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MILITARIZATION AND INCOME INEQUALITY IN EUROPEAN COUNTRIES
(2000-2017)

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Militarization and Income inequality in European Countries (2000-2017)

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Abstract: *This paper empirically investigates the impact of the level of militarization on income inequality. The empirical analysis is performed on a panel of 45 European countries over the period 2000-2017. Our empirical strategy relies on a panel data model. Additionally, we apply the Lewbel (2012) IV–GMM approach to address potentially endogeneity bias. The main findings show that militarization and inequality are positively correlated within sampled countries. The negative influence on inequality persists when using bounded and unbounded Gini indexes and also when different subsets of countries are analyzed. Finally, results are also robust to endogeneity.*

Keywords: Militarization, Income Inequality, Lewbel’s approach, Gini index

Jel Codes: O15, H5, H56, C23

1. Introduction and conceptual background

This paper focuses on the relationship between militarization and income inequality. Income inequality has always been a great concern especially for policy makers, it nowadays represents a major challenge for countries (Alfani, 2021; Hoffman et al. 2020; de Haan and Sturm, 2017; Picketty, 2015). A wide range of potential factors such as trade and financial openness (Heimberger, 2020; Furceri and Ostry, 2019; Jaumotte et al. 2013), education (Abdullah et al., 2015, Gregorio and Lee, 2002), innovation and technological changes (Aghion et al. 2019; Jones and Kim, 2018; Acemoglu 2002), labour market institutions (Fortuna and Neto, 2021; Checchi and Garcia-Penalosa, 2008) as well as countries' democracy level (Wong, 2016; Acemoglu et al., 2015; Gradstein and Milanovic, 2004) affect the income distribution within a society. Among these factors, resources designed to military spending could also have an impact on this distribution. The point of departure of this work is that the commitment to military spending and to other channels of military build-up could affect income distribution within a society. In fact, the impact of military spending on income inequality is a topic which is gaining attention among academics and policy makers.

The existing literature has explored the effect of military spending on income inequality, and several studies have been conducted for individual countries such as Turkey (Elveren, 2012), South Korea (Wolde-Rufael, 2016) or a group of countries that includes 58 OECD and non-OECD countries (Lin and Ali, 2009), 14 NATO countries (Chletsos and Roupakias, 2020) and 26 transition economies (Biscione and Caruso, 2021) pointing to not clear-cut results. A part of the literature shows that military spending can improve the distribution of income (Hirnissa et al 2009; Lin and Ali, 2009; Elveren, 2012; Chletsos and Roupakias, 2020; Ali, 2012). The explanation is based on the theoretical Keynesian view which states that a decrease in inequality due to increased military spending considered as an important instrument of fiscal policy, would result in higher aggregate demand and thus in an increase in the level of employment in the economy. Specifically, if the following two conditions are met, namely, military industries are labour-intensive and military production is domestic, the economic growth can benefit the poor, improving the distribution of income. Empirical findings consistent with the idea that military expenditure leads to an income inequality narrowing effect come from Ali (2012) when examining Middle Eastern and North

African countries during the years 1987- 2005. Similarly, in a more recent study, Chletsos and Roupakias (2020) show a positive effect of defense spending on income inequality in a set of 14 NATO countries over the period 1977–2007.

A different strand of literature is grounded on the idea that military industries prefer more productive workers who have higher salaries than less-skilled workers in the civil sectors (Ali, 2012; Lin and Ali, 2009;). In this way military expenditure can widen the intersectoral wage disparities as it occurs in more than 150 countries during the period 1987-1997 (Ali, 2007). Moreover, the gap between skilled and unskilled labour can be further worsened if the military industry chooses to employ skilled workers rather than unskilled workers in the production sector. In addition, income inequality can increase when additional resources devoted to military spending reduce those designed to social welfare spending This could be due to the pressure from the military industrial complex on policy makers. That is, when the interest groups related to the military complex lobby for a higher spending the military sector can lead to an increase in military spending. Several studies show that the level of income inequality could worsen due to an increase in national defense spending. Shahbaz et al. (2016), for example, examine the relationship between military spending and income inequality in Iran during the period 1969-2011. Focusing on the case of South Korea for the time span 1965–2011, Wolde-Rufael (2016) finds a positive and significant effect of defense spending on income inequality. In a recent study Graham and Mueller (2019) reveal that military spending and income inequality are positively associated in a set of OECD countries in the period 1990–2007¹. The same conclusions can be found in Biscione and Caruso (2021) analyzing a panel of 26 Transition countries from 1990 to 2015. The authors also find a trade-off between military and welfare spending, this means that a higher defense spending could reduce the share of the government budget for welfare programs which has a corrective action on income distribution. Lastly, another set of studies finds a lack of relevance of military spending on inequality since the government decides to direct resources towards welfare rather than defense. This negligible relationship is found in some Asian countries (Malaysia, Indonesia, Singapore, Philippines, India and South Korea) for the

¹ We do not provide a comprehensive review of the empirical studies that indicate the worsening of income distribution as a result of an increase in the level of military spending. Review papers are abundant (e.g. Meng et al., 2015; Tongur and Elveren, 2015; Wolde – Rufael, 2014; Elveren, 2012; Kentor et al., 2012; Vadlamannati, 2008). We restrict the exposition to the most recent works.

