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Military expenditure and income inequality in European NATO Member States

The purpose of this investigation was to empirically assess the association between military expenditure and income inequality in the 19 European member states of NATO between 2011 and 2022. To achieve this, the authors carried out multivariate statistical analysis using Kaplan-Meier life tables and survival estimation techniques. The results highlighted a trend in the countries analysed that income inequality tended to decrease when investment in the military increased during the period under consideration. The association manifested itself in the shortest time in the group of countries with the lowest military spending per capita, while emerging in the longer term in the countries with the highest. Furthermore, under high threat of war, the association tends to be shortest in relative terms in countries with the lowest military expenditure per capita. The results also revealed that the association between military spending and income inequality is more pronounced in the smallest countries by population and those with the lowest military expenditure per capita. The authors believe that this investigation will enrich scientific knowledge with new insights.

Keywords
military expenditure, income inequality, NATO, European countries

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Introduction

Following Russia's annexation of Crimea in 2014 and brutal invasion of Ukraine in February 2022, many countries have seen a significant increase in military spending. Such increases have consequences for countries particularly when it comes to income inequality (Tian et al., 2023). According to Hartley (2011), they may reduce the ability to finance civilian areas in the presence of budgetary constraints and thus lead to a decrease in economic growth rates. Given that economic growth is the most effective tool for alleviating income inequality, a slowdown can be expected to increase it. In other words, an increase in military spending can have a positive association with income inequality. Some other studies (Michael & Stelios, 2020; Ghosh, 2022) have, however, shown a negative association, with increasing military spend tending to reduce income inequality.

A third outcome is also possible, whereby increasing military spending has a neutral association with income inequality (Lin & Ali, 2009; Wolde-Rufael, 2016b). Notably, the rates of change may differ, with military expenditure changing dramatically and quickly while income inequality changes gradually.

But what is the situation in European countries that are members of the North Atlantic Treaty Organization (NATO), which differ in military expenditure per capita and population size? The scientific literature lacks an answer to this question, which the authors therefore aimed to address. The study focuses on assessing the association between military expenditure and income inequality in groups of small and large countries in terms of population. It also aims to elucidate the survival time of income inequality ratios when national military expenditure changes in these groups. Furthermore, the study seeks to answer the question of whether an increased threat of war affects the association.

It should be noted that the research period includes the first year of Russia's war against Ukraine, which started in 2022 – meaning the significant increase in military spending in many countries is only partially reflected in the study. However, the impact of Crimea's annexation in 2014, after which many countries increased military funding, is reflected in the findings. The authors believe that the study will supplement scientific knowledge and enrich study areas such as financial management in defence systems and social research methodology with new insights.

1. Literature review

The research focuses on the association between military expenditure and income inequality, with controversial views on whether the former can reduce the latter (Zhang et al., 2017). Although researchers have increasingly focused on the subject of rising income inequality, there are difficulties in identifying its determinants (Wolde-Rufael, 2016b). According to Ang (2010), however, its association with military expenditure can vary depending on a country's stage of economic development.

In the scientific research examined (Lin & Ali, 2009; Wolde-Rufael, 2016b), three hypotheses have been distinguished with regard to the link between military expenditure and income inequality. First, the *inequality-narrowing* hypothesis states that increases in military expenditure can lead to higher incomes in the sector that may increase aggregate demand. This idea is related to the Keynesian proposition, which states that the financing of the military through the stimulation of aggregate demand has a positive relationship with economic growth, leading to opportunities to reduce income inequality. However, higher military spending can also mean less money for public goods and services such as education, healthcare, public order and security, and this has negative effects on economic development and can worsen the distribution of income (Hartley, 2011). A second proposition is the *inequality-widening* hypothesis, which is underpinned by the perspective that the military industry uses relatively better-paid labour than other less-skilled sectors. The result is a rise in the intersectoral wage gap, thereby increasing income inequality (Ali, 2007; Wolde-Rufael, 2016b). A third, the *neutrality* hypothesis, suggests that the association between military expenditure and income inequality may be insignificant or neutral, as the military accounts for a negligible share of the economy's total spend and workforce.

