times 21 countries), except for Conscripts/Labor Force (73 observations);
all regressions estimated with individual constants for each country (not reported).

Table 12: Growth and Conscription (Country Fixed Effects)

Dependent Variable: Log-difference in GDP per working-age person by decade

Constant	3.278 (0.935)***	3.653 (0.970)***	3.750 (0.959)***	3.705 (1.076)***
Initial GDP	-0.300 (0.068)***	-0.312 (0.067)***	-0.318 (0.069)***	-0.274 (0.100)***
Investment/GDP	0.216 (0.113)*	0.200 (0.114)*	0.204 (0.113)*	0.179 (0.118)
Population Growth +0.05	-0.054 (0.251)	0.013 (0.252)	0.049 (0.244)	0.145 (0.348)
Education	-0.042 (0.084)	-0.037 (0.078)	-0.057 (0.071)	0.032 (0.100)
Conscription Dummy		-0.115 (0.058)*		
Length of Military Service			-0.062 (0.031)**	
Conscripts/Labor Force				-1.303 (2.153)
$\bar{R}^2$	0.651	0.660	0.663	0.532
F-stat.	7.444***	7.431***	7.518***	4.274***
Implied λ	0.0357	0.0374	0.0383	0.0320

Note: *(**)[***] denotes significance at the 10% (5%) [1%] level;
standard errors in parentheses; 84 observations (4 time periods times 21 countries), except for Conscripts/Labor Force (73 observations);
all regressions estimated with individual constants for each country (not reported).

Table 13: Growth, Inflation, and Conscription (Country Fixed Effects)

Dependent Variable: Log-difference in GDP per working-age person by decade

Constant	4.438 (0.987)***	4.899 (1.017)***	4.992 (1.024)***	4.959 (1.060)***
Initial GDP	-0.325 (0.059)***	-0.339 (0.056)***	-0.346 (0.057)***	-0.334 (0.081)***
Investment/GDP	0.295 (0.096)***	0.279 (0.093)***	0.283 (0.093)***	0.268 (0.105)**
Population Growth +0.05	0.233 (0.218)	0.318 (0.223)	0.355 (0.225)	0.352 (0.272)
Education	0.053 (0.089)	0.061 (0.083)	0.039 (0.076)	0.121 (0.095)
Inflation	-0.081 (0.019)***	-0.083 (0.019)***	-0.083 (0.019)***	-0.087 (0.019)***
Conscription Dummy		-0.132 (0.038)***		
Length of Military Service			-0.070 (0.026)**	
Conscripts/Labor Force				0.473 (2.238)
$\bar{R}^2$	0.751	0.767	0.770	0.686
F-stat.	11.033***	11.508***	11.665***	7.037***
Implied λ	0.0393	0.0414	0.0425	0.0406

Note: *(**)[***] denotes significance at the 10% (5%) [1%] level;
standard errors in parentheses; 84 observations (4 time periods times 21 countries), except for Conscripts/Labor Force (73 observations);
all regressions estimated with individual constants for each country (not reported).