SHOULD EDUCATION AND MILITARY EXPENDITURES BE COMBINED FOR GOVERNMENT ECONOMIC POLICY?

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Abstract: *This paper examines the impact of EDUMILEX, namely the ratio between investment in education and military expenditure on economic performance, i.e. GDP per capita and labor productivity, using a panel data estimation for 60 countries over the period 2000-2018. The findings highlight a non-linear relationship. In particular, results suggest that a cubic relationship exists between EDUMILEX and economic performance. The value of EDUMILEX computed at the critical value can be considered the target variable for economic policy. Heterogeneity between developed and non-developed has been also investigated. Findings confirm that the effect of EDUMILEX is heterogeneous. Lower values of EDUMILEX are required to increase of economic performance in developed countries compared to non-developed ones.*

Keywords: Peace, Education, Military Expenditures, Economic Growth, Development.

Jel Codes: H56, H52, O47

Introduction

What is the appropriate economic policy to build peace in the long-run? This paper addresses this question by taking the conceptual insights of Caruso (2017) as point of departure. There, one normative proposal, among others, was that of considering the ratio of public education expenditure to military expenditure (hereafter EDUMILEX for sake of brevity) as relevant policy variable for a peaceful economic policy. This paper does constitute an enrichment of that idea because some simple econometric evidence is produced in order to support that proposal. In particular, we consider some measures of long-run growth, namely GDP per capita and labor productivity as dependent variables and we regress them against the EDUMILEX ratio for a panel of countries across the period 2000-2018.

Why combining investment in education and military expenditure? The choice of this ratio appears to be reasonable in the light of the existing literature. On the one hand, almost all economists agree on the positive impact of education on economic growth in the long run [see among others Hanushek and Woessmann (2020), Marconi (2018), Benos and Zotou (2014), Krueger and Lindhal (2001)]. On the other hand, prevailing literature shows the negative impact of military expenditures on growth [see among others Dunne and Tian (2020, 2016), D'Agostino et al. (2019), Awaworyi Churchill and Yew (2018)]. Then, it seems that military expenditures and investment in education may be considered countervailing forces for economic growth. However, to the best of our knowledge there are no studies which attempt to consider both of them interdependently. In this respect, a first step in this direction is the evidence provided in Keller et al. (2009) that investigate the relationship between military draft and economic growth in OECD countries. The empirical results show that countries with military draft have exhibited poorer economic performance compared to countries with an all-volunteer recruitment of military personnel. In fact, military conscription seems to have a negative impact on human capital accumulation because it diverts younger people from studying. Indirect confirmation of such negative relationship between education and military expenditure is the evidence produced by Cipollone and Rosolia (2007). There the authors show that after an earthquake hit Southern Italy in 1980, young men were exempted from compulsory military service and eventually that exemption determined high-school-graduation rates of boys by more than 2 percentage

points. Moreover, due to peer-effect, graduation rates of young women also increased. In brief, exemption from military conscription has increased human capital. In broader terms, the choice of taking the balance between productive activities and unproductive activities as key-driver for economic growth, is in line with historical account provided by Baumol (1990).

The paper is organised as follows: in the next section we present the relevant variables and long-run correlations by means of several plots. In the following section, we run a panel data estimation. The final section summarizes the results and concludes.

The relevant variables

Our analysis focuses on the impact of EDUMILEX ratio on per capita GDP and labor productivity. The main explanatory variable, EDUMILEX, is defined as the ratio of public investment in education over military expenditure.

$$EDUMILEX = \frac{Public\ investment\ in\ education\ (constant\ \$)}{Military\ expenditures\ (constant\ \$)}$$

Public investment in education in current dollars are from UNESCO[1] dataset. They also are converted in constant dollars (base year 2015) by means of Consumer Price Index from Bureau of Labor Statistics. Unfortunately, data for some relevant countries as China, France or Republic of Korea are not available. Data on military expenditure are provided by Stockholm International Peace Research Institute (SIPRI). We use data in current dollars, and we converted in 2015 constant dollars. Table 2 shows the EDUMILEX ratio for some selected countries. At first glance, two stylized facts emerge: first, it seems that the EDUMILEX ratio has grown over time for several countries. Then, almost evidently secondly countries that have lowest EDUMILEX ratio (Colombia, Israel, Russian Federation, United States, Iran) are frequently involved in armed conflicts. In addition, high-income countries show lower EDUMILEX ratios than middle-income countries with a few exceptions as United States.