Studies in Taiwan, South Korea and Pakistan at different times have shown that higher military expenditure leads to rising income inequality (Wolde-Rufael, 2016a, 2016b; Sharif & Afshan, 2017). Moreover, in South Korea, detailed calculations have shown that a 1% rise in such spending increases that inequality by 0.38% (Wolde-Rufael, 2016b). A study covering 31 provinces in China between 1997 and 2012, meanwhile, found that the relationship between the two varied by the level of economic development. In provinces with high levels of development, increases in military spending did not crowd

out investment in social welfare, whereas the opposite occurred in economically weaker ones (Zhang et al., 2017). A separate study on countries in the Organisation of Islamic Cooperation between 2003 and 2014 linked military spending not only to income inequality, but also levels of corruption. It found that greater corruption strengthened the association between military spending and income inequality, with such inequality tending to grow as a result (Golkhandan & Babayi-Agh-Esmaeili, 2017). Other research for OECD countries showed a positive association between military expenditure and income inequality during the period from 1990 to 2007 (Graham & Mueller, 2019). Elsewhere, the BRICS countries and Turkey saw contrasting results depending on the period analysed. Between 1995 and 2010, income inequality promoted military spending, whereas the period between 2000 and 2015 period saw military expenditure driving income inequality (Gül & Torusdag, 2019). A study of 14 NATO countries showed that income inequality tended to decrease as defence spending increased (Michael & Stelios, 2020). This insight was supported by the results of another study that analysed the 10 highest spenders on defence between 1990 and 2015 (Ghosh, 2022). However, a study of transition countries over the same period produced the opposite results, showing a positive relationship between military spending and income inequality (Biscione & Caruso, 2021). In other research that focused on developing countries, Gillani et al. (2022) classified nations as democratic or authoritarian. In democracies, they found a negative association, with an increase in defence funding tending to be associated with a fall in income inequality. In most of these countries, aggregate demand and employment in the defence sector could be increased by boosting military investment, thereby reducing income inequality through new employment opportunities. In contrast, authoritarian countries showed a positive association, with income inequality tending to increase alongside higher levels of military funding. The researchers suggested these results were due to leaders in authoritarian countries often investing in the military to show their power while ignoring the economic problems associated with income inequality (Gillani et al., 2022). A recent study highlighted that indirect taxes have become an attractive source of funding for increasing military spending in Ukraine (Tian et al., 2023). This regressive form of taxation imposes a relatively higher burden on the poorer majority.

In conclusion, empirical results from research carried out in various countries show that income inequality is sensitive to changes

in military spending in most cases. Higher military spending is sometimes associated with reduced income inequality, mostly in economically stronger and democratic countries. In other cases – mostly in economically weaker countries – the opposite is seen, with higher military expenditure associated with increased income inequality. The literature review also shows that the association between military spending and income inequality depends on other factors, such as the period analysed, and the levels of economic development, democracy and corruption.

2. Research methodology

The authors of this study assume that income inequality is influenced by a wide range of macro-, meso- and micro-level factors, but the focus of this paper is on analysing its association with military expenditure. The choice of research direction was influenced by the literature review, which revealed a lack of up-to-date knowledge on the interrelationship of these two factors in European members of NATO. Such analysis is particularly important in the context of Russia's war against Ukraine.

2.1. Hypotheses

The following hypotheses were formulated and tested in the analysis: **H1** *Income distribution inequality ratios in European NATO countries are associated with national military expenditure per capita*; **H2** *The association between national military expenditure and income distribution inequality ratios in European NATO countries changes in the face of an increased threat of war.* Moreover, in light of the discussions in the scientific literature that military power depends on a country's population size (Baldacchino & Wivel, 2020; Long, 2017), the research hypothesis **H3** was formulated: *National military expenditure is associated with income distribution inequality ratios in European NATO countries depending on country size.*

To test these hypotheses, data on 19 European Union countries was collected from Eurostat (n. d.) and SIPRI (n. d.) for the period between 2011 and 2022. These countries comprised Belgium, Bulgaria, Czechia, Denmark, Estonia, France, Germany, Greece, Hungary, Italy, Latvia, Lithuania, the Netherlands, Poland, Portugal, Romania,

Slovakia, Slovenia and Spain. The countries are also members of NATO, joining the organisation between 1949 and 2004. The idea behind the selection of such countries is that NATO member states follow the same requirements for military expenditure, so are appropriate for inclusion in international-level analysis. Although Luxembourg is a member of the European Union and NATO, it is not included in the analysis because it has the unique position of a micro-state with a huge annual GDP per capita, which makes it stand out from other countries (Baldacchino & Wivel, 2020; Long, 2017). In using the statistical methods applied in the analysis, the exclusion of such extreme cases is a way to avoid large deviations and distortions in the final results (Frankfort-Nachmias et al., 2020).

The period of 2011 to 2022 was chosen for the analysis for two main reasons: (1) it brings the analysis close to the present day but is less explored than other periods, meaning there is a lack of up-to-date knowledge on the phenomena; (2) it has been full of influential events, including mass illegal immigration into Europe and the intensification of military tensions in Eastern Europe.

With regard to the second point, two time periods were analysed: 2011 to 2013, marking the period before Russia's invasion of Crimea; and 2014 to 2022, after the annexation of Crimea in early 2014.

