

# MILITARY DRAFT AND ECONOMIC GROWTH IN OECD COUNTRIES

KATARINA KELLER<sup>a</sup>, PANU POUTVAARA<sup>b</sup> AND ANDREAS WAGENER<sup>c,†</sup>

<sup>a</sup>Department of Economics, Sigmund Weis School of Business, Susquehanna University, Selinsgrove, USA; <sup>b</sup>Department of Economic, University of Helsinki, Finland; <sup>c</sup>University of Hannover, Institute of Social Policy, Hannover, Germany

(Received 6 June 2007)

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.

*Keywords:* Growth; Military draft; Augmented Solow model

*JEL Codes:* H20, H57, J22, C68

## 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 (such as 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 non-drafting 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, eight out of the 22 countries that belonged to the OECD 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 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),

---

<sup>†</sup>Corresponding author: University of Hannover, Institute of Social Policy, Koenigsworther Platz 1, 30167 Hannover, Germany. E-mail: wagener@sopo.uni-hannover.de

scription can be expected to impact economic performance significantly. 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).<sup>1</sup> In other words, high-income countries have a higher opportunity cost of providing for national defence 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 share of conscripts causes the income level. However, we also find, in some instances, that the level of income Granger causes the length of conscription time. Therefore, our results still need to be interpreted with caution.

The rest of the paper is organized as follows: the next section briefly outlines the economic effects (which are mostly disadvantages) of military conscription. The section after 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. The fourth section introduces such a set-up in the form of an augmented Solow model. The fifth section reports our results and includes a sensitivity analysis, and the sixth section concludes.

## 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]: 701). Most economists have since favoured 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

<sup>1</sup> We are indebted to an anonymous referee for raising this point.

(Hansen and Weisbrod, 1967; Fisher, 1969; Lee and McKenzie, 1992; Sandler and Hartley, 1995, Chapter 6; Warner and Asch, 2001; Poutvaara and Wagener, 2007):

- A 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 labour 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 labour productivity for draftees than for professional soldiers.

There are a few exceptions to 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 already stressed by von Thünen (1875: 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 with '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 were 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 1%, 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 a draft is related to other country characteristics. Warner and Negrusa (2005) suggest that differences in evasion costs could also 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 regulations. They argue

that countries with a lot of other government regulation are also more likely to use the 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.

## 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 (i.e. between 9 and 27% of German defence 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% of lifetime earnings (compared with 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% 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% 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 labour 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 a 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 for 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%) 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 labour 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, communication 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 stronger 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.

## 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 labour:

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

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 labour 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 labour force grows at an exogenous and constant rate  $n$ , and the technology parameter grows at a 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  $\delta$  of depreciation for human and physical capital, one obtains (for details see Mankiw *et al.*, 1992):

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

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:

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

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

We use data for the group of 21 OECD<sup>2</sup> countries, also used in Mankiw *et al.* (1992). While Mankiw *et al.* (1992) analyse 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 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 the 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 labour force, the duration of conscription (in years), each measured for the year 1985, and the duration of alternative service for as early as available.<sup>3</sup> While growing over time, the fraction of recruited draftees who actually deliver alternative service has been rather low in most countries.<sup>4</sup> Yet we include the length of alternative service as a regressor. In most countries, alternative service has been considerably longer than ordinary military service. Moreover, there is a selection effect, in which 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

<sup>2</sup> 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.

<sup>3</sup> 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.

<sup>4</sup> For the countries in our sample, WRI (2005) reports shares between 3 and 10% for the 1990s, with exceptions including Austria (more than 20%) and Italy (more than 50%). In Spain, about 75% 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).

initial year and the middle year of each decade (as available).<sup>5</sup> 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 I 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. 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 labour force drafted has also decreased over time from 1.4% of the labour force in 1965 to 0.9% in 1995.

