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Research Article

The Nexus of Economic Growth, Military Expenditures, and Income Inequality

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Abstract

This paper examines the effect of military expenditures on economic growth by utilizing dynamic panel data analysis for 82 countries for the period of 1988-2008. Considering the possible effect of inequality on the military expenditures-economic growth nexus, this paper incorporates inequality along with its interaction with human capital into an augmented Solow growth model. The general finding is that military expenditures have a negative impact on economic growth, valid for several model specifications and sensitivity analyses. The negative impact holds when heterogeneity stemming from different country groups (e.g. development level, arms trade, fuel dependency) is considered. Also, the findings show that negative impact of military expenditure on growth for arms exporter and/or arms importer countries is weaker than those for other countries. Regarding income inequality and human capital, the findings suggest that human capital has a positive effect on growth, as expected. Income inequality on the other hand, has negative direct effect on economic growth. Considering these two variables together, the findings show that income inequality deteriorates growth for lower levels of human capital, whereas the impact of inequality on growth turns out to be positive for higher levels of human capital.

Keywords: Military expenditure, growth, income inequality, human capital, Solow growth model.

JEL Codes: C22, H56, O11

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1. Introduction

Since the seminal works of Benoit (1973, 1978) the literature on military expenditure and economic growth utilized different growth models, namely the Feder-Ram (Biswas and Ram, 1986), the Deger type model (Deger and Smith, 1983; Deger, 1986), the model of Barro (1990), the augmented Solow growth model (Mankiw et al., 1992), and the new macroeconomic model of Romer (2000) and Taylor (2000). Some early studies (Ram, 1995; Dunne, 1996; Smith, 2000) as well as recent ones (Dunne and Uye, 2010; Alptekin and Levin, 2012; Awaworyi and Yew, 2014) review this extensive literature on military expenditures and economic growth nexus. Although empirical works provide inconclusive evidence in general, three major tendencies can be stated. Accordingly, i) both negative and ambiguous effects of military expenditures on economic growth are more commonly found than positive effect, ii) recent studies with advanced methods are likely to find negative effect, iii) positive effect is more pronounced in the case of developed countries.

This study aims to further investigate the relationship between military expenditures and economic growth. We adopt the model that is adapted by Töngür and Elveren (2016), departing from Dunne et al. (2005) and Dunne and Nikolaidou (2011) based on the augmented Solow growth model that was introduced by Mankiw et al (1992). Töngür and Elveren (2016), in the case of Turkey, examine the relationship between military expenditures and economic growth by considering the Theil pay inequality index provided by the University of Texas Inequality Project (UTIP) for the period of 1963-2008. We extend their analysis to 82 countries for the period of 1988-2008 in a more comprehensive analysis by employing system GMM method and by paying special attention to heterogeneity.

In the next section we briefly review the literature. Sections III and IV present the model and data, respectively. Section V introduces the empirical strategy. Section 6 is reserved for the results and discussion. Finally, we summarize the findings in the conclusion.

2. Literature Survey

There are several theoretical approaches to examine the impact of military expenditures on economic growth (Dunne et al., 2005). From a supply-side perspective neoclassical models explain opportunity costs of military expenditures, as resources used by the military would not be available for civilian use. For example, crowding-out of investment may change the capital stock.

Keynesian models consider military expenditures as part of general government expenditures. Adopting a demand-side perspective the models state that increase in military spending boosts aggregate demand (i.e. multiplier effect) and, if there is spare capacity, which in turn increases utilization of resources. However, military expenditures may crowd-out investment or other forms of expenditures. Therefore, how it is financed (i.e. cuts in other public expenditures, increased taxes, borrowing or expansion of money supply) will determine the extent and form of crowding-out.

Military Keynesianism is the policy of using military expenditures as countercyclical and economic tools. However, there is no specific theory of military Keynesianism. The MIC (military-industrial complex), on the other hand, has a sound institutional perspective to explain military power and conflict (Dunne, 2011). The MIC is defined as unified groups of vested interests within the state that result in decisions favorable to those in power and not necessarily favorable to the requirements of national security. This is an important explanation of high military expenditures during the Cold War.

The MIC theory argues for the detrimental effects of military expenditures on the economy. This is because defense spending arguably does not result in economic growth, and

even channels resources away from civilian industries that are more productive (Melman, 1965). Within the MIC, the Defense Department de facto acts like a 'planning ministry' (Melman, 1970), transforming the economy into a military-based 'state capitalism' (Melman, 1974). However, Melman also points to the 'positive' role of military expenditures by stating that military expenditures may have Keynesian economic effects.

Many aspects of the MIC have remained even after the Cold War. Major contractors continue to dominate the market and heavily influence government policy. Contractors are, in turn, dependent on domestic government support despite the internationalization of the military industry. New firms have been unable to displace incumbents in core areas of arms production (Dunne and Sköns, 2011). Therefore, the MIC theory continues to be relevant in explaining the impact of vested interests.

Some scholars argued that military expenditures may have an impact on the economy both in terms of capital productivity and the organic composition of capital within a Marxian framework, presenting the conflicting role of military expenditures on the economy (e.g., Elveren and Hsu, 2015). The Marxist literature about the effect of military expenditures on the economy presents diverse linkages based on different crisis theories with different underlying assumptions.

The studies that utilize Keynesian, neoclassical and structuralist models have provided conflicting results on the issue for different set of countries (inter alia Dunne, 1996; Knight et al., 1996; Smith, 2000; Yakovlev, 2007; Hou and Chen, 2013). Empirical works that rely on different models and assumptions within a distinct theoretical approach have provided inconclusive results on the impact of military expenditures on economic growth.

We adopt an augmented Solow growth model suggested by Mankiw et al. (1992) in order to investigate the possible relationship between military expenditure and economic growth while considering the possible impact of income inequality.

The growth-inequality nexus is one of the most crucial and controversial topics among economists. How inequality affects growth can be explained in five ways in general (Nissanke and Thorbecke, 2010; Barro, 2000). First, individuals with higher income have higher savings rate; that is, the marginal propensity to save out of profit is higher than that out of wages, therefore, redistribution of income from poor to rich results in higher savings and higher investment in physical capital. Therefore, higher inequality stimulates economic growth. Second, since investment projects have large sunk costs, a concentration of assets is a condition for higher investment rates. That is, higher inequality in terms of the distribution of wealth increases the probability to invest, which in turn enhances growth. Third, high inequality increases the incentives to work harder and to invest to take advantage of high rates of return. Therefore, if there is equality among individuals in terms of earnings there will be no encouragement for one to make an effort that creates more output. In other words, higher income dispersion is a natural result of differing work efforts and this has positive effect on total output.

On the other hand, two theories point out the negative impact of inequality on growth. First, in the case of imperfect financial markets, poor people have a tendency to invest less in human capital that offers relatively high rates of return, benefitting society at large. Therefore, in this case a distortion in terms of the redistribution of wealth from poor to rich decreases the average productivity of investment. That is, under-investment by the poor implies that economic growth is likely to be lower in the case of imperfect financial markets. And, finally, according to the new political economy of development theories (i.e. modern theories), inequality may reduce economic growth because voters, as reaction to unbearable inequality, ask for higher taxes and disfavor pro-business policies, creating political and social instability

which leads to greater uncertainty and lower investment incentive (inter alia Alesina and Rodrik, 1994; Kanbur, 2000); unproductive rent-seeking activities, high transaction costs, and increased insecurity of property rights (Nissanke and Thorbecke, 2010: 798).