2.2. Data

Official data on the following measures was collected for the analysis:

(a) Military expenditure in constant US$ per year in millions (SIPRI Military Expenditure Database, n. d.). In the analysis, this expenditure was converted into US$ per capita / year (Annex 1). From this data, the additional variable of military expenditure groups was created, with the following groups used in the analysis: Group 1: expenditure of less than US$200 per capita / year; Group 2: expenditure of US$200-299 per capita / year; Group 3: expenditure of US$300-399 per capita / year; Group 4: expenditure of US$400-499 per capita / year; Group 5: expenditure of US$500-599 per capita / year; and Group 6: expenditure of US$600 or more per capita / year (Annex 2).

(b) Income distribution inequality as an S80/S20 ratio, defined as the ratio between the mean income of the richest and poorest 20

per cent of a country's population. This measure was prioritised over other measures of income distribution inequality, such as the Gini coefficient, because it is most evident and comprises the most comprehensive set of official data available for this research (Eurostat, n. d.; Annex 1)

(c) The population in each country on 1st January. In the analysis, countries were divided into four groups (Annex 2): Country group 1: small countries with a population of 1-9 million (Bulgaria, Denmark, Estonia, Hungary, Latvia, Lithuania, Slovakia and Slovenia); Country group 2 – small countries with a population of 10 to 19 million (Belgium, Czechia, Greece, the Netherlands and Portugal, as well as Romania between 2014 and 2022); and Country group 3: large countries with a population of more than 20 million (France, Germany, Italy, Poland and Spain, as well as Romania between 2011 and 2013).

In total, 228 cases were collected for the analysis, comprising data for 19 countries over a 12-year period. The information was organised into a database that explored by using the IBM SPSS v. 20 statistical package.

2.3. Data analysis methods

A multivariate statistical analysis was conducted to test the hypotheses (Clark et al., 2021; Frankfort-Nachmias et al., 2020), with Kaplan-Meier life tables and survival estimation methods applied as the main research techniques. These techniques relate to the probabilistic statistical group of methods based on event history analysis (Allison, 2014; Blossfeld & Rohwer, 2002), which are linked to the principle that life events intersect over time. The use of life tables enables researchers to estimate the extent to which changes in one event intersect with changes in another. Meanwhile, survival estimation expresses how long certain statuses in the trajectory of one event last before a status change in that of another occurs.

To compare the mean survival time of the trajectories of military expenditure and income distribution inequality, Breslow (generalised Wilcoxon), and log-rank (Mantel-Cox) indexes were calculated (Allison, 2014; Blossfeld & Rohwer, 2002). The mean survival time shows the mean waiting time from the start to end of a certain status in the trajectory, with the Breslow (generalised Wilcoxon) index reflecting differences between compared trajectories, mostly at the

beginning of the waiting time. Meanwhile, the log-rank (Mantel-Cox) index also reflects such differences, but mainly in the second part of the waiting time, i.e. after the annexation of Crimea. With regard to the indexes, the greater the values, the greater the difference between survival trajectories.

During the analysis, the association between military expenditure and changes in the status of income distribution inequality ratios from 3.0 to 8.3 was explored for the period between 2011 and 2022. Six statuses of military expenditure were represented by the groups described above, while two statuses involving time were represented by the periods before and after Crimea's annexation. The results of life tables are provided in figures and the estimation indexes in tables.

The authors of this paper believe that life tables and survival estimations can act as effective means of disclosing the association between military expenditure and the appearance of income distribution inequalities over time.

3. Results and discussion

3.1. Test of hypothesis H1

H1: *Income distribution inequality ratios (measured by S80/S20 ratios) in European NATO countries are associated with national military expenditure (in constant US$ per capita / year)*. First, the mean values for national military expenditure and the income distribution inequality ratio were calculated (Figure 1). A decrease in military expenditure was associated with an increase in income distribution inequality from 2013 to 2014. The opposite was the case when expenditure increased between 2015 and 2020, coinciding with a decrease in the income distribution inequality ratio. There was a small anomaly in this trend between 2020 and 2021, but it was reverted to normal the following year.

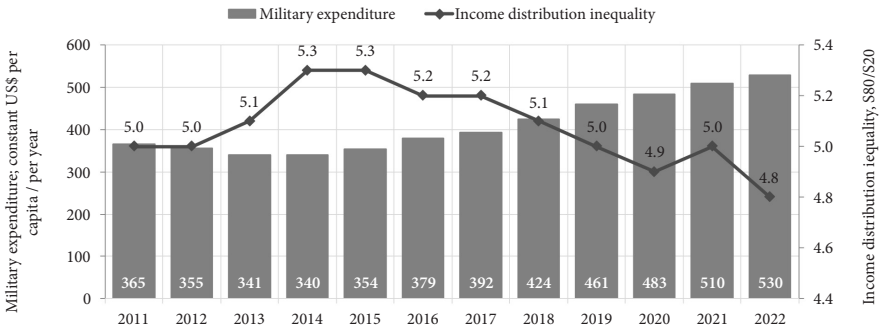

Figure 1. **Mean military expenditure and income distribution inequality ratios in European NATO countries, 2011-2022.**

Source: Authors' elaboration.