TABLE I Descriptive Statistics (Means)<sup>a</sup> (Continued)

		All Countries	With Conscription <sup>b</sup>	Without Conscription <sup>b</sup>
<b>Military Variables:</b>				
Length of Military Service:	1965		1.426 ys	
	1975		1.226 ys	
	1985		1.083 ys	
	1995		0.915 ys	
Length of Alternative Service <sup>c</sup>			1.160 ys	
Conscripts/Labour Force:	1965		0.014	
	1975		0.015	
	1985		0.012	
	1995		0.009	
Military Staff/Labour Force <sup>d</sup>		0.017	0.020	0.009
Military Expenditures/GDP <sup>d</sup>		0.026	0.026	0.026
<b>Economic Variables, Full Period:</b>				
GDP/Working-Age Person	1960	12961	11838	15208
	2000	34049	32151	37844
Growth <sup>e</sup>	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
<b>Economic Variables, Decadewise:</b>				
GDP/Working-Age Person	1960	12961	11838	15208
	1970	19044	18234	20662
	1980	23447	22917	24507

<sup>5</sup> 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' (IISS, 1980: 73), which by 1985 was reduced to '7 weeks basic [training], 20 days per year' (IISS, 1985: 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 IISS (1965) 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 IISS, 1965) has never used conscription (see Irish Defence Forces, 2006). Data on alternative service is not sufficiently available for a panel.

TABLE I (Continued)

		All Countries	With Conscription <sup>b</sup>	Without Conscription <sup>b</sup>
	1990	28041	27030	30064
	2000	34049	32151	37844
Growth <sup>e</sup>	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
	1960–1970	0.242	0.260	0.206
Investment/GDP	1970–1980	0.247	0.261	0.219
	1980–1990	0.227	0.229	0.222
	1990–2000	0.230	0.230	0.230
	1960–1970	0.060	0.058	0.065
Population Growth + 0.05	1970–1980	0.060	0.058	0.065
	1980–1990	0.059	0.059	0.061
	1990–2000	0.056	0.055	0.060
	1960–1970	0.081	0.073	0.097
Education	1970–1980	0.103	0.097	0.115
	1980–1990	0.109	0.106	0.115
	1990–2000	0.112	0.108	0.121
	1960–1970	0.040	0.042	0.038
Inflation	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: <sup>a</sup>Calculations based on WDI data are published with permission from the World Bank.

<sup>b</sup>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 US and Australia as countries without.

<sup>c</sup>Year 2000, or as early as available.

<sup>d</sup>Late 1980s.

<sup>e</sup>Log of difference in GDP/working-age person for the given time interval.

As seen in Table I, 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.

## RESULTS

### Cross-Country Analysis

When estimating equations (1) and (2), we extend the cross-country growth model of 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 has often been shown to affect economic growth negatively, we add inflation as an additional control variable (Tables III and V, later). 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.

TABLE II Income Levels and Military Conscription

<i>Dependent Variable: Log-GDP per working-age person in 2000</i>					
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/Labour Force			-22.382 (4.913)***		
Length of Military Service				-0.312 (0.086)***	
Length of Altern. Service					-0.179 (0.045)***
R <sup>2</sup>	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.

Tables II and III 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% level.<sup>6</sup> The number of conscripts as a share of the labour 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% levels).

Tables IV and V show the results of growth regressions. Running a draft scheme turns out to hamper growth statistically significantly (at the 1 or 5% 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 on economic growth. The coefficient of the conscripts share of the labour 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 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.

<sup>6</sup> 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. Mulligan and Shleifer (2005), however, show that a high deadweight loss of taxation is not able to explain the use of conscription.

TABLE III Income Levels, Military Variables, Inflation, and Conscription

<i>Dependent Variable: Log-GDP per working-age person in 2000</i>					
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/Labour Force			-12.958 (5.168)**		
Length of Military Service				-0.170 (0.074)**	
Length of Altern. Service					-0.115 (0.042)**
$R^2$	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 IV Growth and Conscription