The immense empirical literature on the nexus of growth and inequality provides inconclusive evidence, the results change with respect to disparity in coverage, estimation method, data quality, and inequality measure adopted (Töngür and Elveren, 2016; Cingano, 2014). Although it has been shown that the more unequal an economy is the slower it grows (inter alia Alesina and Rodrik, 1994; Person and Tabellini, 1994; Ravallion, 1995; Peroti, 1996; Garcia-Penalosa and Turnovsky, 2006; Cingano, 2014), it is also argued that problems this negative relationship is not robust due to the lack of high quality data and comparability (Ferreira, 1999). For instance, using advanced econometric methods and a more comprehensive data set Forbes (2000) found a positive relationship between inequality and growth along with some others (for example Li and Zou, 1998; Lundberg and Squire, 2003). Barro (2000) and Castello-Climent (2010) shows that while inequality has a negative effect on growth in low and middle income countries, the effect becomes positive or insignificant for higher income countries. In sum, an immense and fast growing empirical literature on the nexus of economic growth and income inequality is inconclusive.

The role of human capital in economic growth (Becker, 1967), and how inequality affects human capital both via health and education is of importance. That is why we would like to emphasize the role of inequality in economic growth via human capital. This attempt will allow us to better understand the nexus of military expenditures-growth and inequality, because inequality is a key determinant of growth that needs to be considered in the military expenditures-growth analyses.[3]

Inequality affects economic growth by increasing fertility and reducing life expectancy (Dahan and Tsiddon, 1998; Kremer and Chen, 2002; De la Croix and Doepke, 2003; Moav, 2005; Castello-Climent and Domenech, 2008; Castello-Climent, 2011). Castello-Climent (2011) states that, ceteris paribus, higher inequality in the distribution of education leads to both higher fertility rates and higher differential fertility rates between lower and higher educated parents, which in turn generate less accumulation of human capital and to a lower rate of economic growth.

The model suggested by Kremer and Chen (2002) points out a direct linkage between income inequality and education level and fertility rate. The authors construct their model based on the assumption that the optimal fertility rate is a decreasing function of wages because as household income increases the opportunity cost of rearing children rises since substitution effects outweigh income effects. Their model shows that rich people are likely to have less but more educated children, and poor people are likely to have more but less educated children. Therefore, higher income inequality leads to higher fertility and education differentials between poor and rich households, which in turn reduces the skilled-to-unskilled labor. Kremer and Chen (2002) also present empirical evidence on the positive impact of inequality on fertility differentials. In line with Kremer and Chen (2002) and De la Croix and Doepke (2003), Razak (2006) shows that fertility differentials adversely affect the human capital stock, increasing inequality, and lowering the growth rate.

Inequality is ultimately determined by two counter effects on the relative wage: while technology increases the demand for skilled labor, education increases its supply (Tinbergen, 1975, cited in Eicher and Garcia-Penalosa, 2001). Eicher and Garcia-Penalosa (2001) assert

[3] The discussion on human capital and income inequality in this section is mainly based on Töngür and Elveren (2016).

that greater supplies of human capital lower the skill premium and inequality directly and indirectly lead to more innovations that increase the demand for skilled workers to absorb new technologies into production. Therefore, the authors emphasize the ultimate outcomes of growth on inequality depend on social returns to education, the evolution of the direct cost of education, and the elasticity of substitution in production between skilled and unskilled workers.

In short, it can be argued that skill-biased technological change depreciates human capital stock (i.e. by appreciating skilled labor more) while education adds to this stock (Töngür and Elveren, 2016). On the one hand, there has been a steady increase in education levels and a decline in the inequality of education levels across countries for the last four decades (Castello-Climent and Domenech, 2014), and on the other hand changing technology has resulted in the use of 'less labor with higher skill' consistently. However, while there is a decline in inequality in education levels across countries, there is an increase in income inequality within countries, as a result of inequality in education opportunities and inequality in returns of different education levels. That is why it is more accurate not to consider education alone but along with its result, the inequality (Töngür and Elveren, 2016).

Therefore, in this paper, we pursue this novelty of Töngür and Elveren (2016) to argue for an effective human capital stock as a function of the overall schooling rate (education level) and income inequality, where the latter is measured by Theil pay inequality.

3. The Model

The empirical literature on defence-growth nexus rely on some well-established theoretical models. One of them is Feder-Ram model (Biswas and Ram, 1986), based on Feder's (1983, 1986) model of the impact of exports on economic growth in developing countries. This is a neoclassical model that includes a single regression equation, which allows a direct link from theoretical model to econometric specification. Yet, Dunne et al. (2005) strongly criticized this model in terms of both theoretical and econometric issues. On the other hand, there is another conventional modelling style that incorporates the demand and supply side effects of military expenditures on growth via simultaneous equations system, called Deger type model (Deger and Smith, 1983; Deger, 1986).

The model in this paper is constructed with human capital following the fundamental approach in Dunne et al. (2004, 2005), Dunne and Nikolaidou (2011), and Dunne and Tian (2015) in a panel data context. The model is based on an augmented Solow growth model, which was introduced by Mankiw et al (1992) and utilized by Knight et al. (1996) to examine the effect of military expenditures on economic growth.

A human capital augmented Solow growth model with Harrod-neutral technical progress is presented as

$$Y(t) = K(t)^{\alpha} H(t)^{\beta} [A(t)L(t)]^{1-\alpha-\beta} \quad (1)$$

where Y is aggregate income, K is the capital stock, H denotes the human capital stock, L is labor, and A is the technology parameter, and AL refers to effective labor. α, β, and $(1-\alpha-\beta)$ denote the capital's (i.e. capital-output elasticity), human capital's and effective labor's share of income, respectively. Parameters α and β follows the following restrictions: $0<\alpha<1$, $0<\beta<1$, $\alpha+\beta<1$).

Technology parameter evolves according to

$$A(t) = A_0 e^{gt} milex(t)^{\theta} \tag{2}$$

where g is the exogenous rate of technological progress, which allows constant *K/Y* ratio over time, *milex* is the share of military spending in aggregate output, and θ is the elasticity of steady-state income with respect to the long-run military burden. Within this specification, Dunne et al. (2004, 2005) state that a permanent change in *milex* does not affect the long-run steady-state growth rate, but it might have a permanent level effect on per-capita income along the steady-state growth path to the new steady-state equilibrium.