To evaluate the association between income distribution inequality ratios and national military expenditure by year, estimations were calculated for survival time of these ratios when spending changes (Table 1). The shortest mean survival time (4.3 years) was recorded in the group with military expenditure of less than US$200 per capita / year, whereas the longest (7.7 years) was in the US$300-399 group. The US$500-599 and US$600-plus groups had similar survival times to this latter group. In the other two groups, with spends of US$200-299 and US$400-499, respective income distribution inequality ratios of 6.0 and 6.9 years were recorded. Use of the Breslow (generalised Wilcoxon) and log-rank (Mantel-Cox) indexes gave statistically significant results, with values of 13.847 and 15.0074 respectively. Both indexes revealed differences between trajectories, which were greater in the second part of the waiting period than the first.

Table 1. **Survival estimations for income distribution inequality ratios by military expenditure groups in European NATO countries, 2011-2022 (mean survival times, Breslow (generalised Wilcoxon) index and log-rank (Mantel-Cox) index).**

Military expenditure group	Survival estimations of income distribution inequality ratios		
	Mean survival time (in years)	Breslow (generalised Wilcoxon) index	Log-rank (Mantel-Cox) index
Less than US$200	4.3	13.847 ***	15.074 ***
US$200-299	6.0		
US$300-399	7.7		
US$400-499	6.9		
US$500-599	7.2		
US$600 or more	7.2		

Note: statistical significance: *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$.

Source: authors' elaboration.

In summary, the results support hypothesis H1. Meanwhile, income distribution inequality ratios tended to change faster in countries with lower military expenditure per capita and over the longer term in countries that spent higher amounts. Estimation indexes reveal a stronger association between the trajectories explored in the second part of the waiting period.

3.2. Test of hypothesis H2

H2: *The association between national military expenditure (in constant US$ per capita / year) and income distribution inequality ratios (in S80/S20) in European NATO countries changes in the face of an increased threat of war*. As well as including the additional variable of the threat of war in calculations via this hypothesis, it was tested how fast the income distribution inequality ratio changed from 3.0 to 8.3 within the waiting period. Two time periods were considered – that before Russia's military action against Ukraine in 2014 and that afterwards, when the threat of war became high.

To start with, the mean values for national military expenditure and the income distribution inequality ratio were calculated for both the 2011 to 2013 and 2014 to 2022 time periods (Figure 2). The more peaceful period was too short to formulate a fully definitive conclusion, but something of a trend can be noted – with a decrease in national military expenditure and a slight increase in the income distribution inequality

ratio at the same time. However, the latter period showed a clear trend of decreasing income distribution inequality as military expenditure increased, barring small exceptions from 2014 to 2015 and 2020 to 2021.

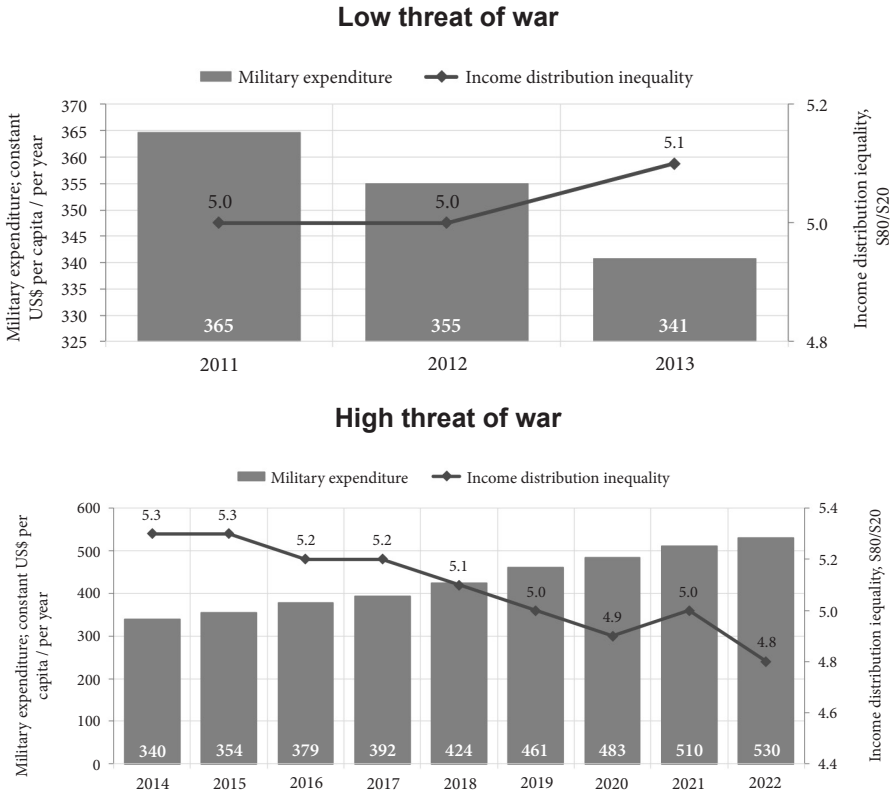

Figure 2. **Mean military expenditure and income distribution ratios in relation to the threat of war in European NATO countries, 2011-2022.**

Source: authors' elaboration.