<i>Dependent Variable: Log-difference in GDP per working-age person; 1960–2000</i>					
Constant	6.471 (1.674)***	5.573 (1.690)***	7.372 (1.147)***	6.827 (1.279)***	6.283 (1.419)***
Initial GDP 1960	-0.592 (0.100)***	-0.634 (0.076)***	-0.731 (0.076)***	-0.717 (0.073)***	-0.649 (0.097)***
Investment/GDP	0.370 (0.230)	0.458 (0.175)**	0.436 (0.167)**	0.437 (0.175)**	0.473 (0.197)**
Population Growth +0.05	-0.843 (0.340)**	-1.199 (0.396)***	-0.832 (0.280)***	-1.039 (0.347)***	-1.177 (0.365)***
Education	0.776 (0.265)***	0.538 (0.229)**	0.492 (0.203)*	0.560 (0.197)**	0.782 (0.230)***
Conscription Dummy		-0.189 (0.072)**			
Conscripts/Labour Force			-13.699 (2.242)**		
Length of Military Service				-0.187 (0.043)***	
Length of Altern. Service					-0.096 (0.029)***
$R^2$	0.740	0.789	0.821	0.814	0.771
$F$ -stat.	15.227***	15.976***	19.291***	18.483***	14.484***
Implied $\lambda$	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 V Growth, Military Expenditure, Inflation, and Conscription

<i>Dependent Variable: Log-difference in GDP per working-age person; 1960–2000</i>					
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/Labour Force			-11.683 (4.419)**		
Length of Military Service				-0.153 (0.071)**	
Length of Altern. Service					-0.102 (0.043)**
$R^2$	0.832	0.844	0.861	0.859	0.855
$F$ -stat.	17.528***	16.454***	18.705***	18.336***	17.848***
Implied $\lambda$	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.

There is little evidence that military expenditures *per se* statistically significantly impact income levels or their growth (Tables III and V). This is in line with the inconclusive evidence on the relationship between defence 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  $R^2$ s varying between 53 and 87% in the income regressions and between 77 and 86% 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.

### 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/Labour Force as a regressor. Here, only 73 observations are

TABLE VI Income Levels and Military Conscription (Panel)

<i>Dependent Variable: Log-GDP per working-age person by decade</i>				
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/Labour Force				-17.816 (3.167)***
$R^2$	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/Labour Force (73 observations).

available. The baseline scenario (without conscription) for these samples has been accordingly adjusted.<sup>7</sup>

Our panel data analysis confirms the negative and statistically significant impact of conscription on income and economic growth that already arises from the cross-country analysis. The negative impact on income is statistically significant at the 1% level for the share of conscripts in the labour force and for the duration of military service, and at the 10% level for the conscription dummy variable (Table VI). Adding inflation (see Table VII) 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% level (Table VIII), while including inflation leads to insignificance of the conscript share (Table IX).<sup>8</sup> However, this variable generally has the largest negative coefficient. Adding conscription variables to the standard model by Mankiw *et al.* (1992), and including 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.

The fixed-effects regressions (reported in Tables X to XIII) 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 X to XIII, generally at the 1 or 5% 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

<sup>7</sup> 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.

<sup>8</sup> 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.

TABLE VII Income Levels, Conscription, and Inflation (Panel)

<i>Dependent Variable: Log-difference in GDP per working-age person by decade</i>				
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/Labour Force				-6.982 (2.646)**
$R^2$	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/Labour Force (73 observations).

TABLE VIII Growth and Military Conscription (Panel)

<i>Dependent Variable: Log-difference in GDP per working-age person by decade</i>				
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/Labour Force				-4.987 (2.069)**
$R^2$	0.554	0.605	0.590	0.427
$F$ -stat.	26.748***	26.394***	24.940***	11.729***
Implied $\lambda$	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/Labour Force (73 observations).

TABLE IX Growth, Conscriptio, and Inflation (Panel)

<i>Dependent Variable: Log-difference in GDP per working-age person by decade</i>				
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/Labour Force				-2.141 (1.704)
$R^2$	0.691	0.709	0.701	0.560
$F$ -stat.	38.038***	34.629***	33.456***	16.265***
Implied $\lambda$	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/Labour Force (73 observations).

TABLE X Income Levels and Conscriptio (Country Fixed Effects)

<i>Dependent Variable: Log-GDP per working-age person by decade</i>				
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/Labour Force				-7.648 (3.375)**
$R^2$	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/Labour Force (73 observations); all regressions estimated with individual constants for each country (not reported).