Given the standard Solow model of an exogenous saving rate (s), a constant labor force growth rate (n), depreciation rate for both physical and human capital (d); the dynamics of physical capital per effective worker ($k_e = K/AL$) and human capital per effective worker ($h_e = H/AL$) can be derived from the model as:

$$\begin{aligned} k_e(t) &= s_k y_e(t) - (n + g + d)k_e(t) \\ h_e(t) &= s_h y_e(t) - (n + g + d)h_e(t) \end{aligned} \tag{3}$$

where s_k and s_h denote the shares of physical capital and human capital investment in aggregate income, and y_e refers to *Y/AL*. The steady-state levels of physical and human capital stock are:

$$\begin{aligned} k_e^* &= \left[\frac{s_h^{\beta} s_k^{1-\beta}}{n + g + d}\right]^{1/(1-\alpha-\beta)} \\ h_e^* &= \left[\frac{s_h^{1-\alpha} s_k^{\alpha}}{n + g + d}\right]^{1/(1-\alpha-\beta)} \end{aligned} \tag{4}$$

The transitory dynamics of income per effective worker in a neighborhood of the steady state are approximated by

$$\frac{\partial \ln y_e}{\partial t} = (\alpha + \beta - 1)(n + g + d)[\ln y_e(t) - \ln y_e^*] \tag{5}$$

where y_e^* is the steady-state level of aggregate output (income). Then, the equation for observable per capita income ($y = Y/L$) in a suitable form for the empirical analysis can be specified as follows.[4]

$$\begin{aligned} \ln y(t) = {} & e^z ln y(t-1) + (1 - e^z) \\ & \times \left\{\ln A_0 + \frac{\alpha}{1-\alpha-\beta}\ln s_k + \frac{\beta}{1-\alpha-\beta}\ln s_h - \frac{\alpha+\beta}{1-\alpha-\beta}\ln(n + g + d)\right\} \\ & + \theta \ln milex(t) - e^z \theta \ln milex(t-1) + (t - (t-1)e^z)g \end{aligned} \tag{6}$$

[4] See Dunne et al. (2004, 2005) for a detailed derivation of the model.

where $z = (\alpha + \beta - 1)(n + g + d)$

In order to investigate the impact of military expenditure on growth in a panel data context, Dunne et al. (2004) proposed the following empirical form:

$$\ln y_{it} = \alpha_0 + \beta_0 \ln y_{it-1} + \sum_j \beta_j \ln x_{jit} + u_{it} \quad (7)$$

where the subscripts i and t denote countries and years, respectively. xj denotes standard explanatory variables in a Solow-type defence-growth model, which includes saving rate, growth rate of effective labor plus depreciation, human capital, and military burden. Based on Equation (6) and (7) by using growth rate of GDP per capita as the dependent variable, there is a rich empirical literature that investigates the effects of military expenditures on growth (e.g., Dunne et al., 2004; Yakovlev, 2007; Heo, 2010; Hou and Chen, 2013; Dunne and Tian, 2015). This specification forms the basis of our empirical model in this study. Since we claim that the consideration of income inequality together with human capital matters within defence-growth nexus, our empirical model also includes the income inequality variable as an ad hoc empirical extension of augmented Solow growth model as specified in the empirical strategy section.

4. Data

The data used in this study is derived from several sources. In the first place, we utilize the data used in Dunne and Tian (2015) as our base dataset for the conventional variables within defence-growth model. Their annual data includes 104 countries covering the period 1988-2010. Military expenditure as a share of GDP is provided by the Stockholm International Peace Research Institute (SIPRI, 2016). Real per capita GDP and gross-fixed capital formation as a share of GDP (as a proxy for saving rate following Mankiw et al., 1992) are taken from the World Bank's World Development Indicators database (World Bank, 2016). For sake of more reliable data, population growth from WDI is used as proxy for the average growth rate of the labor force. The summation of exogenous rates for technological progress and depreciation is assumed to be constant and equals 0.05 in line with –inter alia- Mankiw et al. (1992).

There is a large body of literature on choosing a proxy for human capital variable (Kwon, 2009). There are three major distinct approaches: cost-based, income-based and output based. Cost-based approach computes the stock of human capital summing costs invested in human capital. In the income-based approach human capital is measured based on the returns which an individual obtains from the labor market due to the investment in education. Perhaps the most commonly used method is the output-based approach where school enrolment rate is used as a proxy for human capital, as suggested by Barro (1991) and Barro and Lee (1993). Also, following Mankiw et al. (1992) using schooling rates is also widely accepted in Solow-type growth models, as well as in the defence-growth models (e.g., Hou and Chen, 2013; 2014; Yakovlev, 2007). Barro and Lee (2013) dataset provides average years of schooling in 5-year periods for 146 countries from 1950 to 2010. As a part of Penn World Tables (PWT 8.1), Feenstra et al. (2015) provides an index of human capital per worker annually, based on Barro and Lee (2013) dataset. Due to the need for annual data for our sample, we use human

capital index variable from PWT 8.1 as a proxy for human capital for the corresponding countries available in Dunne and Tian (2015) dataset.

Gini coefficient is the most popular indicator used for income inequality. However, Galbraith and Conceição (2001), Galbraith and Kum (2005) point out that using Gini index to compare countries for income and wage inequality is problematic. In addition, Gini index has very sparse coverage in time, and it includes inconsistent definitions and different quality of data among countries and even within a country over time. Therefore, using Gini coefficient may cause unrobust and misleading results in the empirical analysis. Considering those problems, Galbraith, Lu and Darity (1999) firstly computed a measure for manufacturing pay-inequality by using Theil's formula (Theil 1972). Galbraith et al. (2014) provides the revised and updated version of this index, called UTIP-UNIDO industrial pay inequality, within the scope of University of Texas Inequality project (UTIP). UTIP-UNIDO is a global panel dataset that comprised of the industrial pay-inequality measures for 167 countries from 1963 to 2008, based on the UNIDO Industrial Statistics. The pay-inequality is calculated by applying the formula for the between-groups component of Theil's T statistic to the industrial categories of the UNIDO Industrial Statistics database.[5]

The primary merits of the UTIP-UNIDO dataset are to provide dense, accurate and consistent measures in different countries and years for the inequality of inter-industrial pay. This paper incorporates pay inequality into the defence-growth nexus by utilizing the industrial pay inequality index as a proxy for income inequality in a similar way with Töngür and Elveren (2016). We acknowledge that manufacturing is just one part of overall economic activities; therefore pay inequality and income inequality are not the same things. However, we take manufacturing pay inequality to be an appropriate indicator of overall income inequality in line with Galbraith and Conceição (2001), Galbraith and Kum (2005), Galbraith et al. (2014). Moreover, due to the way we incorporate inequality into the model, there is no need for pay inequality to mimic income inequality. The supporting reason is that we care about human capital (schooling rate) and inequality together, and their interaction, in which the relationship between education level and wage income is more plausible than the one with non-wage income.