[1] Germany data are from OECD.

Table 1. EDUMILEX ratio for some selected countries

Country	2000	2010	2018
United States	1.93	1.36	-
United Kingdom	1.72	2.15	2.50
Russian Federation	0.83	-	1.26
France	-	-	2.93
China	-	-	-
Argentina	3.98	6.12	6.66
Brazil	2.28	3.67	4.14
Colombia	1.16	1.33	1.47
Germany	2.98	3.45	-
Ireland	5.94	10.52	11.79
Israel	0.97	0.93	1.15
Italy	2.47	2.88	3.13
Iran	0.55	1.14	1.57
Japan	3.52	3.48	3.25
Kenya	4.04	3.27	3.76
Mexico	9.32	11.39	8.90
New Zealand	-	4.40	4.96
Spain	2.42	3.50	3.33

Our hypothesis is that the greater the EDUMILEX ratio is at a certain point in time, the greater the level of GDP per capita and labor productivity will be in the long run. Put differently, we aim to test whether the EDUMILEX ratio at time t can be expected to have a positive impact on growth measures at $t+n$.

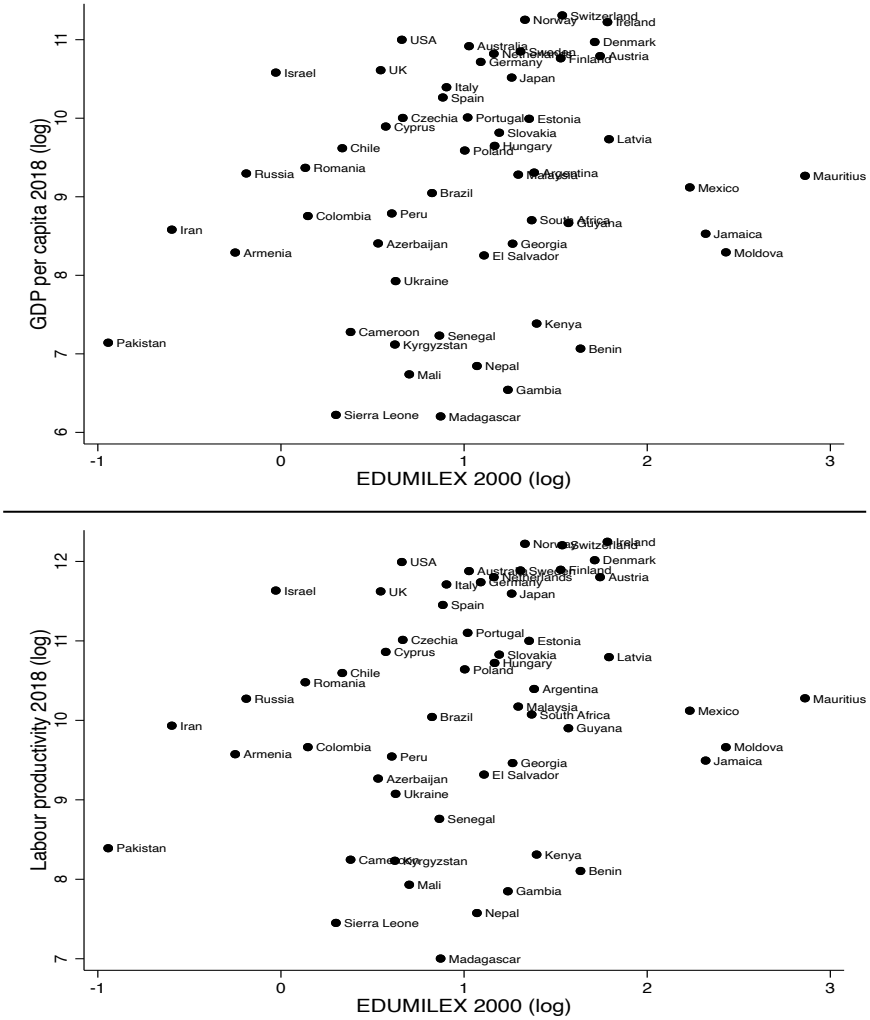
We compute labor productivity as the ratio between GDP and the number of employed persons in line with the definition provided by International Labor Organization[2]. Figures of GDP in current dollars are from UNCTAD, then converted in constant dollars (base year 2015) using Consumer Price Index from Bureau of Labor Statistics. The number of employed persons has been computed by multiplying the employment rate of 15+ population and working age population (15-64) from World Bank. GDP per capita is computed as the ratio of GDP (UNCTAD) over total population (World Bank). The plots below depict a long-run relationship between the EDUMILEX ratio, and the development measures used. We use data for 60 countries[3]