period 1970-2005 (Hirnissa et al., 2009) and in 58 countries when using the data for the years 1987-1997 (Lin and Ali, 2009). This neutral effect happens because military spending represents a small part of the total public expenditure and labor force employed in the military sector is a negligible part of the total labor force (Hirnissa et al., 2009; Lin and Ali, 2009). The effects described above underline three different expectations with respect to the impact of military expenditure on income inequality. However, it could be asserted that the impact of military spending on income disparities differs across countries and changes over time. In other words, there is no consistent pattern for all countries because each country has a different economic, historical, cultural, political, and institutional development (Jingxi et al., 2015). Despite the availability of an extensive literature that attempts to analyze the relationship between military expenditure and income inequality, this topic still arouses particular interest among policy makers and scholars since inequality within and among countries is a persistent cause for concern. In this context, financial resources used for military spending could significantly reduce the government budget allocated to social protection and consequently lead to an increase in income inequality.

Then, this paper may constitute a contribution to the debate because it focuses on the relationship between the degree of militarization and income inequality in a sample of 45 European countries over the period 2000-2017². We contribute to this research stream in two ways. First, we test whether military spending leads to an improvement or worsening of income inequality in a panel of 45 European countries over the period 2000-2017. Second, differently from the existing studies in literature that use traditional measures (military expenditure in levels, military expenditure per capita or military burden) to observe the effect of military expenditure on inequality, we use the Global Militarization Index (hereinafter GMI). GMI is a composite indicator that provides information on the means and capabilities provided to state armed forces.

² In this respect, this paper enriches the growing set of studies which focuses on the impact of military spending on societies. Traditionally, the studies on military expenditure in literature focus on: (i) the relationship between military spending and economic growth (Azam, 2020; Lobont et al., 2019; Raju and Ahmed, 2019; Khalid and Noor, 2018; D'Agostino et al., 2017; Kollias et al. 2017; Kollias and Paleologou, 2015; Dunne and Tian, 2013; Kollias 2010; Kollias et al., 2007), (ii) the possible convergence across countries in military spending (Clements et al., 2021; Yilanci et al., 2020) and finally (iii) its determinants (i.e. Odehnal et al., 2020; Odehnal and Neubauer, 2018; Solarin, 2018). Another minor strand of literature has investigated the connection between defense spending and debt (Dudzevičiūtė et al., 2021; Dunne et al., 2019; Abbas and Wizarat 2018; Caruso and Di Domizio, 2017; Paleoglou, 2013, Smyth and Narayan, 2009; Dunne et al., 2004), and the interdependence of military spending among countries (Saba, 2021; Liu et al., 2018; Caruso and Di Domizio, 2016).

Thus, this index defines the relative weight and relevance of a state's military apparatus with respect to its society. To the best of our knowledge there is only one study conducted by Elveren and Moghadam (2019) that employs this index to examine empirically the impact of militarization on gender inequality in a sample of 133 countries for the period 1990-2017.

Our main findings show that military expenditure measured with the GMI negatively influences the income inequality corroborating the inequality-widening assumption. This result is confirmed when we estimate an alternative sample of countries. Furthermore, results related to the control variables are interesting. When we use as robustness checks the IV strategy with the Lewbel model and the corresponding statistical tests that exclude any endogeneity problem, our main previous results are confirmed.

The remaining part of this paper is organized as follows. Section 2 describes the data and the variables, while Section 3 outlines the econometric strategy and presents the findings of a baseline model. Alternative estimations and robustness check are presented in Section 4. Conclusions are in the last Section.

2. Data collection and variables

To investigate the relationship between the degree of militarization and inequality, we construct a panel that includes 45 European countries³ from 2000 to 2017 combining information from different sources. Our dependent variable is income inequality captured by Gini index which is bounded between 0 (perfect equality) and 100 (max inequality). Data on Gini index come from the Standardized World Income Inequality Database (SWIID, version 8.2). SWIID database has an important advantage, it allows maximum comparability for a broad number of countries and years (Ahamad, 2017; Bergh and Nilson, 2010), standardized through the Bayesian approach information gathered from several data sources⁴. The main drawback related to the use of this

³ The following countries were considered in the dataset for our analysis: Albania, Armenia, Austria, Azerbaijan, Belarus, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Georgia, Germany, Greece, Hungary, Ireland, Italy, Kazakhstan, Latvia, Lithuania, Luxemburg, North Macedonia, Malta, Moldova, Montenegro, Netherlands, Norway, Poland, Portugal, Romania, Russia, Serbia, Slovakia, Slovenia, Spain, Sweden, Tajikistan, Ukraine, United Kingdom and Uzbekistan.

⁴ SWIID database combines information taken from: (i) Luxembourg Income Study data; (ii) OECD Income Distribution Database; (iii) the Socio-Economic Database for Latin America and the Caribbean; (iv) Eurostat; (v) the World Bank's PovcalNet, the UN Economic Commission for Latin America and the Caribbean and (iv) national statistical institutes.

dataset is that Gini coefficients are estimated and therefore subject to measurement bias (Chletsos and Stelios, 2020; Herzer, 2016; Solt, 2020). In our analysis we first employ the Gini index estimated before and after taxes and transfers. Then, we employ the Gini index unbounded. We transform the Gini index (net and gross) into unbounded variables as defined in Reuveny and Li (2003) employing the following equation $\log Gini = \log \left[\frac{Gini}{100 - Gini} \right]$. The converted variable is equal to $-\infty$ for a Gini coefficient of 0 and to $+\infty$ when the Gini index takes the value of 100 (Pindyck and Rubinfeld, 1991). We employ the Gini index unbounded for two reasons: (i) as the Gini coefficient has a value between 0 and 100, the use of the OLS estimator could generate some problems since it supposes that the dependent variable is unbounded and (ii) when using an OLS estimator, the Gini index unbounded provides a better fit to asymptotic normality assumption.