TABLE XI Income Levels, Conscription, and Inflation (Country Fixed Effects)

<i>Dependent Variable: Log-GDP per working-age person by decade</i>				
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/Labour Force				-3.839 (3.897)
$R^2$	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/Labour Force (73 observations); all regressions estimated with individual constants for each country (not reported).

TABLE XII Growth and Conscription (Country Fixed Effects)

<i>Dependent Variable: Log-difference in GDP per working-age person by decade</i>				
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/Labour Force				-1.303 (2.153)
$R^2$	0.651	0.660	0.663	0.532
$F$ -stat.	7.444***	7.431***	7.518***	4.274***
Implied $\lambda$	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/Labour Force (73 observations); all regressions estimated with individual constants for each country (not reported).

TABLE XIII Growth, Inflation, and Conscription (Country Fixed Effects)

<i>Dependent Variable: Log-difference in GDP per working-age person by decade</i>				
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/Labour Force				0.473 (2.238)
$R^2$	0.751	0.767	0.770	0.686
$F$ -stat.	11.033***	11.508***	11.665***	7.037***
Implied $\lambda$	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/Labour Force (73 observations); all regressions estimated with individual constants for each country (not reported).

effects removes the important cross-country differences in panel data, and relies instead on the within-country time-series aspect. Moreover, adding conscription variables, inflation or country-specific effects boosts the estimated rate of convergence (the implied  $\lambda$ ) in almost all of our growth regressions.

Our different panel regressions corroborate the statistically significant negative impact of conscription on income and growth. To consider the magnitudes of these effects on 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.<sup>9</sup> These effects are quite large. They conform to the intuition that the more intensely conscription is enforced, the more labour is diverted from endeavours 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.<sup>10</sup> However, when we test for this by adding government spending (without education expenditures) to the regressions in our Tables, the highly significantly

<sup>9</sup> 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.

<sup>10</sup> We are grateful to an anonymous referee for offering this interpretation.

negative signs of the conscription variables generally remain. In a few cases, the conscription variables obtain even higher levels of significance (e.g. the conscription dummy variable gains significance at the 5% level in Table VI). In Table VII, conscription duration becomes significant at the 5% level, and the share of conscripts at the 1% level. An exception is the fixed effects model for growth without inflation (Table XII), where the conscription variables lose significance at standard levels (although by a narrow margin). However, they regain the same significance levels as in Table XIII once inflation is included.<sup>11</sup> Hence, it does not appear that the conscription variables are capturing the effects of overall government spending.

## 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 a draft and richer countries use professional armies, in which case the causality would run reversely from income levels to conscription variables.<sup>12</sup> Growth rates are often used in the growth literature because they are less prone to reverse causality problems than income levels, and half of our regressions use growth rates as the dependent variable, following Mankiw *et al.* (1992). Using lagged variables reduces reverse causality 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).<sup>13</sup> For many countries, the null hypothesis of no Granger causality in either direction cannot be rejected at the 5% 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, such as 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 labour force Granger cause growth. However, in Sweden, growth causes the duration of military

<sup>11</sup> The variable for government expenditure generally has a positive sign for income and a negative sign for growth, and is usually insignificant in the cross-country regressions and for growth. The significant positive sign for 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 from the authors.

<sup>12</sup> 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).

<sup>13</sup> 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 also rejected for the conscripts share (for Denmark, Norway, Sweden, Switzerland and Turkey, highly significantly, except for Norway.).

service, and in Switzerland, growth causes the conscripts share. While we observe high statistical significance from conscription variables (especially the conscripts share in the labour 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.

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 a much reduced adjusted R-squared (about 30%). 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% level. These regressions explain about 20% 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 II to IX. 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 labour 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.<sup>14</sup>

## **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 microeconomic 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 method 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 labour force share of conscripts, and by the duration of conscription or of an alternative service. With all these variables, conscription has a consistently negative and usually statistically significant effect. In line with previous studies (see the third

<sup>14</sup> Detailed material on the sensitivity analysis and extensions is available upon request.

section), 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 favourably biased towards military draft), Lau *et al.* (2004) estimate that conscription may cost an economy up to 1% of GDP. In an empirical study on Italy, Cipollone 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%.