Furthermore, we use six dummy variables to control for possible heterogeneity issues across several country groups. The first dummy is for developed countries based on World Bank classification. The second one is for the countries with conflict experience derived from the Uppsala Conflict Data Programme and International Peace Research Institute Oslo (UCDP/PRIO) database. The third and fourth dummies are related to natural resource dependence, namely fuel dependent countries and non-fuel mineral dependent countries, based on export shares in total exports from Haglund (2011). Those four dummies are already included in Dunne and Tian (2015) dataset. On the other hand, considering potential effects of arms trade on defence-growth nexus (e.g., Yakovlev, 2007) we created two dummies in the matter of arms exports and arms imports, respectively. SIPRI regularly takes notice of the top 20 countries for arms exporters and importers as indicators in its yearbooks and website. By using SIPRI Arms Transfers Database (SIPRI, 2015), we calculate and rank the total value of arms exports and total value of arms imports for all countries for the period 1988-2008, and determine the top 20 arms exporter and top 20 arms importer countries. Then, the last two

[5] Specifically, for each industry, one has pi as the share of that industry in total employment, and Yi/Y as the mean pay in that industry divided by the mean pay in all of manufacturing. The "Theil element" is the product: pi* (Yi/Y) * ln(Yi/Y) and the between-groups component of Theil's T is the sum of these elements across all industries in the observed set (Galbraith et al., 2014). Note that when the value of index is 0 (zero), this represents perfect equality, and the value increases as inequality rises.

country group dummies are created as arms exporters and arms importers for the corresponding countries available in Dunne and Tian (2015) dataset.

Due to lack of data with regard to human capital variable and/or income inequality variable for some countries in Dunne and Tian (2015) dataset, our resulting sample is an unbalanced panel and it includes 82 countries and 1164 observations for the period 1988-2008. Variable definitions and summary statistics are provided in Table 1. Full list of countries in the final sample is provided in Table A1 in the appendix. One can also see the list of countries according to some groups taken into account in the regressions as well (Table A2 in the appendix).

Table 1: Variables used in the regressions and summary statistics

Name	Description	Mean	Std. dev.
y_{it}	Real per capita GDP	14669.6	12827.8
$growth_{it}$	Log growth rate of real per capita GDP	0.024	0.042
k_{it}	Gross fixed capital formation as share of GDP	21.699	5.745
$n_{it}+g+d$	Log growth rate of population + 0.05 (assumed value for g+d) used in the Solow type regressions	0.063	0.011
$milex_{it}$	Military expenditure as share of GDP	2.423	1.732
hc_{it}	Human capital index based on years of schooling and returns to education	2.544	0.503
$theil_{it}$	UTIP-UNIDO Industrial pay inequality index	0.053	0.052
Developed	Dummy for developed countries	0.405	0.491
ArmsExp	Dummy for arms exporter countries	0.218	0.413
ArmsImp	Dummy for arms importer countries	0.220	0.414
Conflict	Dummy for the countries with conflict experience	0.318	0.466
Fuel	Dummy for fuel dependent countries	0.105	0.308
NonFuel	Dummy for non-fuel mineral dependent countries	0.121	0.326

Source: Authors' calculation.

5. Empirical Strategy

Although there is an immense empirical work on defence-growth nexus, the impact of income inequality together with military burden on growth have not been addressed adequately. To the best of our knowledge, there is only one empirical study, Töngür and Elveren (2016), in which the authors examines the impact of military spending and income inequality on economic growth in Turkey. That study gives us the basic motivation for this paper. This is because we firstly investigate the impact of income inequality in defence-growth nexus in a panel data context.

Our empirical approach employs a dynamic specification in a panel data context to account significant lagged effects of the dependent variable which determine serial correlation in itself on the basis of Equation (7). The regression specification is as follows:

$$growth_{it} = \beta_0 \ln y_{it-1} + \beta_1 \ln k_{it} + \beta_2 \ln(n_{it} + g + d) + \beta_3 \ln milex_{it} + \beta_4 \ln milex_{it-1} + \beta_5 \ln hc_{it} + \beta_6 \ln theil_{it} + \beta_7 (\ln theil_{it} * \ln hc_{it}) + \alpha_i + \alpha_t + u_{it} \quad (8)$$

where the subscripts *i* and *t* refer countries and years, respectively. $growth_{it}$ is the growth rate of real per capita GDP, y_{it-1} denotes the lagged real per capita GDP, k_{it} is gross fixed capital formation as share of GDP, $(n_{it}+g+d)$ reflects the growth rate of population + 0.05 (assumed value for g+d as conventionally used in Solow-style regressions), $milex_{it}$ represents military expenditure as share of GDP, hc_{it} shows human capital index based on years of schooling and returns to education. Considering the uncertainty in the effect of income inequality together with human capital on defence-growth nexus, we include the income inequality variable as an

ad hoc empirical extension of augmented Solow growth model. Then, $theil_{it}$ reflects industrial pay inequality (Theil) index. Based upon the possible interaction between human capital and income inequality, we also add an interaction term ($\ln theil_{it} * \ln hc_{it}$) in order to control for a nonlinear relationships between these two variables within the model. This specification also allows to test for a significant nonlinear relationships between income inequality and economic growth, and between human capital and economic growth. The variable α_i and α_t denotes time invariant country specific effects and time specific effects, respectively. The last term u_{it} is idiosyncratic error component.

The dynamic model violates the assumption of strict exogeneity of the estimators since the existence of country specific effects in Equation (8) creates a correlation between the lagged dependent variable and the individual fixed effect. Specifically, using of ordinary least squares gives inconsistent and upward biased estimates for the coefficient of the lagged dependent variable (Hsiao, 1986; Baltagi, 1995) whereas fixed effects estimator leads to a downward bias for the estimated parameter (Nickell, 1981). Thereby either approach would yield biased estimates also for independent variables.

To deal with the problems pointed above, Arellano and Bond (1991) proposed using a Generalized Method of Moment (GMM) estimation. The dynamic growth equation is expressed in the first differences to remove country specific effects, and in this first differenced equation they use lagged values of the right hand side variables as instruments in the regression (GMM-DIF). It provides consistently estimated parameters in the models by using instrumental variables for endogenous explanatory variables. However, taking the first differences removes most of the variation in the data if there is strong persistence in the time series. This implies that lagged values of explanatory variables would be weak instruments and thus large finite sample biases and imprecision can occur (Blundell and Bond, 1998; Blundell and Bond, 2000; Bond et al., 2001). In addition, the first difference GMM estimator is poorly behaved when the time dimension is small relative to its cross-section dimension. (Bond et al., 2001).

Blundell and Bond (1998) suggest using additional level moment conditions and obtaining system GMM estimation (GMM-SYS), in which they use lagged first-differences as instruments for equations in levels, in addition to the lagged levels as instruments for equations in the first differences. In this way, GMM-SYS uses all information available in the data (Bond, 2002). GMM-SYS combines equations in levels with equations in first differences to gain asymptotic efficiency, and it has better asymptotic and finite sample properties compared to GMM-DIF (Bond et al., 2001, Blundell et al., 2000). We thus adopt GMM-SYS approach due to the existence of strong persistent time series and short time dimension relative to cross-section units in our sample (i.e. small T and large N). Note that the empirical issues considered in our estimation specifications are mainly based on Roodman (2006) and Roodman (2009a).