The main explanatory variable of interest is the Global Militarization Index (GMI) developed by the Bonn International Center for Conversion (BICC) that has defined the levels of militarization of 161 states since 1990. This index describes the relative weight and the role played by the military apparatus of a state within its society.

The BICC constructs this index exploiting information from several sources of data: (i) the Stockholm Peace Research Institute (SIPRI); (ii) the International Monetary Fund (IMF); (iii) the World Health Organization (WHO) and finally (iv) the International Institute for Strategic studies (IISS). To define the level of militarization of a country, the BICC considers the following three categories: (i) expenses; (ii) personnel and (iii) heavy weapons. The first category gives information on the proportions of military expenditure on GDP and health spending. The degree of militarization is also determined by the relation between (para) military personnel and both total population and physicians. Finally, the third category provide information on the number of an armed force' heavy weapons⁵ with respect to the total population. The GMI is computed considering the score of the three weighted categories, its final value is normalized on a scale from 0 to 1,000. Most countries in our sample have not experienced significant fluctuations in recent years. In fact, in countries such as Austria, Belgium, France and Greece, military spending has even been almost stable

⁵ Heavy weapons are defined as all military equipment that fall into one of these four categories: (i) armored vehicles; (ii) artillery over 100mm caliber; (iii) combat aircraft, and (iv) major fighting ships.

for some years now. Many NATO member states in the Eastern Europe show a disarmament propensity, except for Estonia, Latvia and Lithuania. The increase observed in the Baltic countries could be due to the still perceived threat from Russia and the need to modernize its army in joining NATO. In 2000, three European countries were in the top twenty positions, while in 2017 there were 5. Russia, whose military capabilities have been at their peak since its armed forces were formed in 1992, from 2001 to 2017 was in the top ten. This result is due to both the relatively high number of military personnel and the very highest number of heavy weapons systems. Although ranked among the top ten, in recent years Russia has recorded a slightly lower level of militarization. Differently from the Eastern Europe, most of large Western European countries have not experienced an increase in the militarization degree. During the period 2000-2017, in some countries such as Germany, France, Great Britain, Italy and Spain, the GMI values even decreased.

Table 1. GMI Score and Rank-2017

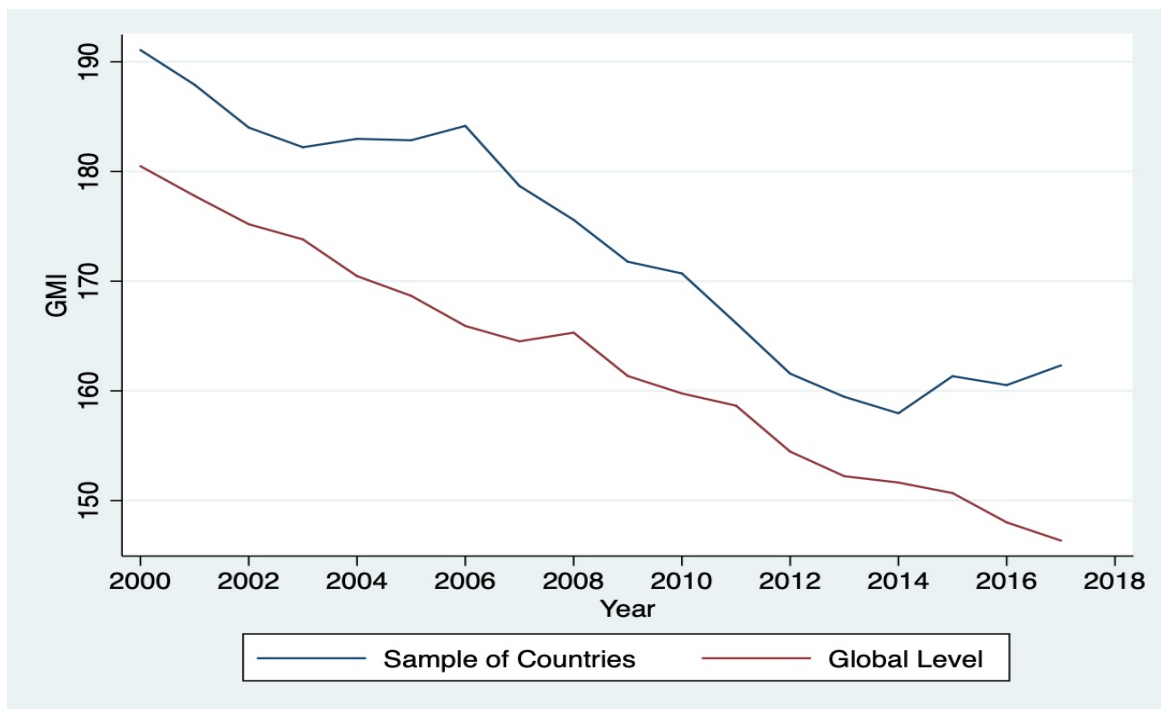
Country	GMI Score	GMI World Ranking
<i>Top 5 European countries in the ranking</i>		
Armenia	310	4
Russia	283	8
Cyprus	272	12
Greece	272	13
Belarus	230	17
<i>Last 5 European countries in the ranking</i>		
Luxembourg	116	103
Netherlands	115	104
Germany	115	105
Austria	111	106
Albania	79	129