[2] https://ilostat.ilo.org/resources/concepts-and-definitions/description-labour-productivity/

[3]Countries included in the panel are: Argentina, Armenia, Australia, Austria, Azerbaijan, Benin, Brazil, Cameroon, Chile, Colombia, Côte d'Ivoire, Cyprus, Czech Republic, Denmark, El Salvador, Estonia, Finland, The Gambia,

for the period 2000-2018. In particular, our sample include 28 current high-income countries and 32 current middle- and low-income countries according to World Bank classification. Figure 1 shows on the top the relationship between GDP per capita in 2018 and the EDUMILEX ratio in 2000 and, on the bottom, the relationship between labor productivity in 2018 and EDUMILEX ratio in 2000. As we may observe, a positive relationship exists. In other words, countries which had higher levels of EDUMILEX ratio in 2000, exhibit better economic performance in 2018 both in terms of productivity and GDP per capita.

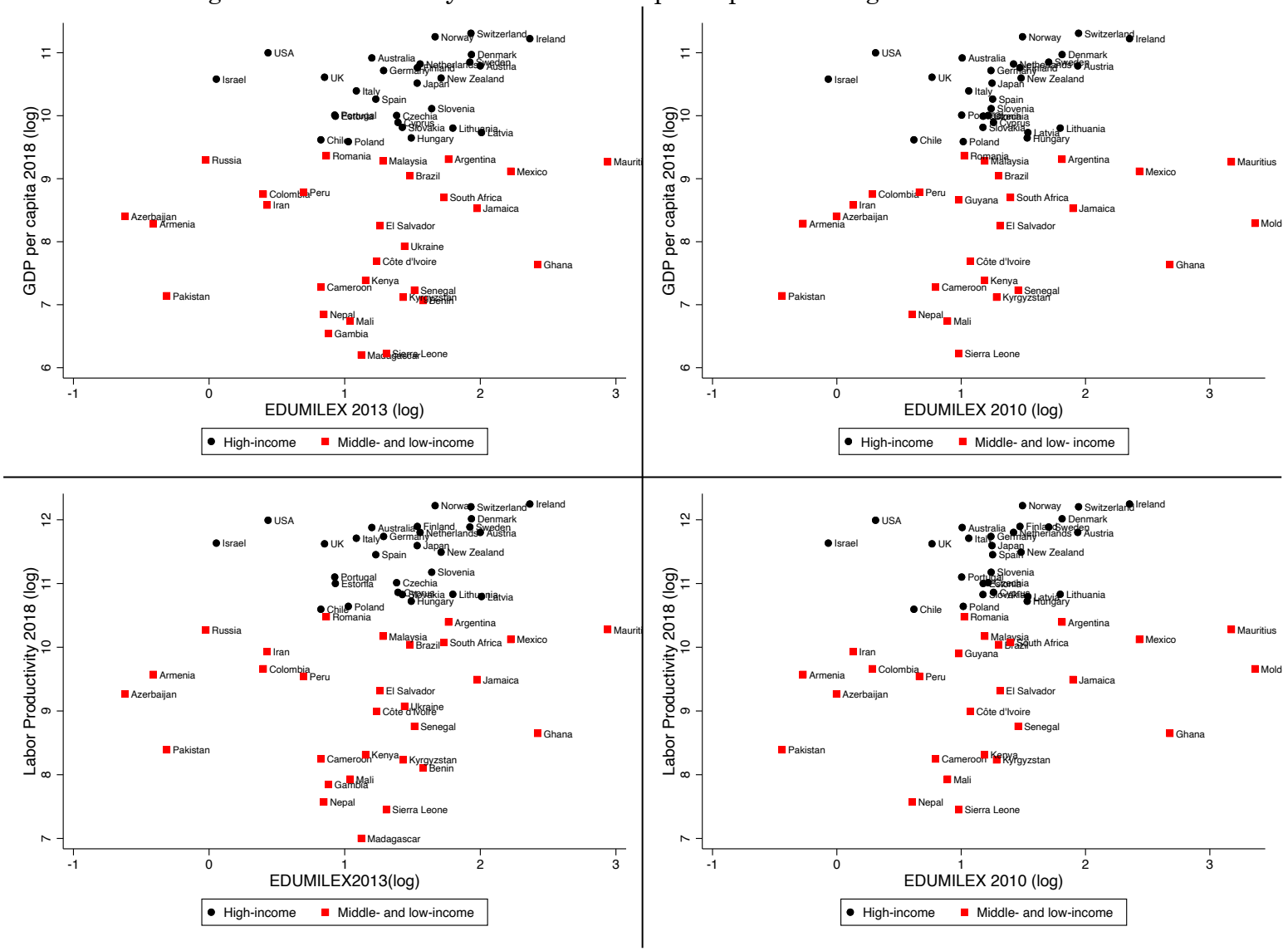
Figure 1. Productivity 2018 and GDP per capita 2018 against the EDUMILEX ratio