To evaluate the association between national military expenditure and income distribution inequality ratios by year, estimations were calculated for the survival time of these ratios when national military spend changes (Table 2). The estimations show that when the threat of war was low, the fastest change in the income distribution inequality ratio from low to high occurred in the US$500-599 military expenditure group (with a mean survival time of 1.6 years). That was followed by the US$300-399 group (mean of 1.7 years). In all the other groups, the ratios changed comparatively slowly, and the longest time without changes was in the US$400-499 group (2.3 years). Meanwhile, the

Breslow (generalised Wilcoxon) and log-rank (Mantel-Cox) indexes showed no statistically significant differences in the trajectories of income inequality ratios in association with military expenditure.

When the threat of war was high, the fastest change in the income distribution inequality ratio from low to high was in the military expenditure group below US$200 per capita (with a mean survival time of 6.4 years; Table 2). Meanwhile, the longest survival time was in the US$300-399 group (8.9 years), with the US$500-599 and US$600-plus groups accounting for the second-longest times (8.7 years). The other two groups were in between, with their mean survival times varying between 7.1 and 8.0 years. The Breslow (generalised Wilcoxon) and log-rank (Mantel-Cox) indexes produced statistically significant results, at values of 12.008 and 10.954 respectively. In other words, both indexes showed significant differences between trajectories, while these were greater in the first part of the waiting period than the second.

Table 2. **Survival estimations for income distribution inequality ratios by military expenditure groups and threat of war starting in European NATO countries, 2011-2022 (means of survival time, Breslow (generalised Wilcoxon) index and log-rank (Mantel-Cox) index).**

Military expenditure group by threat of war	Survival estimations of income distribution inequality ratios		
	Mean survival time	Breslow (generalised Wilcoxon) index	Log-rank (Mantel-Cox) index
Low threat of war			
Less than US$200	2.0	0.118	0.127
US$200-299	2.2		
US$300-399	1.7		
US$400-499	2.3		
US$500-599	1.6		
US$600 or more	2.0		
High threat of war			
Less than US$200	6.4	12.008 ***	10.954 ***
US$200-299	7.1		
US$300-399	8.9		
US$400-499	8.0		
US$500-599	8.7		
US$600 or more	8.7		

Note: statistical significance: *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$.

Source: authors' elaboration.

To summarise, hypothesis H2 is supported, with income distribution inequality ratios in European NATO countries associated with military expenditure, especially when the threat of war increases. When there was a low threat of war, income inequality ratios changes were statistically insignificant across all spending groups. However, it should be noted that this low-threat period was too short to form a definitive conclusion and further research is needed for a clearer insight. Meanwhile, under a high threat of war, a statistically significant association was found between military spending and income inequality, which changed fastest in countries with the lowest levels of investment and slowest in those with the highest.

3.3. Test of hypothesis H3

H3: *National military expenditure is associated with income distribution inequality ratios in European NATO countries depending on country size*. To test this hypothesis, the additional variable of countries grouped by population size was included in the calculations.

The analysis started by looking at the mean values of national military expenditure and income distribution inequality ratios (Figure 3). Trends varied between country groups, but some similarities in patterns can be observed. In general, income distribution inequality ratios decreased when military expenditure was higher, and vice versa. However, in small countries with a population of 1-9 million, the breaking point was 2015 and there were small turns in 2012 and 2020.