In 2017 the European country with the highest level of militarization was Armenia followed by Russia, Cyprus, Greece and Belarus. These countries devote a high share of government budget to the armed forces in comparison to other sectors of society. Finally, the evolution of the level of militarization of Ukraine also deserves attention. Following Russia's annexation of Crimea, Ukraine significantly increased its level of militarization. Since 2014 this country has experienced a significant increase in military spending mainly due to investments in new equipment for the armed forces. To get an overview of the trend of the GMI, we calculate the average GMI for the set of countries

under examination and on a global level. Graph 1 simply visualizes that the average GMI at global level is always lower than that for the countries analyzed in our study although, during the period considered, the index has decreased in both.

The lower values of the average globally GMI are due to the inclusion, in the calculation of the average value of countries with a negligible level of militarization which smooths out the final result.

Graph 1. Trend in Global Militarization Index



Control variables are included in the analysis to account for other factors that also potentially impact the income inequality. To assess the effect of the change in the population's human capital endowments on income inequality, we include the human capital index extracted from Version 9.1 of the Penn World Table (PWT 9.1). This index is based on the average years of schooling and the rate of return to education derived from estimates in Mincer's equation. As an indicator of economic openness, we add the trade openness which is typically calculated as the ratio of the sum of imports and exports to the GDP. To capture the democracy status of countries we exploit the scores taken from Polity IV dataset (Marshall et al., 2019). These scores range from -10 (most autocratic) to +10 (most democratic). To observe if changes in pro-economic freedom policies and institutions affect income inequality, we include the Index of Economic

Freedom⁶ released by the Heritage Foundation that assigns each country a rating on a 0–100 scale. Data on GDP per capita, age dependency (defined as the ratio of dependents -- people younger than 15 or older than 64 -- to the working-age population -- those aged 15-64), inflation level and unemployment rate are taken from the World Bank’s World Development Indicator. We also add three dummy variables. The NATO dummy is equal to 1 for NATO member countries, 0 if not. The conflict dummy takes a value of 1 if the states are involved in an armed conflict and 0 otherwise. Conflict information is gathered from UCDP/PRIO Armed Conflict Dataset Codebook Version 20.1–2019. Finally, to observe the effect of compulsory military service on income disparities, we create a dummy variable that assumes a value equal to 1 if the country has mandatory conscription during the time interval under analysis and 0 otherwise. Table 2 contains the description and the sources of variables, whereas the descriptive statistics of the variables used in the estimations are presented in Table 3.

Table 2. Definition and sources of variables

Variable	Definition	Source
Inequality	Gini Index	The Standardized World Income Inequality Database - SWIID
GMI	Globalization Military Index	Bonn International Center for Conversion - BICC
GDP per capita	GDP divided by Population	World Development Indicators- WDI
Trade Openness	Exports plus imports as percent of GDP	World Development Indicators- WDI
Human Capital	Huma Capital endowments	Penn World Table-PWT
Inflation	Inflation Rate	World Development Indicators- WDI
Unemployment	Unemployment Rate	World Development Indicators- WDI
Dependency		
Economic Freedom	Index of Economic Freedom	Heritage Foundation
Democracy	Polity index	Polity IV dataset
Conscription	Country with military conscription	The World Factbook CIA
Conflict	Country in an armed conflict	UCDP/PRIO
NATO	For non-NATO members NATO = 0 and for NATO members, NATO =1	Author’s computation

Table 3. Descriptive statistics

Variables	Number of Observations	Mean	Standard Deviation	Minimum Value	Maximum Value
Inequality					
Gini Net	776	3.823	0.150	3.096	4.036
Gini Net Unbounded	776	-0.156	0.251	-1.260	0.266
Gini Gross	776	3.415	0.154	3.109	3.777
Gini Gross Unbounded	776	-0.819	0.225	-1.243	-0.253
Global Militarization Index	767	6.525	9.147	6.001	6.762
GDP per capita	810	9.524	1.300	5.309	11.803

⁶ The index considers 10 different elements of economic freedom that are grouped in four categories:

- (i) rule of law: property rights, freedom from corruption.
- (ii) government size: fiscal freedom, government spending.
- (iii) regulatory efficiency: business freedom, labor freedom, monetary freedom.
- (iv) market openness: trade freedom, investment freedom, financial freedom.

Openness	768	-0.053	0.413	-1.184	1.331
Human Capital	684	1.178	0.438	0.802	7.616
Inflation	747	1.028	1.210	-5.116	5.128
Unemployment	810	2.169	0.556	0.591	3.618
Dependency	792	3.880	0.114	3.548	4.450
Economic Freedom	790	4.157	0.152	3.600	4.414
Democracy	762	2.728	0.637	0	2.996
Conscription	810	0.594	0.491	0	1
Conflict	810	0.585	0.493	0	1
NATO	810	0.478	0.500	0	1

Note: All continuous variables are expressed in the natural logarithm form

3. Econometric specification and results

Based on the previous theoretical considerations on the relationship between militarization and income inequality, we verify empirically the following hypotheses:

H1: The militarization impacts positively on income inequality - the inequality-narrowing hypothesis.