Moreover, we make use of some strategies to improve the efficiency of GMM-SYS estimation and to avoid an over-identification problem. At first, we collapse the GMM instruments by creating one instrument for each variable and lag distance (rather than one for each time period, variable, and lag distance). Note that collapsing instruments reduces statistical efficiency in large samples. However, in small samples it can avoid the bias that arises as the number of instruments climbs toward the number of observations. Also, we allow to use all available lags in the data as long as the number of instruments is smaller than number of cross section units (countries in our case) as suggested by Roodman (2009b). In this context, we restrict number of instruments by using maximum lags in the first differenced equations provided that the number of instruments is smaller than the number of countries.

Furthermore, year dummies are included in all regressions to control for macroeconomic shocks. Including time specific effects in the regressions reduces the cross-sectional dependence in the error term as well.

On the other hand, Roodman (2006) and Roodman(2009a) point out a weakness of the first difference transformation when there are some gaps in the sample (since the gaps cause a data loss). He suggests using forward orthogonal deviations as a transformation instead of first difference. It means subtracting the average of all available future observations of a variable from the contemporaneous observation. Since we have an unbalanced panel data, we use forward orthogonal deviations as a transformation to minimize data loss in our dataset.

All explanatory variables in our model are treated as endogenous in GMM-style to take potential endogeneity in the model into account. Our control variables for time and country effects are set to be exogenous and treated as typical instrumental variables. Since Arellano and Bond (1991) and Blundell and Bond (1998) points out that two-step standard errors are clearly downward biased, all GMM-SYS estimations in this study are conducted using a two-step efficient GMM technique to correct any non-spherical errors, and finite sample corrections (Windmeijer-corrected standard errors) to the covariance matrix estimate (Windmeijer, 2005).

Furthermore, some usual econometric issues in the estimations are taken into consideration. First of all, Wald tests are conducted for overall joint significance of the explanatory variables and time dummies. Also, Hansen test for over-identifying restrictions is performed to test the null hypothesis of adequate instruments. Thirdly, Difference-in-Hansen test is applied to test the null hypothesis of the validity of the additional moment restriction necessary for GMM-SYS. Failure to reject those null hypotheses implies that the instruments are valid. Moreover, Arellano-Bond tests for the serial correlations are employed to test whether there is serial correlation in the first-differenced residuals. The null hypothesis is that the residuals are serially uncorrelated. If the null hypothesis for AR(1) is rejected, it implies that a dynamic specification is needed. If the null hypothesis for AR(2) cannot be rejected, it provides the evidence that there is no second-order serial correlation and the GMM estimator is consistent.

6. Estimation Results and Discussion

The paper employs system GMM estimation method to investigate the effect of income inequality together with human capital and military expenditures on economic growth in an augmented Solow growth model. The baseline estimation results are reported in Table 2. Before the discussion of the estimation results, some econometric issues are examined. First of all, we compare the results of OLS, FE, and GMM-SYS with regard to estimated coefficient of lagged dependent variables. GMM-SYS estimates give lower values for the lagged dependent variable than those in OLS results, whereas GMM-SYS results provide higher values for the value of the estimated coefficient of the lagged dependent variable than those in FE estimates. Then, consistency of lagged coefficients among three methods supports to use GMM-SYS. We also check the persistence of per capita GDP time series. For all specifications in Table 2, the significant value of the lagged coefficients of real per capita GDP confirms the persistence of its time series, favoring the adoption of GMM-SYS.

Moreover, we examine some diagnostic tests of results, which are performed to test the validity of model specification and estimation results. All estimations include year dummies but not reported to save space. Note that most of the coefficients of year dummies is found to be significant. Wald test 1 denotes a Wald test to test overall joint significance of the explanatory variables, which is asymptotically distributed as chi-squared with the degrees of freedom computed with respect to the number of restricted coefficients. Wald test 2 is a Wald

test of joint significance of the time dummies. According to Wald tests for overall joint significance of the explanatory variables and time dummies, respectively, the null hypotheses of insignificant coefficients are always rejected. We do not reject the null hypothesis of the Hansen test, thus it approves the validity of the instruments. Moreover, there is no evidence to reject the null of the validity of the additional instruments used in GMM-SYS estimation according to Difference-in-Hansen test. Hence, the test statistics indicate a proper specification in terms of instrument validity. According to Arellano-Bond test statistics for AR(1), the null hypothesis of no autocorrelation is rejected, hence it requires a dynamic specification. On the other hand, Arellano-Bond test statistics for AR(2) show that the consistency of the GMM estimators is supported, as there is no evidence of a second order serial correlation in the differenced residuals of the models. All in all, we rely on the GMM-SYS technique to investigate the effect of income inequality together with human capital and military expenditures on growth in an augmented Solow growth model.

Table 2: The effects of military expenditures and income inequality in the augmented Solow growth model

	OLS		FE		GMM-SYS	
$\ln y_{it-1}$	-0.005***	-0.004***	-0.160***	-0.156***	-0.026***	-0.015***
	[0.002]	[0.002]	[0.012]	[0.012]	[0.004]	[0.004]
$\ln k_{it}$	0.042***	0.042***	0.046***	0.047***	0.081***	0.073***
	[0.005]	[0.005]	[0.007]	[0.007]	[0.005]	[0.004]
$\ln(n_{it}+g+d)$	-0.028***	-0.029***	-0.049***	-0.043***	-0.085***	-0.039***
	[0.008]	[0.008]	[0.015]	[0.015]	[0.010]	[0.009]
$\ln milex_{it}$	-0.007	-0.007	-0.009	-0.009	-0.011*	-0.030***
	[0.006]	[0.006]	[0.007]	[0.006]	[0.006]	[0.007]
$\ln milex_{it-1}$	0.007	0.007	0.005	0.005	0.010	0.001
	[0.006]	[0.006]	[0.006]	[0.006]	[0.008]	[0.006]
$\ln hc_{it}$	0.009	0.028	-0.001	0.160**	0.043**	0.324***
	[0.009]	[0.024]	[0.046]	[0.072]	[0.020]	[0.048]
$\ln theil_{it}$		-0.006		-0.040***		-0.075***
		[0.008]		[0.014]		[0.015]
$\ln theil_{it}$* $\ln hc_{it}$		0.006		0.046***		0.081***
		[0.008]		[0.015]		[0.015]
Constant	-0.146***	-0.164***	1.170***	1.017***	-0.266***	-0.436***
	[0.027]	[0.034]	[0.130]	[0.140]	[0.042]	[0.061]
Observations	1164	1164	1164	1164	1164	1164
Countries	82	82	82	82	82	82
Instruments					70	80
Wald test-1	94.68***	95.28***	215.3***	228.0***	389.0***	502.6***
Wald test-2	78.47***	75.24***	149.5***	139.1***	897.2***	1395.9***
Hansen					(0.120)	(0.417)
Diff-in-Hansen					(0.672)	(0.135)
AR(1)					(0.002)	(0.029)
AR(2)					(0.796)	(0.385)

Notes: All models include year dummies but not reported to save space. Estimations in the last two columns were conducted with two-step efficient GMM and finite-sample corrections to the covariance matrix estimate.
Standard errors in brackets: *** p<0.01, ** p<0.05, * p<0.1
Source: Authors' calculation.