Georgia, Germany, Ghana, Guyana, Hungary, Iran, Ireland, Israel, Italy, Jamaica, Japan, Kenya, Kyrgyz Republic, Latvia, Lithuania, Madagascar, Malaysia, Mali, Mauritius, Mexico, Moldova, Nepal, Netherlands, New Zealand, Norway, Pakistan, Peru, Poland, Portugal, Romania, Russian Federation, Senegal, Sierra Leone, Slovakia, South Africa, Spain, Sweden, Switzerland, United Kingdom, Ukraine, United States.

The visual analysis of the plots confirms the expected positive relationship between EDUMILEX ratio and GDP per capita or labor productivity alternatively. However, it seems that plots reveal a non-linear relationship and the presence of multiple equilibria. In addition, the same suggestion comes from recent empirical works such as Tiwari and Shahbaz (2013) and Dunne and Tian (2015). In order to infer additional insights about such relationship we present the same plots highlighting the difference between high-income and middle- low-income countries with different time lags. Figures 2 show the relationship between EDUMILEX ratio and GDP per capita and labor productivity respectively at t-5 and t-8.

Figure 2. Productivity 2018 and GDP per capita 2018 against the EDUMILEX ratio



The panel data analysis

In what follows we employ a parsimonious panel data analysis. Hereafter we estimate the following simple econometric model:

$$y_{i,t} = \beta_0 + \beta_1 y_{i,t-1} + \beta_2 EDUMILEX_{i,t-n} + \beta_3 EDUMILEX^2_{i,t-n} + \beta_3 EDUMILEX^3_{i,t-n} + X_{it} + \epsilon_{i,t}$$

Where y denotes alternatively (i) the GDP per capita and (ii) the labor productivity and the number of lags n is equal to 5 and 8 alternatively. X_{it} is the vector of control variables. We use as control variables military conscription and Electoral Democracy Index (EDI) only. The first is a dummy which is equal to 1 if military draft is in force in country i at time t. Information are drawn from CIA World Factbook. Most countries (75% of the sample) show no change in their military recruitment policies during the relevant period such as US which enduringly relies on all-volunteer recruitment of military personnel or Russian Federation which, conversely, has chosen military draft as a permanent recruitment strategy. In Europe, by contrast, we observe changes in the military recruitment strategy. Countries such as Italy, Portugal or Spain abolished conscription in the early 2000s, so we can account for a lasting change in military recruitment strategy. Countries such as Sweden or Ukraine which abolished conscription respectively in 2010 and 2012 has reinstated it (respectively in 2018 and 2014) to counter the deteriorating security situation. Electoral Democracy Index (EDI) provided by V-Dem measures to what extent country i at time t accomplish electoral democracy features of polyarchies as defined by Dahl (1971). It ranges from 0 (low) to high (1). In fact, the quality of political and economic institutions (Acemoglu and Robinson, 2012, Monteforte and Temple, 2020) has an undeniable impact on development paths. In particular, Acemoglu et al. (2019) highlighted that democracy is pivotal for economic growth because democracies tend to invest more in human capital compared to autocratic regimes. Moreover, several studies show that democracies tend to exhibit lower levels of military expenditure compared to autocratic regimes (Mulligan, Gil, Sala-i-Martin, 2004; Albalate, Bel and Elias, 2012). Table 2 summarizes the descriptive statistics of the data used in the panel regression.