H2: The militarization negatively affects income inequality – the inequality-widening hypothesis

H3: The militarization has a negligible impact on income inequality - the neutrality hypothesis

To test these assumptions, we use a panel data model specified as follows:

$$\ln inequality_{it} = \beta_0 + \beta_1 \ln GMI_{t-1} + \beta_2 Z_{it-1} + \beta_3 W_{it} + \mu_i + v_{it}$$

where, $\ln inequality_{it}$ is the dependent variable, namely the Gini index (net and gross) that describes the level of income inequality in country i at time t and $\ln GMI_{t-1}$ represents the one-year lagged index of militarization. The vector Z_{it-1} is a vector of the demographic, political and economic variables defined above, whereas the vector W_{it} includes a set of dummy variables (conflict, military conscription and NATO). To estimate a punctual elasticity and mitigate the skewness, all continuous explanatory variables are converted into a natural log value. Simultaneously, the explanatory variables have been also one-year lagged to minimize the endogeneity issue. Finally, μ_i refers to the country fixed effect, and v_{it} is the error term capturing all other omitted factors. We have performed the Hausman test, which shows that the fixed-effect model is to be preferred to the random effect model. Table 4 collects the results of the regression estimates in assessing the impact of military spending on income inequality.

Table 4. Globalization Military Index and Inequality - Main Results

VARIABLES	(1) Gini Net	(2) Gini Net Unbounded	(3) Gini Gross	(4) Gini Gross Unbounded
Ln Globalization Military Index $(t-1)$	0.089*** [0.030]	0.164*** [0.057]	0.105** [0.043]	0.149** [0.064]
Ln Human Capital $(t-1)$	0.088 [0.132]	0.095 [0.238]	-0.202 [0.174]	-0.342 [0.258]
Ln GDP per capita $(t-1)$	-0.020** [0.009]	-0.035** [0.016]	-0.029*** [0.010]	-0.041*** [0.014]
Ln Openness $(t-1)$	-0.011 [0.021]	-0.021 [0.037]	0.015 [0.025]	0.025 [0.036]
Ln inflation $(t-1)$	0.000 [0.001]	0.000 [0.003]	-0.001 [0.002]	-0.001 [0.002]
Conflict	0.008* [0.004]	0.014* [0.008]	0.010* [0.005]	0.014* [0.007]
Conscription	-0.018*** [0.006]	-0.033*** [0.012]	-0.024*** [0.007]	-0.034*** [0.010]
NATO	0.016 [0.010]	0.026 [0.019]	0.019 [0.013]	0.029 [0.020]
Ln unemployment $(t-1)$	0.028*** [0.008]	0.051*** [0.015]	0.030*** [0.007]	0.043*** [0.011]
Ln Economic Freedom Index $(t-1)$	0.080 [0.052]	0.144** [0.084]	0.171*** [0.058]	0.253*** [0.081]
Ln Polity Index $(t-1)$	0.117** [0.049]	0.209** [0.087]	0.062 [0.055]	0.092 [0.080]
Ln Dependency $(t-1)$	0.099* [0.055]	0.189* [0.100]	0.047 [0.061]	0.066 [0.090]
Linear Time Trend	YES	YES	YES	YES
Constant	2.205*** [0.479]	-3.095*** [0.822]	2.052*** [0.488]	-2.746*** [0.695]
Observations	513	513	513	513
R-squared	0.398	0.402	0.397	0.403
Number of ID	36	36	36	36
Hausman's test				
<i>P-Value</i>	0.000	0.000	0.000	0.000

Notes: Clustered standard error at country level in brackets. Statistical significance *** p<0.01, ** p<0.05, * p<0.10

Findings in columns 1 and 2 refer to the baseline model with the Gini index estimated after taxes and transfers, and the same indices transformed into unbounded variables. Column 3 and 4 present results with the Gini index estimated before taxes and transfers and the relative unbounded index.

The main result we would claim is that the one-year lagged value of the global military index is significantly and positively associated with the current values of income inequality. In fact, militarization appears to be positively associated with income inequality. The magnitude of the effect of global military index on income inequality changes depending on the Gini score employed. Looking at the effect of the lagged militarization index on the Gini bounded coefficient (net and gross), we find that it is statistically significant for both indices although the effect turns out to be larger for the Gini gross coefficient (0.105%).

The impact is, on the contrary, greater when the unbounded Gini index is considered. In particular, when we use the unbounded Gini index after taxes and transfers, the estimated coefficient on military expenditure highlights that a 1-point percent change in militarization index in the previous year leads to a change equal to 0.164% in the income inequality in the current year, whereas when we employ the

unbounded Gini index before transfers and taxation the coefficient is slightly lower. In any case we could argue that a 1-point percent change in militarization index in the previous year is associated with an increase in inequality that is slightly larger than 0.1%. There are several additional findings that deserve to be highlighted. It emerges that inequality increases during conflict. This result points to the direction that conflict impedes economic growth with disproportionate effects especially for the poorest population. Conflict also reduces social spending as governments lose access to revenue due to both poor economic performance and poor tax collection. As a result, the poorest people suffer the most from the economic hardships generated by the conflict. Interestingly, military conscription seems to be negatively related to income inequality. This means that, in the countries analyzed, military conscription has had a redistributive effect in the period considered.