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

## ACKNOWLEDGEMENTS

We are grateful for useful comments from two anonymous referees, and to Niclas Berggren, Jesús Crespo-Cuaresma, Henrik Jordahl, Doina Radulescu, seminar participants at the University of Linz, WZB Berlin, ETLA and VATT in Helsinki, IFN in Stockholm, and conference participants in Munich, Yaroslavl, Hanoi, and Paphos. Poutvaara acknowledges financial support from the Yrjö Jahnsson Foundation.

## References

- Anderson, G.M., Halcoussis, D. and Tollison, R.D. (1996) Drafting the competition: labor unions and military conscription. *Defence and Peace Economics* 7 189–202.
- Angrist, J.D. (1990) Lifetime earnings and the Vietnam era draft lottery: evidence from Social Security Administration records. *American Economic Review* 80 313–335.
- Benoit, E. (1973) *Defence and Economic Growth in Developing Countries*. Lexington: Lexington Books.
- Bermanke, B.S. and Gürkaynak, R.S. (2001) Is growth exogenous? Taking Mankiw, Romer, and Weil seriously. *NBER Macroeconomics Annual* 16 11–57.
- Cipollone, P. and Rosolia, A. (2007) Social interactions in high school: lessons from an earthquake. *American Economic Review* 97 948–965.
- Crespo-Cuaresma, J. and Reitschuler, G. (2003) A non-linear defence-growth nexus? Evidence from the US economy. *Defence and Peace Economics* 15 71–82.
- Deger, S. and Sen, S. (1995) Military expenditures and developing countries. In *Handbook of Defence Economics*, Vol. 1, edited by K. Hartley and T. Sandler. Amsterdam: Elsevier, 275–307.
- Dunne, J.P., Smith, R.P. and Willenbockel, D. (2005) Models of military expenditure and growth: a critical review. *Defence and Peace Economics* 16 449–461.
- EBCO (2001) European Union without compulsory military service: consequences for alternative service – a comparative study on the policies in EU-member states. EU-Study Paper No.1. Brussels: European Bureau for

<sup>15</sup> 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).