Table 2. Descriptive statistics

Variable	Source	Obs	Mean	Std. dev.	Min	Max
EDUMILEX	UNESCO/SIPRI	1,068	4.25	3.95	0.29	33.44
GDP per capita	UNCTAD/World Bank	1,200	18,964.71	21,640.79	258.41	106,721.5
Labor productivity	UNCTAD/World Bank	1,200	46,129.91	51,383.07	511.35	248480.6
Military Conscription	CIA The World Factbook	1,200	0.45	0.50	0	1
Electoral Democracy Index	V-Dem	1,200	0.69	0.22	0.16	0.919

Results of the OLS fixed-effect estimation are presented in Table 3 and Table 4. We also use random effects to ensure that results remain robust. However, the Hausman test suggest that the fixed-effect model is more appropriate. When considering GDP per capita as dependent variable, findings show a non-linearity. In detail data suggest that between GDP per capita and EDUMILEX ratio a cubic relation exists. This means that for very low levels of EDUMILEX ratio, an increase of that ratio will result in increased GDP per capita until a critical level after which GDP per capita starts to decrease. After reaching the minimum level of GDP per capita, any additional increase of EDUMILEX ratio generates further GDP per capita growth. In practice as the EDUMILEX ratio is beyond some critical level then we observe an increase in GDP per capita. Such result holds when the EDUMILEX ratio is five-years lagged and eight-year lagged. The same relationship is suggested for labor productivity and EDUMILEX ratio, even though it is statistically significant only when the EDUMILEX ratio is eight-years lagged.

Table 3. GDP per capita and EDUMILEX ratio.

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable	Gdp per capita (log)	Gdp per capita (log)	Gdp per capita (log)	Gdp per capita (log)	Gdp per capita (log)	Gdp per capita (log)
GDP per capita$_{t-1}$ (log)	**0.732*****	**0.732*****	**0.727*****	**0.680*****	**0.660*****	**0.651*****
	(0.016)	(0.016)	(0.016)	(0.029)	(0.028)	(0.028)
EDUMILEX$_{t-5}$ (log)	-0.022	-0.001	0.002			
	(0.141)	(0.020)	(0.020)			
EDUMILEX$_{t-5}$ (log) squared		**-0.037****	**-0.035****			
		(0.017)	(0.017)			
EDUMILEX$_{t-5}$ (log) cubic		**0.010***	**0.009***			
		(0.005)	(0.005)			

$EDUMILEX_{t-8}$ (log)				0.004	0.023	0.031
				(0.017)	(0.023)	(0.023)
$EDUMILEX_{t-8}$ (log) squared					**-0.081*****	**-0.086*****
					(0.020)	(0.020)
$EDUMILEX_{t-8}$ (log) cubic					**0.025*****	**0.026*****
					(0.006)	(0.006)
Military conscription			0.002			-0.034
			(0.020)			(0.026)
Electoral Democracy Index			**0.139****			**0.156****
			(0.063)			(0.076)
Constant	**2.493*****	**2.510*****	**2.454*****	**2.943*****	**3.168*****	**3.149*****
	(0.144)	(0.146)	(0.150)	(0.258)	(0.261)	(0.261)
Groups	60	60	60	60	60	60
Obs.	846	846	846	673	673	673
R-squared within	0.7333	0.7349	0.7366	0.4937	0.5094	0.5141
R-squared between	0.9996	0.9995	0.9992	0.9998	0.9994	0.9986
R-squared overall	0.9951	0.9949	0.9949	0.9954	0.9949	0.9942

Standard error in parentheses. *** significant at 1%, **significant at 5%, *significant at 1%. For sake of readability statistically significant coefficients are in bold.