Other control variables exhibit the expected signs. An increase in GDP per capita in the previous year reduces inequality in the current year. On the contrary, unemployment leads to a worsening of income distribution. Looking at the economic freedom, we find that a higher degree of economic freedom go hand in hand with a higher degree of income inequality. In other words, income inequality is strongly related to the economic reform policies and institutional changes that many countries have adopted. More liberalized policies by means of non-progressive taxes, spending, and regulatory frameworks can limit redistribution by benefiting those with high incomes. Our results are consistent with those obtained by Bergh and Nilson (2010) and who argue that economic freedom seems to increase inequality mainly in developed countries. Going to the democracy level, results prove that countries with a more democratic political system are those with a higher inequality level. It follows that democratic institutions do not necessarily guarantee a reduction in income inequality (Gradstein and Milanovic, 2004; Acemoglu et al., 2015; Wong, 2016; Timmons, 2010) as well as a more progressive tax system (Scheve and Stasavage, 2016) and social welfare schemes for the poor population (Pagalyan, 2021) because the implementation of equalizing policies depends mainly on the social and institutional context in which democracies operate (Bahamonde and Trasberg, 2021; Albertus and Menaldo, 2018, Sofier, 2013). This result is in contrast with other studies (Bollen and Jackman, 1985; Lee, 2005; Rodrik, 1999; Reuveny and Li, 2003) which claim that generally democracies are more inclined to redistribute in accordance with the median voter and selectorate theories (Scervini,

2012; Acemoglu and Robinson, 2006; Boix, 2003) with a reduction in inequality as final effect. Finally, changes in the population age structure also affect the income inequality, in fact, the increase in the old-age dependency ratio appears to worsen income distribution, too. This is probably due to the fact that in general the economic status of elderly people has a significant dispersion because of idiosyncratic events or shocks occurred during their lifetime. Particularly, the income of elderly people depends on their accumulation of human capital, saving, and finally risk management abilities. Therefore, a high proportion of elderly people worsens the aggregate income inequality of the total economy.

4. Robustness check and alternative estimations

(i) The issue of Endogeneity

To rule out endogeneity issues, we estimate IV regressions based on the approach suggested by Lewbel (2012) which is based on the use of a 2SLS (two-stage-least squares) strategy that incorporates internally constructed heteroskedasticity-based instruments. This approach is preferred when no external instruments are readily available, in fact, employing the Lewbel's technique the internal instruments can be built from the residuals of the auxiliary equations and these residuals are multiplied by each included exogenous variable in mean-centering form. Specifically, this approach uses the conditional second moment of the focal regressors that in our study is the level of militarization. This approach works under two conditions: (i) the residuals derived from the first-stage regression must be heteroscedastic; and (ii) the vector of regressors used must be correlated with the variance of these residuals and, at the same time, these regressors must be independent of the covariance between these first-stage residuals and the residuals derived from the second-stage regression. If these assumptions are satisfied, the product of first-stage regression and mean-centering regressors gives instruments. Therefore, since it is useful to check for the heteroscedasticity of the first-stage residuals, we employ the Breusch-Pagan test, the null hypothesis is that errors are homoscedastic (Baum and Lewbel, 2019). Thus, in the first stage, we estimate our dependent variables on the other regressors, and we compute the residuals. Then, we perform the Breusch-Pagan statistic to control the heteroscedasticity of residuals. We obtain the instruments by mean centering each

regressor and multiplying it with the first-stage residuals. In the second stage, we estimate the previous equation exploiting the instruments derived. The validity of our instrumentation procedure is tested applying the Kleibergen-Paap F statistic whereas the Hansen-J test is used to control the overidentifying restrictions. Finally, we also test for the exogeneity of our inequality output performing the Sargan test. The null hypothesis, namely the level of militarization is exogenous, is checked using a statistical test distributed as a chi-squared with a number of degrees of freedom corresponding to the number of endogenous variables (Courtemanche et al., 2021). Table 6 contains the results obtained through the IV-GMM technique developed by Lewbel (2012). Specifically, columns 1-4 show the estimations considering the total sample of countries, columns 5-8 present the findings obtained excluding Russia and finally columns 5-8 display empirical evidence when excluding those countries with a median population over the 90th percentile of the total population.