- Conscientious Objection and Heinrich Böll Foundation. Online at [http://www.ebco-beoc.org/Documents/boell\\_study2001.PDF](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, A.C. (1969) The cost of the draft and the cost of ending the draft. *American Economic Review* **59** 239–254.
- Gilroy, C.L. and Williams, C. (eds) (2006) *Service to Country: Personnel Policy and the Transformation of Western Militaries*. Cambridge, MA: MIT Press.
- Haltiner, K.W. (2003) The decline of the European mass armies. In *Handbook of the Sociology of the Military*, edited by G. Caforio. New York: Kluwer Academic/Plenum Publishers, 361–384.
- Hansen, W.L. and Weisbrod, B.A. (1967) Economics of the military draft. *Quarterly Journal of Economics* **81** 395–421.
- Heo, U. (1998) Modeling the defense-growth relationship around the globe. *Journal of Conflict Resolution* **47** 637–657.
- Heston, A., Summers, R. and Aten, B. (2000) *Penn World Table Version 6.1*. Center for International Comparisons at the University of Pennsylvania (CICUP).
- Holmlund, B. and Liu, Q. (2006) Mind the gap? Estimating the effects of postponing higher education. CESifo Working Paper 1792.
- Hooker, M.A. and Knetter, M.M. (1997) The effect of military spending on economic activity: evidence from state procurement spending. *Journal of Money, Credit, and Banking* **29** 400–421.
- IISS (1965) *The Military Balance: 1965–1966*. London: International Institute for Strategic Studies.
- IISS (1980) *The Military Balance: 1980–1981*. London: International Institute for Strategic Studies.
- IISS (1985) *The Military Balance: 1985–1986*. London: International Institute for Strategic Studies.
- Imbens, G. and van der Klaauw, W. (1995) Evaluating the cost of conscription in The Netherlands. *Journal of Business and Economic Statistics* **13** 207–215.
- Irish Defence Forces (2006) History, <http://www.military.ie/intro-duction/history.htm>.
- Islam, N. (1995) Growth empirics: a panel data approach. *Quarterly Journal of Economics* **110** 1127–1170.
- Kerstens, K. and Meyermans, E. (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, M., Loayza, N. and Villanueva, D. (1996) The peace dividend: military spending cuts and economic growth. *IMF Staff Papers* **43** 1–37.
- Kunze, A. (2002) The timing of careers and human capital depreciation. IZA Discussion Paper No. 509. Bonn: Institute for the Study of Labor.
- Lau, M.I., Poutvaara, P. and Wagener, A. (2004) Dynamic costs of the draft. *German Economic Review* **5** 381–406.
- Lee, D.R. and McKenzie, R.B. (1992) Reexamination of the relative efficiency of the draft and the all-volunteer army. *Southern Economic Journal* **59** 646–654.
- Lutz, D.S. (1996) Ist eine Freiwilligen-Streitkraft billiger? (Are all-volunteer forces cheaper?) In *Hamburger Beiträge zur Friedensforschung und Sicherheitspolitik*, edited by J. Gross and D.S. Lutz. Hamburg, 39–54.
- Mankiw, N.G., Romer, D. and Weil, D.N. (1992) A contribution to the empirics of economic growth. *Quarterly Journal of Economics* **107** 407–437.
- Mulligan, C. and Shleifer, A. (2005) Conscription as regulation. *American Law and Economics Review* **7** 85–111.
- Nonneman, W. and Vanhoudt, P. (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, <http://www.omhroi.gr/>.
- Poutvaara, P. and Wagener, A. (2007) Conscription: economic costs and political allure. *Economics of Peace and Security Journal* **2** 6–15.
- Ram, R. (1995) Defense expenditure and economic growth. In *Handbook of Defense Economics*, Vol. 1, edited by K. Hartley and T. Sandler. Amsterdam: Elsevier, 251–273.
- Sandler, T. and Hartley, K. (1995) *The Economics of Defense*. Cambridge: Cambridge University Press.
- Smith, A. (1976 [1776]) *An Inquiry into the Nature and Causes of the Wealth of Nations*. Oxford: Clarendon Press.
- Spencer, D.L. and Woroniak, A. (1969) Valuing transfer of military-acquired skills to civilian employment. *Kyklos* **22** 467–492.
- Stroup, M.D. and Heckelman, J.C. (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, J.H. von (1875) *Der isolierte Staat in Beziehung auf Landwirtschaft und Nationalökonomie*, 3rd edn. Berlin: Wiegandt, Hempel & Parey.
- United Nations (2003) World population prospects: the 2002 revision, population division. Department of Economic and Social Affairs.
- Warner, J.T. and Asch, B.J. (1995) The economics of military manpower. In *Handbook of Defense Economics*, Vol. 1, edited by K. Hartley and T. Sandler. Amsterdam: Elsevier, 348–398.
- Warner, J.T. and Asch, B.J. (1996) The economic theory of a draft reconsidered. *Defense and Peace Economics* **7** 297–315.
- Warner, J.T. and Asch, B.J. (2001) The record and prospects of the all-volunteer military in the United States. *Journal of Economic Perspectives* **15** 169–192.
- Warner, J.T. and Negrusa, S. (2005) Evasion costs and the theory of conscription. *Defense and Peace Economics* **16** 83–100.

- World Bank (2003) WDI Online, World Development Indicators. Washington, DC: World Bank.  
 World Bank (2004) World Development Indicators 2004 CD-ROM. Washington, DC: World Bank.  
 WRI (1998) Italy (1998 report). London: War Resisters' International. Online at <http://www.wri-irg.org/co/rtba/archive/italy.htm>.  
 WRI (2005) *Refusing to Bear Arms: A World Survey of Conscription and Conscientious Objection to Military Service*. London: War Resisters' International. Online at <http://www.wri-irg.org/co/rtba/index.html>.

## APPENDIX: DATA SOURCES

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

<i>Variables</i>	<i>Source</i>
Real GDP	Heston <i>et al.</i> (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 labour 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).