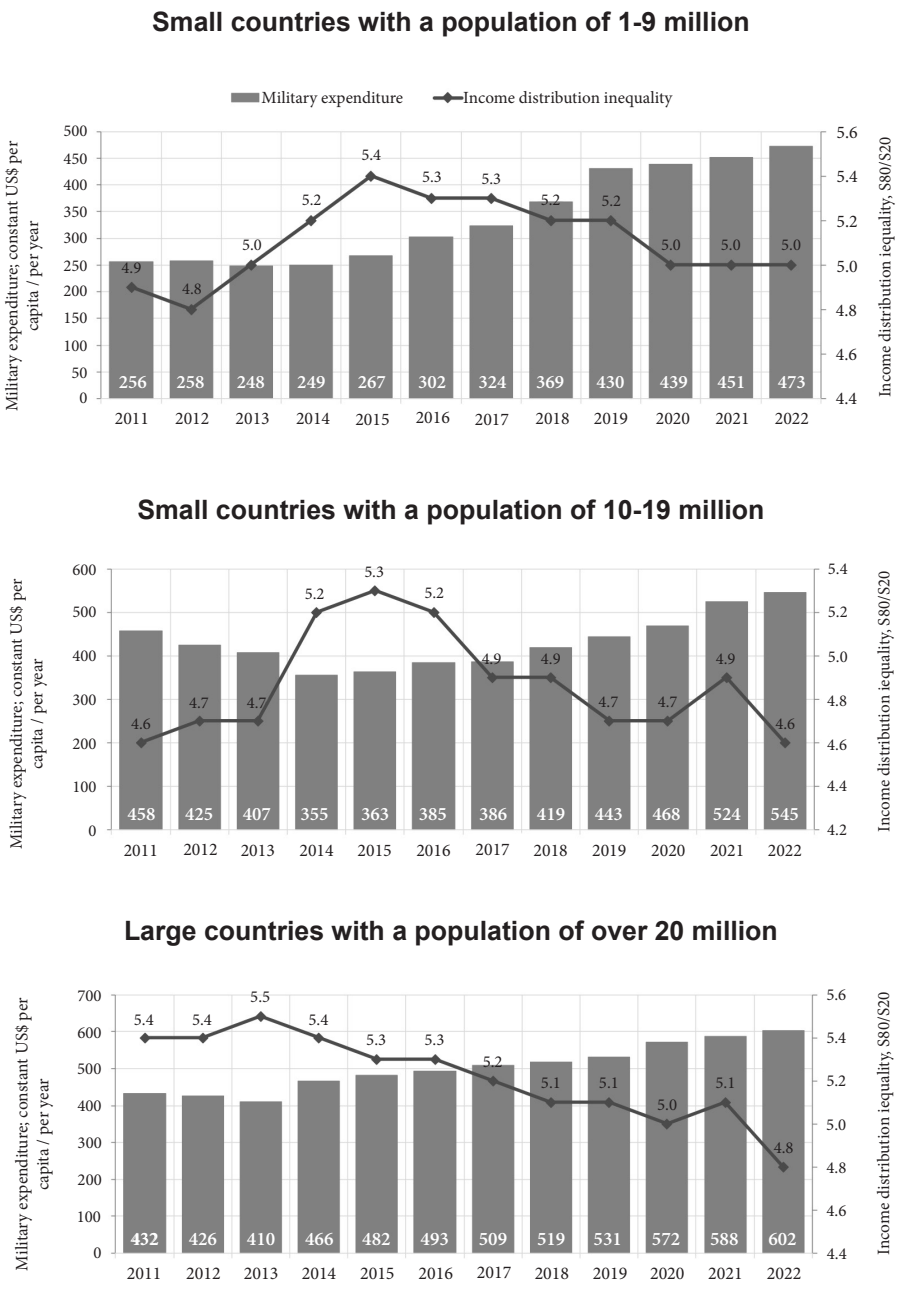

Figure 3. **Mean values of income distribution inequality ratios by military expenditure and country groups in European NATO countries, 2011-2022. Cumulative proportion at the end of time intervals.**

Source: authors' elaboration.

In small countries with a population of 10-19 million population, the breaking point also occurred in 2015, but the reaction in income distribution inequality was not so strict – starting earlier, in 2014, and surviving longer after 2015. Moreover, the second break point appeared in 2021, a bit later than in the smallest countries.

In large countries with a population of more than 20 million, income inequality steadily declined from 2013 onwards, with only a small break to the trend in 2021. Income inequality was higher than in the second group of countries and closer to that of the first group.

To evaluate the association between national military expenditure and income distribution inequality ratios by year, estimations were calculated for survival times of the ratios when spend changed (Table 3).

Table 3. **Survival estimations for income distribution inequality ratios by military expenditure and country groups in European NATO countries, 2011-2022 (mean survival times, Breslow (generalised Wilcoxon) index and log-rank (Mantel-Cox) index).**

Military expenditure group	Survival estimations of income distribution inequality ratios		
	Mean survival time	Breslow (generalised Wilcoxon) index	Log-rank (Mantel-Cox) index
Small countries with a population of 1-9 million			
Less than US$200	4.4	13.384 ***	14.820 ***
US$200-299	6.6		
US$300-399	7.5		
US$400-499	8.9		
US$500-599	10.8		
US$600 or more	6.5		
Small countries with a population of 10-19 million			
Less than US$200	5.3	0.679	1.243
US$200-299	6.0		
US$300-399	9.0		
US$400-499	4.9		
US$500-599	7.4		
US$600 or more	7.5		
Large countries with population over 20 million			
Less than US$200	2.0	4.937 *	5.748 *
US$200-299	3.8		
US$300-399	6.9		
US$400-499	7.2		
US$500-599	5.4		
US$600 or more	7.4		

Note: statistical significance: *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$.