Table 6. Globalization Military Index and Inequality - Lewbel's Estimates

VARIABLES	Total Sample of Countries				Excluding Russia			Excluding countries with a median population over the 90th percentile of the total population				
	(1) Gini Net	(2) Gini Net Unbounded	(3) Gini Gross	(4) Gini Gross Unbounded	(5) Gini Net	(6) Gini Net Unbounded	(7) Gini Gross	(8) Gini Gross Unbounded	(9) Gini Net	(10) Gini Net Unbounded	(11) Gini Gross	(12) Gini Gross Unbounded
Δ Ln Global Militarization Index	0.008*	0.016*	0.011*	0.016*	0.011**	0.020**	0.014***	0.020***	0.010**	0.018**	0.015***	0.021***
	[0.005]	[0.009]	[0.006]	[0.008]	[0.005]	[0.009]	[0.005]	[0.007]	[0.005]	[0.009]	[0.005]	[0.007]
Δ Ln Human Capital	0.079	0.112	-0.136**	-0.236**	0.113*	0.179	-0.106	-0.196*	0.120*	0.197*	-0.088	-0.173*
	[0.066]	[0.118]	[0.067]	[0.096]	[0.063]	[0.114]	[0.071]	[0.102]	[0.065]	[0.116]	[0.073]	[0.104]
Δ Ln GDP per capita	-0.010**	-0.019**	-0.006	-0.009	-0.015***	-0.026***	-0.011	-0.014	-0.015***	-0.026***	-0.011	-0.015
	[0.005]	[0.010]	[0.007]	[0.010]	[0.005]	[0.010]	[0.007]	[0.010]	[0.006]	[0.010]	[0.007]	[0.010]
ΔLn Openness	0.000	0.000	0.001	0.002	-0.003	-0.005	-0.001	-0.000	-0.005	-0.008	-0.001	-0.000
	[0.001]	[0.001]	[0.001]	[0.001]	[0.004]	[0.008]	[0.006]	[0.009]	[0.004]	[0.008]	[0.006]	[0.009]
Δ Ln inflation	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	[0.000]	[0.001]	[0.000]	[0.001]	[0.000]	[0.001]	[0.000]	[0.001]	[0.000]	[0.000]	[0.000]	[0.001]
Δ Ln unemployment	0.010***	0.018***	0.013***	0.018***	0.009***	0.017***	0.012***	0.017***	0.009***	0.016***	0.011***	0.016***
	[0.002]	[0.004]	[0.003]	[0.004]	[0.002]	[0.004]	[0.003]	[0.004]	[0.002]	[0.005]	[0.003]	[0.004]
Δ Ln Economic Freedom Index	-0.007	-0.014	0.026*	0.037*	-0.011	-0.022	0.022	0.031	-0.016	-0.030	0.020	0.027
	[0.012]	[0.021]	[0.015]	[0.022]	[0.012]	[0.022]	[0.016]	[0.023]	[0.012]	[0.021]	[0.016]	[0.023]
Δ Ln Polity Index	0.001	-0.001	-0.01	-0.017	-0.003	-0.012	-0.019	-0.032	0.006	0.008	-0.018	-0.032
	[0.011]	[0.022]	[0.013]	[0.022]	[0.010]	[0.020]	[0.012]	[0.020]	[0.008]	[0.014]	[0.012]	[0.020]
Δ Ln Dependency	0.034	0.068	-0.034	-0.058	0.027	0.056	-0.041	-0.064	0.027	0.054	-0.039	-0.062
	[0.023]	[0.043]	[0.030]	[0.044]	[0.023]	[0.044]	[0.030]	[0.043]	[0.024]	[0.044]	[0.031]	[0.044]
NATO	0.002***	0.004**	0.003***	0.005***	0.002**	0.003*	0.003***	0.004***	0.001	0.002	0.003**	0.004**
	[0.001]	[0.002]	[0.001]	[0.002]	[0.001]	[0.002]	[0.001]	[0.002]	[0.001]	[0.002]	[0.001]	[0.002]
Conflict	0.001*	0.002*	0.002**	0.003**	0.002***	0.004***	0.003**	0.004**	0.003***	0.005***	0.004***	0.005***
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.002]
Conscription	0.001	0.002	0.001	0.001	0.001	0.002	0.001	0.001	0.000	0.001	-0.000	-0.000
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.002]	[0.001]	[0.001]
Observations	518	518	518	518	497	497	497	497	431	431	431	431
R-squared	0.193	0.195	0.138	0.138	0.208	0.211	0.14	0.139	0.207	0.211	0.156	0.157
YEAR DUMMIES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Hansen Test (p-value)	0.5862	0.5634	0.7464	0.7248	0.7162	0.655	0.7332	0.6954	0.8168	0.7453	0.8641	0.8381
Endogeneity test (p-value)	0.8078	0.7889	0.1289	0.1282	0.7176	0.652	0.1693	0.1752	0.4451	0.3768	0.3177	0.3306
Kleibergen-Paap rk Wald F statistic	59.2	59.2	59.2	59.2	68.881	68.881	68.881	68.881	84.353	84.353	84.353	84.353
<i>First stage: Breusch-Pagan test (p-value)</i>												
Dep Var: Ln Globalization Military Index	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.10

With respect to the main estimation presented in the previous section, the main results do not change. The impact of the level of militarization on inequality preserves its statistical significance and passes endogeneity tests in all specifications. Specifically, the impact of the militarization degree on income inequality ranges from 0.008 to 0.016 when we consider the total sample of countries. Instead, excluding Russia and the countries with a population over 90th percentile, the effect of GMI on income disparities is between 0.011% and 0.021%. Thus, when we perform the Lewbel's approach on the sub-sample countries, the effect of the militarization degree on the income distribution assumes a higher coefficient compared to those found when we examine the total set of countries.