Although we take into account the impact of the income inequality effects together with human capital on defence-growth nexus, we also conduct the estimation by employing only standard human capital variable (i.e. without inequality) for comparison. All six models in Table 2 provide statistically significant coefficients for the standard variables in the Solow growth model ($\ln y_{it-1}$, $\ln k_{it-1}$, $\ln(n_{it-1}+g+d)$) with the expected signs. These are the only variables that are statistically significant in OLS, and FE in case of the specification without

inequality. However, FE with inequality results have statistically significant coefficients for human capital, income inequality, and its interaction. Note that impact of the military burden on growth is found to be insignificant in OLS and FE models.

In case of GMM-SYS estimates in Table 2, first note that GMM-SYS specification gives the opportunity for more appropriate modelling, and it provides more reliable results in our case as discussed in previous section. Although OLS and FE have insignificant but negative sign for the coefficient of military expenditure, the effect of military burden turns out to be significant in either specifications with and without inequality in GMM specifications, not distorting the sign and significances of other variables in the model. Then, our sample strongly fits the fact that GMM-SYS estimate for the specification with inequality indicates statistically significant negative effect of military burden on growth.

Moreover, we check the military expenditures-growth nexus for several country groups to consider potential heterogeneity. We introduce country group dummies into the model in multiplicative form with military expenditures variable to capture the interaction between military expenditure and country group effects. Note that we add those variables separately in order to avoid possible multicollinearity. The results for the model with dummies for country groups are presented in Table 3. The validity of model specification and estimation results is satisfied for all models. It is clear that the incorporation of the multiplicative dummies for the interaction between military expenditure and country group effects does not deteriorate signs and significance of the coefficients in our base model. The negative impact of military expenditure on growth still exists although heterogeneity stemming from some country groups matter with regard to strength of effect. Country group dummies with military expenditure for developed countries, fuel dependent countries, and non-fuel mineral dependent countries are not statistically significant. On the other hand, being arms exporter country and/or arms importer country seems to contribute growth. However, this effect does not dominate. Then, one can claim that negative impact of military expenditure on growth for arms exporter and/or arms importer countries is weaker than those for other countries. This finding is consistent with Yakovlev (2007) which reports statistically significant positive interaction between net arms export and military expenditure, and it is partly consistent with Elveren and Hsu (2015), who also suggest weak effect of military expenditures on profit rates in the case of arms exporter and arms importer countries compared to the rest. Similarly, we find that the countries with conflict experience may utilize the military expenditure for growth in line with Smaldone (2006) and Dunne (2012). However, the positive military spending effect of being a country with conflict experience on growth, again, does not dominate. Moreover, we provide the plots of predictive margins with 95 percentage confidence intervals for the effects of military expenditures on growth by country groups in Figure A1 in appendix. All in all, the (net) negative impact of military burden on economic growth is valid for all models in Table 3.

Regarding the income inequality together with human capital in GMM-SYS, the direct effect of human capital on growth is positive, confirming the theory. The direct effect of income inequality is negative. The interaction term is positive. It means that the higher the human capital is the higher the effect of inequality on growth, and vice versa. In other words, this specification implies that the effect of income inequality on growth also depends on the level of human capital, whereas the impact of human capital on growth depends on the level of income inequality since the interaction term is found to be significant. In order to show separate effects of inequality and human capital on growth, we compute marginal effects using the estimates of GMM-SYS specification in Table 2. This allows us to measure how the income inequality affects growth according to human capital, and to measure how the human capital affects growth according to income inequality. Specifically, we can compute the

marginal effect of Theil index on growth as a function of human capital index, and marginal effect of human capital index on growth as a function of Theil index as well. These calculations are presented in Figure 1.

Table 3: The effects of military expenditures and income inequality in the augmented Solow growth model with dummies for country groups: GMM-SYS estimates

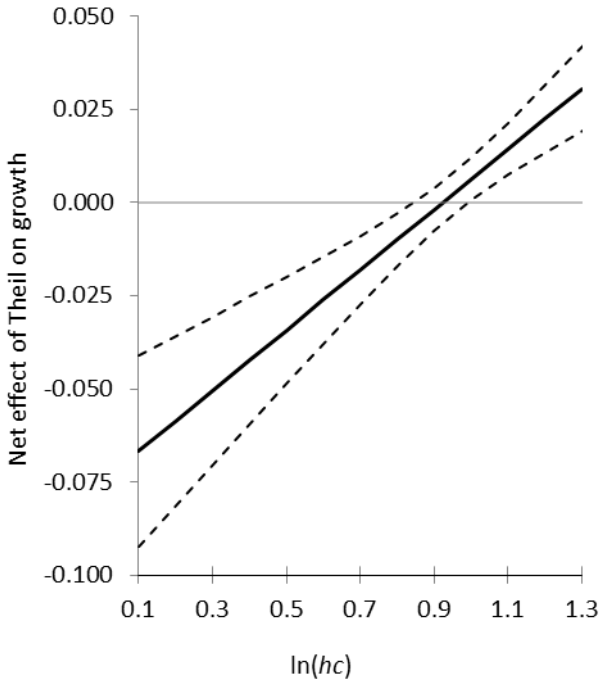
	(1)	(2)	(3)	(4)	(5)	(6)
$\ln y_{it-1}$	-0.014***	-0.014***	-0.015***	-0.005	-0.016***	-0.015***
	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]
$\ln k_{it}$	0.073***	0.073***	0.071***	0.081***	0.071***	0.071***
	[0.004]	[0.004]	[0.004]	[0.005]	[0.004]	[0.004]
$\ln(n_{it}+g+d)$	-0.043***	-0.040***	-0.049***	-0.056***	-0.035***	-0.036***
	[0.009]	[0.008]	[0.009]	[0.009]	[0.009]	[0.009]
$\ln milex_{it}$	-0.032***	-0.019***	-0.042***	-0.042***	-0.016**	-0.027***
	[0.007]	[0.007]	[0.007]	[0.008]	[0.008]	[0.008]
$\ln milex_{it-1}$	0.001	-0.005	0.003	-0.010	-0.005	-0.001
	[0.006]	[0.005]	[0.006]	[0.006]	[0.006]	[0.006]
$\ln hc_{it}$	0.295***	0.257***	0.304***	0.389***	0.285***	0.324***
	[0.049]	[0.046]	[0.051]	[0.060]	[0.042]	[0.046]
$\ln theil_{it}$	-0.073***	-0.061***	-0.068***	-0.096***	-0.063***	-0.073***
	[0.014]	[0.014]	[0.015]	[0.018]	[0.014]	[0.014]
$\ln theil_{it}$* $\ln hc_{it}$	0.079***	0.066***	0.075***	0.106***	0.070***	0.080***
	[0.015]	[0.014]	[0.015]	[0.018]	[0.014]	[0.014]
$\ln milex_{it}$*Developed	0.010					
	[0.006]					
$\ln milex_{it}$*ArmsExp		0.014**				
		[0.006]				
$\ln milex_{it}$*ArmsImp			0.019***			
			[0.004]			
$\ln milex_{it}$*Conflict				0.032***		
				[0.005]		
$\ln milex_{it}$*Fuel					0.007	
					[0.004]	
$\ln milex_{it}$*NonFuel						-0.002
						[0.007]
Constant	-0.434***	-0.393***	-0.434***	-0.637***	-0.369***	-0.414***
	[0.055]	[0.057]	[0.061]	[0.068]	[0.054]	[0.059]
Observations	1164	1164	1164	1164	1164	1164
Countries	82	82	82	82	82	82
Instruments	81	81	81	81	81	81
Wald test-1	561.2***	513.6***	661.5***	575.5***	430.4***	483.8***
Wald test-2	1601.5***	1507.8***	1391.4***	1335.9***	1490.7***	1596.9***
Hansen	(0.414)	(0.465)	(0.494)	(0.363)	(0.336)	(0.305)
Diff-in-Hansen	(0.130)	(0.219)	(0.305)	(0.190)	(0.098)	(0.148)
AR(1)	(0.030)	(0.030)	(0.029)	(0.027)	(0.030)	(0.029)
AR(2)	(0.399)	(0.394)	(0.393)	(0.395)	(0.396)	(0.391)