Table 4. Productivity and EDUMILEX ratio

	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Dependent variable	Labor productivity (log)	Labor productivity (log)	Labor productivity (log)	Labor productivity (log)	Labor productivity (log)	Labor productivity (log)
Labor $productivity_{-1}$ (log)	**0.759*****	**0.760*****	**0.752*****	**0.660*****	**0.639*****	**0.627*****
	(0.013)	(0.013)	(0.014)	(0.027)	(0.027)	(0.027)
$EDUMILEX_{t-5}$ (log)	0.005	0.010	0.014			
	(0.015)	(0.020)	(0.020)			
$EDUMILEX_{t-5}$ (log) squared		-0.015	-0.012			
		(0.017)	(0.017)			
$EDUMILEX_{t-5}$ (log) cubic		0.005	0.004			
		(0.005)	(0.005)			
$EDUMILEX_{t-8}$ (log)				**0.033***	0.033	**0.044***
				(0.017)	(0.023)	(0.023)
$EDUMILEX_{t-8}$ (log) squared					**-0.069*****	**-0.075*****
					(0.020)	(0.020)
$EDUMILEX_{t-8}$ (log) cubic					**0.026*****	**0.027*****
					(0.006)	(0.006)
Military conscription			-0.017			**-0.048***
			(0.021)			(0.027)

Electoral Democracy Index			**0.161**** (0.063)			**0.187**** (0.078)
Constant	**2.462***** (0.131)	**2.466***** (0.134)	**2.430***** (0.139)	**3.445***** (0.272)	**3.694***** (0.277)	**3.705***** (0.276)
Groups	60	60	60	60	60	60
Obs.	846	846	846	673	673	673
R-squared within	0.8126	0.8129	0.8145	0.5042	0.5195	0.5264
R-squared between	0.9996	0.9997	0.9987	0.9992	0.9987	0.9962
R-squared overall	0.9947	0.9947	0.9940	0.9943	0.9936	0.9913

Standard error in parentheses. *** significant at 1%, **significant at 5%, *significant at 1%. For sake of readability statistically significant coefficients are in bold.

In order to infer a policy prescription, we have computed the critical values of such non-linearities. In fact, at the critical value we can compute the value of the ratio beyond which the relationship between the EDUMILEX ratio and dependent variables turned to be unambiguously positive. The critical value of EDUMILEX may be considered the target variable for economic policy.

The minimum critical value is computed when the first derivative of the function is zero and the second derivative is positive at that point. When GDP per capita is the dependent variable and EDUMILEX is eight-years lagged, the function derived from the regression is therefore $y = 3.17 + 0.023\,x - \ 0.069\,x^2 + \ 0.025\ x^3$. Then the minimum critical value is 2, and therefore taking the natural antilog the value of EDUMILEX is 7.39. If control variables are included, the critical value of EDUMILEX rises to 7.46. When labor productivity is the dependent variable, the coefficient associated with EDUMILEX ratio at *t-8* is 1.49 and therefore taking the natural antilog the critical value of EDUMILEX is 4.44. If the control variables are included the critical value of EDUMILEX increases slightly to 4.53.

In sum, regression results indicate that: (i) if we consider GDP per capita as dependent variable, a higher value of EDUMILEX ratio is required to enable long-lasting growth compared to labor productivity as dependent variable; (ii) when the model is augmented by means of control variables, the critical value of EDUMILEX ratio slightly increase whatever the dependent variable. Overall regression results confirm the hypothesis that current higher EDUMILEX ratio is associated to better economic performance in the future.

Since existing literature explains that the impact of military expenditures may differ between developed and developing economies [see for example Kollias and Paleologou (2019)], we hypothesize that critical levels of EDUMILEX ratio could differ substantially between developing and developed countries. Then we split our sample in two sub-samples: high income countries and middle- and low-income countries. Results of OLS fixed-effect regression are in Table 6 and Table 7 for high-income and middle- and low- income countries respectively. Regression results confirm the previous findings. In the two sub-samples cubic coefficient of EDUMILEX when it is eight-years lagged is statistically significant whatever the dependent variable. Moreover, as predicted, the critical values of the EDUMILEX ratio differ between the two sub-samples. When GDP per capita is the dependent variable, the critical value of eight-years lagged EDUMILEX ratio is 4.48 for high-income countries and 8.85 for middle- and low- income countries when control variables are not included, and it is 4.66 for high-income countries and 8.76 for middle- and low-income countries when control variables are included. When labor productivity is the dependent variable, the critical value of eight-years lagged EDUMILEX ratio is 3.63 for high-income countries and 5.99 for middle- and low- income countries when control variables are not included, and it is 3.82 for high-income countries and 6.36 for middle- and low-income countries when control variables are included.

For sake of readability, Table 5 summarizes the critical values of the EDUMILEX ratio for all the statistically significant regressions. In detail in the column EDUMILEX we highlight the critical values of EDUMILEX required for prompting an increase in economic performance.

