

ARMING EUROPE

Military expenditures and
their economic impact
in Germany, Italy, and Spain



GREENPEACE

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EXECUTIVE SUMMARY

European countries are on a road to militarisation. In the last ten years, military expenditures of NATO EU countries (according to NATO definitions and data) have increased by almost 50%, from €145 billion in 2014 to a budget forecast of €215 billion in 2023 (measured in constant 2015 prices). This total is greater than the annual GDP of a country such as Portugal. With the war in Ukraine, 2023 outlays are expected to increase by almost 10% in real terms over the previous year. NATO EU countries as a whole now spend 1.8% of GDP on their militaries, close to the 2% target set by the US and NATO.

This report, commissioned by the three Greenpeace national offices in Germany, Italy and Spain, investigates the rise of military expenditures in Europe with a focus on these three countries. Over a decade, Germany has increased its real military spending by 42%, Italy by 30%, Spain by 50%. In all countries, this expansion has been entirely due to higher acquisitions of arms and equipment. In 2023, arms expenditure in NATO EU countries reached €64.6 billion (+270% over a decade); Germany tripled its spending to €13 billion; Italy reached €5.9 billion; Spain €4.3 billion. EU imports of arms (based on data from SIPRI, the Stockholm International Peace Research Institute) have jumped, increasing by three times between 2018 and 2022. Half of all imports come from the US.

**SUCH A RISE
IN MILITARY
EXPENDITURE AND
ARMS PROCUREMENT
CONTRASTS STARKLY
WITH THE STAGNATION
OF EU ECONOMIES**

**MILITARY
EXPENDITURES HAVE
INCREASED FROM €145
BILLION IN 2014 TO
€215 BILLION IN 2023**

The European Union has joined this drive towards militarisation. After decades of playing no role in military affairs, the EU has launched the European Defence Fund with €7.9 billion for new arms research and production in 2021-2027 and the European Peace Facility with €12 billion for military aid and supplies outside the EU over the same period.

Such a rise in military expenditure and arms procurement contrasts starkly with the stagnation of EU economies. In the aggregate of NATO EU countries, between 2013 and 2023, real GDP has increased by 12% (just over 1% per year on average), total employment by 9%, and military expenditures by 46%, four times faster than national income. The picture in the area of new investment is even more dramatic: while capital formation has risen by 21%, arms acquisitions have increased by 168% – eight times as fast – throughout NATO EU countries. In Germany, Italy and Spain, the disparities in growth rates are broadly similar. Arms are absorbing a rapidly increasing proportion of the resources that countries devote to new production capabilities, new technologies, and new infrastructures.

At a time of concerns about public finances, such a rise in military spending comes at the expense of other types of public expenditures. In the aggregate of NATO EU countries, total government expenditures increased over a decade by 20% in real terms (about 2% per year on average). However, military expenditure expanded twice as fast, by 46%, as opposed to lower increases in education (+12%), environmental protection (+10%), health (+34%).

Arms procurement can be compared to the capital investment outlays of public expenditures. In NATO EU countries, the latter increased by 35% over a decade, but arms acquisition increased by 168%, almost five times as fast. Germany and Spain are broadly in line with EU patterns, while Italy shows a less dynamic growth in its expenditure, due to its public finance constraints.

What is the economic effect of military expenditure on growth and employment? And how does it compare to public expenditures for education, health and the environment? A €1,000 million expenditure creates demand for intermediate goods and services from all industries; part of this demand goes to imports from abroad, which do not increase domestic production; the value of imports must therefore be excluded from the initial €1,000 million expenditure when we estimate the expected economic impacts. Such flows can be documented by input-output tables that allow us to estimate the resulting changes in national output and employment.

In Germany, a €1,000 million expenditure in arms procurement sets in motion an increase in domestic output of €1,230 million. In Italy, the resulting increase is only €741 million, as a larger part of the expenditure goes to imports. In Spain, the increase in domestic output totals €1,284 million. The employment effect equates to 6,000 additional (full time) jobs in Germany, 3,000 in Italy, and 6,500 in Spain.

**MORE EXPENDITURES
FOR THE ENVIRONMENT,
EDUCATION, AND HEALTH
WOULD HAVE
BETTER EFFECTS
ON GROWTH AND JOBS**

**IN ECONOMIC TERMS,
MILITARISATION
IS A 'BAD DEAL'**

However, the economic and employment impact is greater when the €1,000 million is spent on education, health and the environment. The greatest impact is found in the area of environmental protection, with an increased output of €1,752 million in Germany, €1,900 million in Italy, and €1,827 million in Spain. For education and health, the additional output ranges from €1,190 to €1,380 million. In Germany, in terms of employment opportunities, €1,000 million could create 11,000 new jobs in the environmental sector, almost 18,000 jobs in education or 15,000 jobs in health services. In Italy, the equivalent figures range from 10,000 jobs in environmental services to almost 14,000 in education. In Spain, the employment effect would range between 12,000 new jobs in the environmental sector to 16,000 in education. The employment impact is between two and four times that expected from increased arms procurement.