Focusing on the Gini gross index and relative unbounded Gini index, we observe that the human capital becomes statistically significant at 5% and it seems to reduce inequality. This means that a change in the population's human capital endowments reduce inequality since it exists an interdependence between the human capital investments and the increase in income levels (Barro and Lee, 2013). The result related to NATO deserves attention. Differently from baseline results, the countries belong to NATO exhibit a higher level of inequality than non-NATO countries. The plausible explanation is that the European NATO countries, particularly Baltic and Eastern European countries, allocate public resources to armed forces because they perceive themselves to be threatened by Russia (Mutschler and Bales 2020). Yet, the result obtained through the Lewbel's approach seems to show the trade-off between military and welfare spending since NATO countries appear more inclined to allocate public funding to maintain and function their countries' defense rather than divert resources that could be devoted to programs designed to reduce income inequality. This result contrasts with that highlighted by Chletsos and Stelios (2020) who show that in some NATO countries defense spending leads to an improvement in income distribution. Finally, the Hansen test and the Wald statistics, presented in the last lines, confirm the validity of our instruments.

(ii) Alternative sample of countries

As alternative estimations, we have re-run the analysis so highlighting the effect of militarization on income inequality in sub-samples of countries. For these estimates, we have also performed the Hausman's test indicating that the fixed-effects model is always

preferred. Table 5 contains the empirical findings obtained excluding: (i) Russia that could be considered an outlier and (ii) the countries with a median population over the 90th percentile of the total population⁷. The main results are confirmed. For the sake of clarity, coefficients of control variables are not reported since all control variables confirm the expected signs.

Table 5. Military spending and income inequality – Different Samples

4.1 Excluding Russia				
VARIABLES	(1)	(2)	(3)	(4)
	Gini Net	Gini Net Unbounded	Gini Gross	Gini Gross Unbounded
Ln Globalization Military Index $(t-1)$	0.088*** (0.030)	0.163*** (0.057)	0.104** (0.043)	0.147** (0.064)
Control Variables	YES	YES	YES	YES
Linear Time Trend	YES	YES	YES	YES
Constant	2.174*** (0.498)	-3.107*** (0.844)	2.031*** (0.506)	-2.753*** (0.721)
Observations	497	497	497	497
R-squared	0.144	0.167	0.354	0.351
Number of ID	35	35	35	35
Hausman's test				
<i>P-Value</i>	0.000	0.000	0.000	0.000
4.2 Excluding countries with a median population over the 90th percentile of the total population				
VARIABLES	(1)	(2)	(3)	(4)
	Gini Net	Gini Net Unbounded	Gini Gross	Gini Gross Unbounded
Ln Globalization Military Index $(t-1)$	0.087*** (0.030)	0.016*** (0.058)	0.103** (0.043)	0.146** (0.064)
Control Variables	YES	YES	YES	YES
Linear Time Trend	YES	YES	YES	YES
Constant	2.144*** (0.511)	-3.153*** (0.860)	2.047*** (0.521)	-2.727*** (0.744)
Observations	433	433	433	433
R-squared	0.140	0.165	0.268	0.271
Number of ID	31	31	31	31
Hausman's test				
<i>P-Value</i>	0.000	0.000	0.000	0.000

Notes: Clustered standard error at country level in brackets. Statistical significance *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

When we exclude these countries from our sample, the statistical results do not change with respect to the findings obtained by the baseline model, since these countries are not in the extreme positions but close to the mean. In sum, the impact of lagged militarization level on current inequality is always positive and significant with reference to both the Gini index bounded and unbounded.

5. Conclusions

The aim of the paper was to investigate the relationship between the degree of militarization and income inequality in a panel of 45 European countries in the period

⁷ The countries excluded are the following: France, Germany, Italy, Russia and the United Kingdom.

2000-2017. Our measure of income inequality is the Gini index (net and gross) also expressed in unbounded values. Instead, to observe the militarization level, we have employed the Global Militarization Index (GMI) compiled by the Bonn International Center for Conversion (BICC).

The main findings highlight a positive effect of military spending on income inequality. More specifically, we find that a 1-point percent change in militarization index in the previous year leads to a change equal to 0.16% in the income inequality in the current year when we use the unbounded Gini index after taxes and transfers. This means that the magnitude effect of military spending on inequality appears to be relevant. This result is robust since resists several robustness checks, including sample restrictions and outliers. The main results are confirmed when we exclude Russia and the countries with a population over 90th percentile. In addition, for the sake of robustness, we have applied the Lewbel (2012) IV–GMM approach to address potentially endogeneity bias. Moreover, the main result is confirmed with the use of the Lewbel model, in fact, a 10% increase in the militarization degree corresponds to an average 0.08% increase in inequality. These results suggest that the militarization negatively affects income inequality and the empirical evidence is in line with the strand of literature that highlights the presence of the inequality-widening hypothesis.

Among controls, results also highlight that according to the literature the democracy level is negatively correlated with inequality. Differently from the baseline model and in contrast with the literature, NATO countries seem to be characterized by higher levels of income inequality. In addition, we originally obtain results when considering military conscription since it is negative associated with income inequality. This means that in our set of countries, the compulsory military service has a re-distributional effect.

To conclude, our empirical evidence could be useful for policymakers whose main objective is to maximize the social welfare function and allocate limited public resources in an efficient way to be used for different items. Specifically, these public financial resources could be devoted to the social and welfare systems, which should reduce inequality. Thus, the persistence of the inequality-widening hypothesis suggests a change in the policy objective: military spending should be reduced while spending on economic and social cohesion should be increased.

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Appendix

Graphs 2–8. Trends in Global Militarization Index