In sum, regression results suggest that in middle- and low- income countries EDUMILEX ratio should be considerably higher compared to high-income countries in order to trigger economic growth. In detail, it should be almost double if the dependent variable is GDP per capita, and around 65% higher if the dependent variable is labor productivity. In brief: (1) EDUMILEX critical values are higher when the dependent variable is GDP per capita compared to labor productivity in both sub-samples; (2) EDUMILEX critical values are higher when controls are included in the regression in both sub-samples.

Table 5. Critical values 8-years lagged EDUMILEX ratio

	Dependent variable	**Controls**	**EDUMILEX**
All countries	GDP per capita	No	7.39
High Income	GDP per capita	No	4.48
Middle and Low Income	GDP per capita	No	8.85
All countries	GDP per capita	Yes	7.46
High Income	GDP per capita	Yes	4.66
Middle and Low Income	GDP per capita	Yes	8.76
All countries	Labor productivity	No	4.44
High Income	Labor productivity	No	3.63
Middle and Low Income	Labor productivity	No	5.99
All countries	Labor productivity	Yes	4.53
High Income	Labor productivity	Yes	3.82
Middle and Low Income	Labor productivity	Yes	6.36

Notes: In column EDUMILEX we highlight the critical values of EDUMILEX ratio beyond which economic performance, namely GDP per capita and labor productivity, unambiguously increase.

Table 6. Baseline results – High Income Countries

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variable	Gdp per capita (log)	Gdp per capita (log)	Gdp per capita (log)	Gdp per capita (log)	Labor productivity (log)	Labor productivity (log)	Labor productivity (log)	Labor productivity (log)
GDP per capita$_{t-1}$ (log)	**0.678*****	**0.679*****	**0.635*****	**0.639*****				
	(0.030)	(0.031)	(0.042)	(0.043)				
Labor Productivity$_{t-1}$ (log)					**0.708*****	**0.698*****	**0.507*****	**0.506*****
					(0.024)	(0.025)	(0.047)	(0.047)
EDUMILEX$_{t-5}$ (log)	0.008	0.010			0.067	0.068		
	(0.166)	(0.166)			(0.159)	(0.159)		
EDUMILEX$_{t-5}$ (log) squared	-0.127	-0.137			-0.151	-0.161		
	(0.136)	(0.136)			(0.130)	(0.130)		
EDUMILEX$_{t-5}$ (log) cubic	0.046	0.049			**0.058***	**0.062***		
	(0.035)	(0.035)			(0.034)	(0.034)		
EDUMILEX$_{t-8}$ (log)			0.061	0.090			-0.013	0.026
			(0.196)	(0.199)			(0.189)	(0.190)
EDUMILEX$_{t-8}$ (log) squared			-0.209	-0.240			-0.140	-0.184
			(0.161)	(0.165)			(0.155)	(0.157)
EDUMILEX$_{t-8}$ (log) squared			**0.084****	**0.091****			**0.075***	**0.087****
			(0.042)	(0.043)			(0.040)	(0.041)
Military conscription		0.005		-0.009		-0.027		-0.026
		(0.020)		(0.025)		(0.019)		(0.023)
Electoral Democracy Index		-0.145		-0.118		-0.143		-0.167
		(0.119)		(0.130)		(0.114)		(0.124)
Constant	**3.449*****	**3.572*****	**3.859*****	**3.927*****	**3.358*****	**3.610*****	**5.682*****	**5.846*****
	(0.312)	(0.344)	(0.467)	(0.475)	(0.274)	(0.303)	(0.554)	(0.563)
Groups	406	406	325	325	406	406	325	325
Obs.	28	28	28	28	28	28	28	28

R-squared within	0.5927	0.5944	0.4926	0.4943	0.7213	0.7241	0.3926	0.3993
R-squared between	0.9923	0.9905	0.9944	0.9930	0.9980	0.9957	0.9893	0.9854
R-squared overall	0.9717	0.9698	0.9750	0.9735	0.9765	0.9732	0.9664	0.9615

Standard error in parentheses. *** significant at 1%, **significant at 5%, *significant at 1%. For sake of readability statistically significant coefficients are in bold.