Notes: All models include year dummies but not reported to save space. All estimations were conducted with two-step efficient GMM and finite-sample corrections to the covariance matrix estimate.
Standard errors in brackets: *** p<0.01, ** p<0.05, * p<0.1
Source: Authors' calculation.

Figure 1 shows that higher human capital increases the effect of inequality on growth, and a logarithm value of human capital index of about 0.90, which is a little lower than both the mean value (0.91) and the median value (0.97) of the sample, is sufficient to make the effect of income inequality to zero, i.e. no response of economic growth to a rise in Theil index. Hence, income inequality deteriorates growth for lower levels of human capital. However, this impact becomes weaker as human capital increases, and even it has no effect

near the mean and median values of human capital. The impact of inequality on growth turns out to be positive for higher levels of human capital. Therefore, the net effect of income inequality depends on the human capital on the one hand; on the other hand its effect actually ends up with the dominance of several mechanisms.

Figure 1: Variation in the effects of Theil index on growth



Note: The figure shows the net effect of Theil index on growth as a function of human capital. The plot indicates predictive margins with 95 % confidence intervals based on the last column of Table 2.
Source: Authors' calculation.

Our finding that income inequality has direct negative impact on economic growth is in line with two views. First, in case of the imperfect financial markets, in which poor people have a tendency to invest less in human capital (Nissanke and Thorbecke, 2010). Therefore, under-investment in human capital leads to lower economic growth. Second, the new theory of political economy of development suggests that in case of high inequality voters ask for higher taxes and disfavor pro-business policies, creating political and social instability that leads to greater uncertainty and lower investment incentive, (Alesina and Rodrik, 1994; Kanbur 2000); also high inequality is likely to lead to unproductive rent-seeking activities, high transaction costs, and increased insecurity of property rights (Nissanke and Thorbecke, 2010: 798), which in turn reduces economic growth.

Our addendum finding that while inequality has negative effect on economic growth in low human capital levels, the effect is likely to be positive in high human capital levels is a supportive evidence to the literature that suggests the differing effect of income inequality on economic growth with respect to the income level of the countries. In this context, considering the significant linkage between the income and the human capital levels, our finding confirms the major finding of the literature that while inequality has a negative effect on growth in low and middle income countries, the effect becomes positive or insignificant for higher income countries (Barro, 2000; Castello-Climent, 2010). Indeed, statistically significant interaction term implies significant nonlinear relationship between income

inequality and economic growth, and between human capital and economic growth. Also, it emphasizes the mechanism between, human capital, inequality, and growth through those channels pointed out above.[6]

In order to control the validity of the estimation results with regard to the sensitivity of variables' measure, we re-estimate all regressions in this study by defining different measures for some variables used in the specifications. First of all, instead of 0.05, we take alternative assumed values for (g+d) as 0.025, 0.075, and 0.100. All variables remain significant and provide same effects leaving our results unaltered. On the other hand, we estimate all models by introducing alternative dummy variables for country classifications. We consider the World Bank criteria for income groups (as low, middle, high), and we take account of top 10 and top 5 countries for arms exporters and arms importers. Moreover, instead of conflict variable, we use two alternative country groups with a civil war experience or interstate war experience. Finally, we exploit an aggregate natural dependency measure by combining fuel dependent countries and non-fuel mineral dependent countries. The main variables remain significant with similar effects on growth, and alternative dummies for country groups have similar effects as in Table 3. Therefore, the main findings in this study can be considered to be robust to different model specifications.[7]

7. Conclusion

There exists a sizable literature on military expenditure and economic growth that utilizes different growth models. The literature suggests three main tendencies: both negative and ambiguous effects of military expenditures on economic growth are more commonly found than positive effect; recent studies with advanced methods are likely to find negative effect; and positive effect is more pronounced in the case of developed countries

Regarding the inconclusive findings this study was an attempt to contribute to the literature by considering an important variable, income inequality. Therefore, following Töngür and Elveren (2016), a first study that attempts to address the possible effect of income inequality in the military expenditures-growth nexus within an interaction with human capital for the case of Turkey, we also adopted an augmented Solow growth model to extend the examination to 82 countries for the period of 1988-2008 by employing GMM-SYS method, and by paying special attention to heterogeneity. The general finding of this paper is that there is a negative impact of military expenditures on economic growth. This general finding is robust across several model specifications and sensitivity analyses. The findings show that negative impact of military expenditure on growth for arms exporter and/or arms importer countries is weaker than those for the rest of the countries. It is also weaker for the countries experiencing conflict although military expenditure can lead to growth for those countries. Then, the negative impact of military expenditure on growth also holds when the heterogeneity stemming from different country groups (e.g. development level, arms trade, fuel dependency) is taken into account as well. This result is in line with the recent trend in the literature. That is, our finding is also against to the early findings that support Military Keynesianism.

A novelty of this study is to analyze the effect of inequality together with human capital in the context of military expenditures and growth. The findings suggest positive effect of human capital on growth, as expected. Income inequality on the other hand, has negative

[6] We acknowledge that the reduced form of the growth model prevent us from capturing specific dynamics of interaction between inequality and human capital. However, such an investigation is beyond the scope of this paper. The main aim of this paper is to understand better the effect of military expenditures on economic growth by considering income inequality.

[7] We do not present these results to save space. However, these results are available upon request.

direct effect on economic growth. Considering these two variables together, the findings show that while income inequality deteriorates growth for lower levels of human capital, its effect on growth is positive for higher levels of human capital. This is in line with the findings in the literature where Barro (2000) and Castello-Climent (2010) shows that although inequality has a negative effect on growth in low and middle income countries, the effect becomes positive or insignificant for higher income countries.

This study is an early attempt to analyze the military expenditures-growth-inequality nexus within a panel data context. Although there is a sizable literature on the military expenditure-growth context, the possible role of economic inequality has not been received the desired attention. Our modest goal was to point out this issue. One possible way was to discuss it by considering the linkage between income inequality and human capital within an augmented Solow growth model. However, we acknowledge that future studies may investigate this relationship with different methods and specifications, which may allow more flexibility in terms of analyzing the interaction between inequality and military expenditures and economic growth. Also, some alternative systems of equations for endogenous variables in the model can be specified. Finally, one can relax the assumption of using the same value of human capital variable for all sectors. For instance, a distinct human capital in the defence industry can be taken into account within a defence-growth nexus model (McDonald, 2011).