Source: authors' elaboration.

In small countries with a population of 1-9 million changes in the income distribution inequality ratio appeared faster in the military expenditure group of less than US$200 per capita than in the other groups (with a mean survival time of 4.4 years). The longest survival time was, meanwhile, observed in the US$500-599 group, at 10.8 years. The ratios in the other groups within this set of smallest countries were in between these values. The Breslow (generalised Wilcoxon) and log-rank (Mantel-Cox) indexes revealed that such results were statistically significant, while differences between trajectories varied a bit more in the second part of the waiting time than the first (with the indexes having respective values of 13.384 and 14.820).

In small countries with a population of 10-19 million, the income distribution inequality ratio changed fastest in the group with military expenditure of US$400-499 per capita (with a mean survival time of 4.9 years). Coming next was the below-$200 group (5.3 years) and then the US$200-299 group (6.0 years). At the other end of the scale, survival time was longest in the US$300-399 group (9.0 years). The ratios in the other groups were in between these values. The Breslow (generalised-Wilcoxon) and log-rank (Mantel-Cox) indexes, however, showed statistical insignificance in the results, so it is not possible to say more about variations in trends in this country group.

In the large countries with a population of more than 20 million, the income distribution inequality ratio changed fastest in the group with military expenditure group of less than US$200 per capita (with a mean survival time of 2.0 years) and second-fastest in the US$200-299 group (3.8 years). The longest survival time was in the U$600-plus group (7.4 years), followed closely by the US$400-499 group (7.2 years). The Breslow (generalised-Wilcoxon) index showed a value of 4.937 and the log-rank (Mantel-Cox) index 5.748, with both being statistically significant and thus showing that the ratios varied. Moreover, the trajectories varied a bit more in the second part of the waiting period than the first. Meanwhile, it is worth noting that trajectories showed a lower level of variation in larger countries than in smaller ones with a population of 1-9 million.

In summary, hypothesis H3 is supported, with changes in military expenditure associated with changes in income distribution inequality ratios in European NATO countries depending on country size. The association was more evident in lower-population countries, with smaller countries and those among them that spent more seeing longer survival times when military investment changed. Conversely,

the larger the country and the lower its military expenditure, the faster the change in income distribution inequality ratios when spending changed.

3.4. Discussion

With the ongoing war in Ukraine, increased military spending has become an unavoidable necessity for many European NATO countries. Although conflicting views on military financing prevailed in the scientific and political arena before Russia's war in Ukraine, the current threat situation leaves nobody indifferent to the need to increase military spending to acquire modern technologies, focus on the qualifications of defence personnel and improve infrastructure. Yet at the same time, the question arises whether an increase in such funding will not worsen income inequalities in countries. Increasing military expenditure can negatively impact on the achievement of the 2030 Sustainable Development Goals (Tian et al., 2020), which include reducing income inequality. This research revealed the situation in the countries under consideration. As the analysis of scientific literature (Lin & Ali, 2009; Wolde-Rufael, 2016b) has shown, three ideas stand out when examining the association between military expenditure and income inequality: inequality-narrowing, inequality-widening and neutrality.

In general, the results of the study show a negative association between the two factors, meaning that when military funding increases, income inequality tends to decrease in the countries under consideration. This insight may be explained by increased military funding leads to countries being able to acquire modern weapons, improve service conditions for soldiers and develop infrastructure. That then creates a better environment for attracting investment, having a positive impact on economic growth and thus reducing inequality. This explanation reflects the inequality-narrowing idea and relates to the Keynesian perspective, which states that the funding of military has a positive relationship with economic growth through the stimulation of aggregate demand and therefore presents opportunities to reduce inequality. The findings of this investigation are also consistent with the results of a study of 14 NATO countries (Michael & Stelios, 2020), research on the top-10 defence-spending countries (Ghosh, 2022), and insights from an analysis of the relationship between military spending and income inequality in democracies (Gillani et al., 2022).

Moreover, inequality ratios change faster in countries with lower military expenditure and in the longer term in countries that spend larger amounts per capita. Furthermore, the study found that the association emerges faster in countries that spend relatively little on military affairs, taking 4.3 years on average, compared with six to 7.7 years in those with higher spending. Meanwhile, when the threat of war is high, income inequality associates significantly with military spending.

It should be acknowledged that this investigation has some limitations. Firstly, the grouping of countries in this investigation means the results reflect the general trend in the overall groups, but this does not mean the results would be the same for individual countries and it cannot be ruled out that they may even be opposite in some nations. Secondly, income inequality is influenced by a variety of other factors at the macro-, meso- and micro-levels that may also affect its trajectory. Examining such factors would be useful in future research.