Table 7. Baseline results – Middle and Low Income Countries

	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
Dependent variable	Gdp per capita (log)	Gdp per capita (log)	Gdp per capita (log)	Gdp per capita (log)	Labor productivity (log)	Labor productivity (log)	Labor productivity (log)	Labor productivity (log)
GDP per capita$_{t-1}$ (log)	**0.747*****	**0.736*****	**0.667*****	**0.641*****				
	(0.199)	(0.020)	(0.038)	(0.039)				
Labor productivity$_{t-1}$ (log)					**0.773*****	**0.762*****	**0.668*****	**0.638*****
					(0.017)	(0.018)	(0.036)	(0.036)
EDUMILEX$_{t-5}$ (log)	0.005	0.009			0.016	0.022		
	(0.023)	(0.023)			(0.023)	(0.024)		
EDUMILEX$_{t-5}$ (log) squared	**-0.033***	-0.031			-0.016	-0.013		
	(0.020)	(0.020)			(0.021)	(0.021)		
EDUMILEX$_{t-5}$ (log) cubic	0.007	0.006			0.003	0.002		
	(0.006)	(0.006)			(0.006)	(0.006)		
EDUMILEX$_{t-8}$ (log)			0.026	0.046*			0.036	**0.058****
			(0.026)	(0.026)			(0.027)	(0.028)
EDUMILEX$_{t-8}$ (log) squared			**-0.088*****	**-0.105*****			**-0.077*****	**-0.096*****
			(0.024)	(0.024)			(0.025)	(0.025)
EDUMILEX$_{t-8}$ (log) squared			**0.025*****	**0.029*****			**0.025*****	**0.029*****
			(0.007)	(0.007)			(0.007)	(0.007)
Military conscription		-0.012		**-0.142****		-0.001		**-0.139****
		(0.052)		(0.065)		(0.054)		(0.068)
Electoral Democracy		**0.203*****		**0.258****		**0.230*****		**0.307*****

Index		(0.078)		(0.099)		(0.081)		(0.104)
Constant	**2.086*****	**2.060*****	**2.732*****	**2.867*****	**2.084*****	**2.047*****	**3.043*****	**3.203*****
	(0.157)	(0.164)	(0.311)	(0.312)	(0.151)	(0.158)	(0.321)	(0.321)
Groups	440	440	348	348	440	440	348	348
Obs.	32	32	32	32	32	32	32	32
R-squared within	0.7829	0.7866	0.5257	0.5428	0.8418	0.8449	0.5693	0.5864
R-squared between	0.9987	0.9955	0.9983	0.9826	0.9990	0.9947	0.9984	0.9748
R-squared overall	0.9867	0.9850	0.9867	0.9707	0.9862	0.9826	0.9855	0.9622

Standard error in parentheses. *** significant at 1%, **significant at 5%, *significant at 1%. For sake of readability statistically significant coefficients are in bold.

Conclusions

The aim of this paper was to propose a target variable for a peaceful economic policy based on the evidence that education and military expenditures are countervailing factors in securing long-run growth. The key implication from a policy perspective is that balancing appropriately the investments in education and burden of unproductive military spending is a first-order importance for economic performance in the long-run. In order to analyse that, we have employed the ratio between public investment in education and military expenditures – here named EDUMILEX – as relevant variable to capture the impact of such balance on economic growth in the long-run. Findings exhibit a non-linear relationship between the EDUMILEX ratio and both GDP per capita and labor productivity. In particular data suggest that between GDP per capita and the EDUMILEX ratio a cubic relation exists. This means that for very low levels of EDUMILEX ratio, an increase of that ratio will result in increased GDP per capita until a critical level after which GDP per capita decreases. Eventually, beyond a critical value any additional increase of EDUMILEX ratio generates further GDP per capita growth. In a policy perspective it is reasonable that we consider the minimum critical value of the function derived from the regression as a target variable for economic policy. In fact, when considering GDP per capita as dependent variable and EDUMILEX was eight years lagged the computed target variable is 4.5 for high-income countries and 8.9 for middle and low-income countries. When labor productivity is considered and EDUMILEX was eight years lagged, the target variable computed is 3.8 for high-income countries and 6.3 for middle- and low-income economies. If we take a look to current data, it is clear that several developed economies appear to be far from such values.

Needless to say, this work cannot be considered as a conclusive evidence. However, it could be a point of departure for future research intended to provide policy-makers with a workable set of instruments for a peaceful economic policy.

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