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APPENDIX

Table A1: Sample of countries included in the regressions

Albania	Canada	Germany	Japan	Morocco	Portugal	Syria
Argentina	Chile	Ghana	Jordan	Mozambique	Romania	Tanzania
Australia	China	Greece	Kenya	Nepal	Russia	Thailand
Austria	Colombia	Guatemala	Kuwait	Netherlands	Senegal	Tunisia
Bangladesh	Cyprus	Hungary	Lesotho	New Zealand	Singapore	Turkey
Belgium	Denmark	India	Luxembourg	Norway	South Africa	United Kingdom
Bolivia	Ecuador	Indonesia	Malawi	Pakistan	South Korea	Uganda
Botswana	Egypt	Iran	Malaysia	Panama	Spain	United States
Brazil	El Salvador	Ireland	Malta	Paraguay	Sri Lanka	Uruguay
Bulgaria	Fiji	Israel	Mauritius	Peru	Swaziland	Venezuela
Burundi	Finland	Italy	Mexico	Philippines	Sweden	
Cameroon	France	Jamaica	Mongolia	Poland	Switzerland	

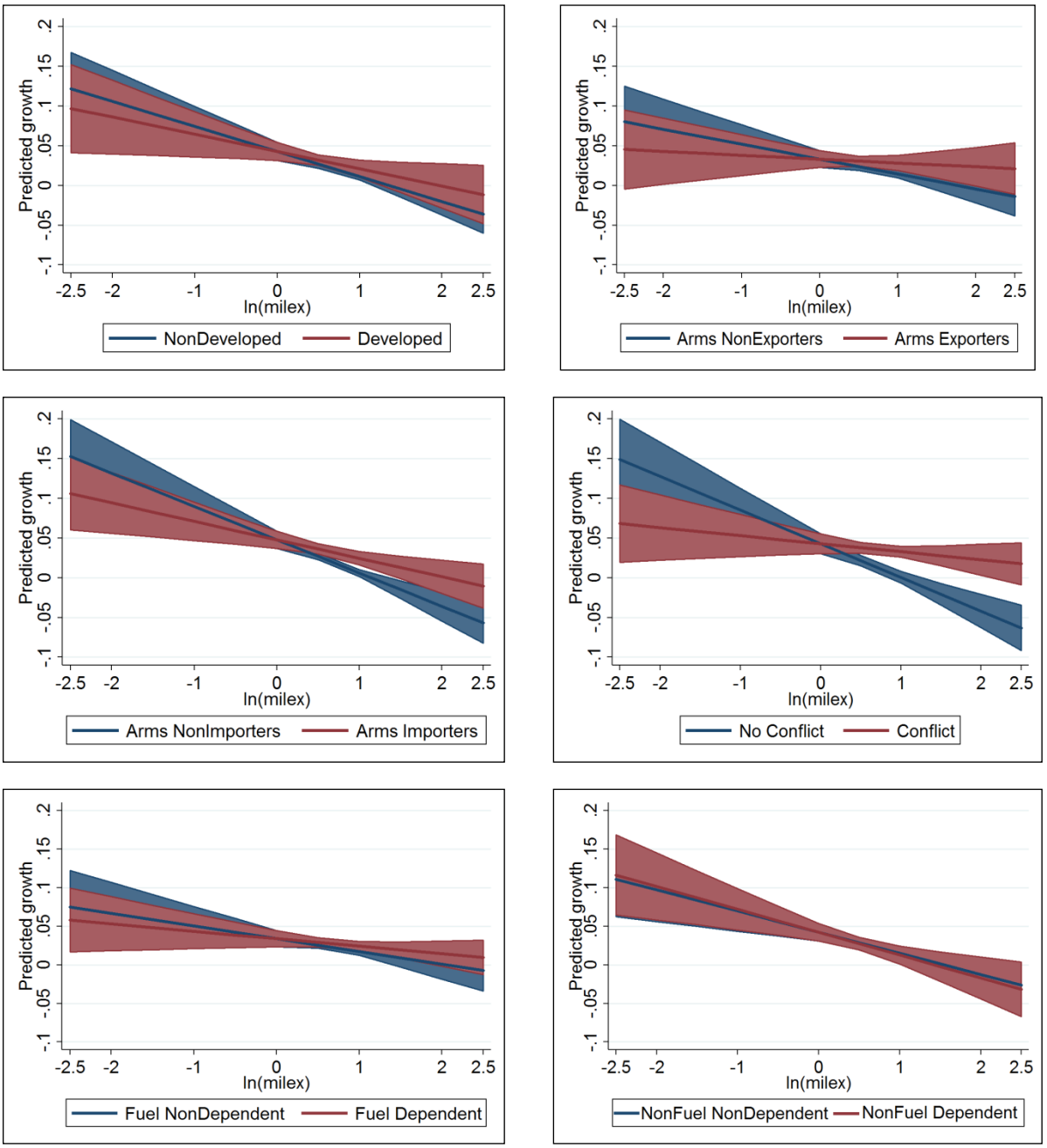
Source: Several sources specified in Data section of the study.

Table A2: Country groups for some dummies used in the regressions

Developed Countries	*Arms Exporters*	*Arms Importers*	*Conflict Experience*	*Fuel Dependent*	*NonFuel Dependent*
Australia	Canada	Australia	Australia	Cameroon	Australia
Austria	China	Canada	Bangladesh	Colombia	Bolivia
Belgium	France	China	Burundi	Ecuador	Botswana
Canada	Germany	Egypt	Cameroon	Egypt	Ghana
Cyprus	Israel	Greece	Colombia	Iran	Israel
Denmark	Italy	India	Ecuador	Kuwait	Jamaica
Finland	Netherlands	Iran	Egypt	Russia	Mongolia
France	Norway	Israel	Guatemala	Syria	Mozambique
Germany	Poland	Japan	India	Venezuela	Peru
Greece	Russia	Pakistan	Indonesia		South Africa
Ireland	South Korea	Singapore	Iran		Tanzania
Israel	Spain	South Korea	Israel		
Italy	Sweden	Spain	Kuwait		
Japan	Switzerland	Turkey	Morocco		
Luxembourg	United Kingdom	United Kingdom	Mozambique		
Malta	United States	United States	Nepal		
Netherlands			Pakistan		
New Zealand			Paraguay		
Norway			Peru		
Poland			Philippines		
Portugal			Russia		
Singapore			Senegal		
South Korea			South Africa		
Spain			Sri Lanka		
Sweden			Turkey		
Switzerland			United Kingdom		
United Kingdom			Uganda		
United States			United States		

Source: Authors' calculation from several sources specified in Data section of the study.

Figure A1: Effects of military expenditures on growth by country groups



Note: All plots indicate predictive margins with 95 % confidence intervals based on the estimations in Table 3.
Source: Authors' calculation.