The results obtained add new insights to the scientific literature on the association between military spending and income inequality. Among this study's most important contributions are the highlighting of differences between groups of small and large countries by population, and the analysis of military expenditure per capita among different country groups. From a practical perspective, the findings can be used to give students of such topics a broader perspective on defence financing and the development of critical thinking.

Conclusions

The aim of the investigation was to empirically assess the association between military expenditure and the income inequality ratio in 19 European NATO member states between 2011 and 2022 through the formation of several hypotheses.

The results supported hypothesis H1, which stated that income distribution inequality ratios in European NATO countries are associated with national military expenditure per capita. Life tables and survival estimations revealed a statistically significant association between the two factors, with ratios changing faster in the countries that invest less per capita in the military, and in the longer term in countries with higher spending. Meanwhile, estimation indexes

revealed a stronger association between the trajectories explored in the second part of the waiting period.

Furthermore, the research results supported hypothesis H2, which stated that the assocation between national military spending per capita and income distribution inequality ratios changes in the face of an increased threat of war. Life tables and survival estimation revealed further that when there was a low threat of war, the association was statistically insignificant, whereas income inequality varied considerably with military spending when the threat was high. Countries with low levels of military spending also experienced a faster change in inequality, while those with high levels saw the longest survival times in terms of changes in inequality.

Finally, the research results also supported hypothesis H3, which stated that national military expenditure is associated with income distribution inequality ratios in European NATO countries depending on country size. It can be argued that the smaller the country's population, the more pronounced the association between the two factors – and this was especially true for countries with low military expenditure per capita. Conversely, the larger the country and the higher its military spending per capita, the longer the survival times when there were changes in the income inequality ratio.

The authors hope that this investigation will enrich the scientific knowledge with new insights.

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Annex 1. Annual military expenditure and income distribution inequality ratios in European NATO countries, 2011-2022.

	Military expenditure (in constant US$ per capita / year)			Income distribution inequality ratio (S80/S20)		
	Mean	Min	Max	Mean	Min	Max
Belgium	481.3	437.6	606.4	3.7	3.4	4.0
Bulgaria	149.8	199.8	342.1	7.3	6.1	8.2
Czechia	271.0	214.5	375.0	3.4	3.3	3.5
Denmark	788.4	670.0	976.9	4.0	3.9	4.1
Estonia	460.3	301.9	586.7	5.5	5.0	6.5
France	797.0	755.7	839.8	4.4	4.2	4.6
Germany	598.6	540.7	694.5	4.7	4.3	5.1
Greece	550.3	448.4	798.1	6.0	5.1	6.6
Hungary	185.0	111.4	314.5	4.2	3.9	4.4
Italy	500.0	407.3	611.9	5.9	5.6	6.3
Latvia	278.1	130.4	436.9	6.4	6.2	6.8
Lithuania	306.1	115.5	590.2	6.4	5.3	7.5
Netherlands	699.4	603.7	890.9	3.9	3.6	4.2
Poland	308.0	226.8	446.7	4.5	3.9	5.0
Portugal	316.4	269.9	378.4	5.6	5.0	6.2
Romania	191.3	106.6	280.3	6.9	6.0	8.3
Slovakia	265.6	177.0	401.4	3.5	3.0	3.9
Slovenia	276.8	221.2	361.7	3.4	3.2	3.7
Spain	386.7	346.2	442.3	6.3	5.6	6.9

Source: authors' elaboration based on SIPRI Military Expenditure Database (n. d.) and income quintile share ratio S80/S20 (n. d.).

Annex 2. Division of European NATO countries into groups by population size and military expenditure, 2011-2022.

Country	Country group (1 = population of 1-9 million; 2 = population of 10-19 million; 3 = population of 20 million or more)	Military expenditure group (in constant US$ per capita / year: 1 = less than US$200, 2 = US$200-299, 3 = US$300-399, 4 = US$400-499, 5 = US$500-599, 6 = US$600 or more)
Belgium	2	4, 5, 6
Bulgaria	1	1, 3
Czechia	2	2, 3
Denmark	1	6
Estonia	1	3, 4, 5
France	3	5, 6
Germany	3	5, 6
Greece	2	4, 5, 6
Hungary	1	1, 2, 3
Italy	3	4, 5, 6
Latvia	1	1, 2, 3, 4
Lithuania	1	1, 2, 3, 4, 5
Netherlands	2	6
Poland	3	2, 3, 4
Portugal	2	2, 3
Romania	2, 3	1, 2
Slovakia	1	1, 2, 3, 4
Slovenia	1	2, 3
Spain	3	3, 4, 6

Source: authors' elaboration based on population on 1 January (n. d.), and SIPRI Military Expenditure Database (n. d.)