These findings underline the problematic nature of the current rise in Europe's military expenditures. In security terms, a more militarised Europe would still find it difficult to resolve current conflicts and greater spending could lead to new arms races, further destabilising the international order around Europe.

In economic terms, militarisation is a 'bad deal'. Rising military expenditures are leading Europe along a trajectory of lower economic growth, lower job creation, and lower quality of development. The alternatives – more expenditures for the environment, education, and health – would have better effects on growth and jobs, and would bring major benefits in the quality of life and of the environment in Europe.

FOREWORD

The 1980s were a decade of arms build-up between East and West. As the confrontation between East and West abated, accompanied by disarmament and years of falling military budgets in Europe, those who experienced this period must have hoped that we would never again channel such a significant proportion of GDP into the arms industry. Those born in Western Europe after 1981, generations X and Y, probably never imagined that military spending could ever return to approach pre-1989/90 levels. Today, however, the countries of Western Europe are in danger of falling back into these times of deterrence and high spending on armaments. At their summit in Vilnius in July, the NATO States decided to tighten the joint target margin for their military investments once again. Instead of setting 2% of gross domestic product as the regular contribution, they agreed that this should represent the lower limit in future. For more than half of the countries involved, this means a sometimes drastic increase in their military budgets.

Investments in the three-digit billion range are planned in Italy, Spain and Germany alone. Other EU countries are also planning to increase their military budgets, sometimes dramatically. This is happening at a time when the European economy has not yet recovered from the consequences of the Covid-19 pandemic and is also suffering from the effects of the war in Ukraine. At the same time, the economies of Western Europe in particular are suffering from weak growth compared to the US and emerging countries such as China and India.

**EVERY EURO SPENT ON
THE MILITARY CANNOT BE
SPENT ELSEWHERE
AND THUS JEOPARDISES
THE NON-MILITARY
DIMENSION OF SECURITY**

In this study, Mario Pianta, Professor of Economic Policy at Scuola Normale Superiore in Florence, and his team have analysed the role of the massive allocation of scarce public resources to the arms industry and the military against this backdrop. The study was commissioned by Greenpeace Italy, Greenpeace Spain and Greenpeace Germany. It analyses the following areas: military spending over the past decade, its share of total government spending and its impact on economic growth and employment. The report concludes with a comparison of the stimulus effect of investments in the military compared to those in environmental protection, education and health.

It is obvious that for many, after the Russian invasion of Ukraine in 2022, it is not possible to think about "security" in exclusively civilian terms. However, it is also true that security cannot be thought of solely in military terms either. The concept of human security, adopted by the UN in Resolution 66/290, among others, is based on the realisation that peace and stability can only be achieved or maintained in the long term if people's basic needs are met. These include a healthy environment, social security, and education. These require financial resources, which in turn have to be generated. But every euro spent on the military cannot be spent elsewhere and thus jeopardises the non-military dimension of security.

Greenpeace Italy, Greenpeace Spain and Greenpeace Germany would like to thank the research team for highlighting and categorising the economic dimension of military spending in this study and for giving us all an idea of the economic and social consequences of excessive investment in armaments.

1.

HOW TO UNDERSTAND MILITARY EXPENDITURES

Military expenditures are the outcome of the military system, national politics, and economic processes. They represent the quantity of economic resources that a country's government allocates to the national military system: the armed forces, the acquisition of armaments, military infrastructures, and the implementation of military operations.

Military expenditures are influenced by four main drivers (Nascia and Pianta, 2009):

- a. The military system plans spending programmes based on strategic priorities, taking security objectives, military alliances and external threats into account. An emphasis on military power can lead to arms races with other countries or alliances, resulting in growing military spending. Military bureaucracies may also demand greater resources for expanding their power.
- b. In the political system, governments use the military as a foreign and security policy instrument. Other means for achieving security include regional political integration, international economic cooperation, diplomacy and trust-building, disarmament treaties, human rights protection, and development aid. By reducing the risk of international tensions and conflicts, such policies may reduce the prominence of the military system.
- c. In the economic system, military expenditures are funded by tax revenue or government debt and compete with other public expenditures – for education, health, welfare, research, the environment, etc. Government policies define the relative importance of the military as opposed to other economic, social or environmental priorities. Different types of public expenditures support economic growth to varying degrees, and shape the trajectory and quality of a country's development.
- d. Military expenditures create demand for products sold by companies – either private or public – and support research, development, production and exports of armaments. Profits in arms production are usually higher than average and a country's 'military industrial complex' – a definition coined by General Dwight Eisenhower in his farewell speech at the end of his US presidency – is a major force driving the growth of military expenditures.

The debate regarding the impact of military expenditures on growth and employment reflects their contradictory nature. On the one hand, military expenditure, like other public expenditures, may act as a stimulus to the economy by increasing public sector demand in accordance with Keynesian principles. This may compensate for problems of underconsumption and stabilise business cycles. In the US, since the Second World War, military spending has included considerable resources for research and investment in new technologies that have contributed to the expansion of new economic activities (Baran and Sweezy, 1968; Krell, 1981; Dunne and Tian, 2013).

On the other hand, military spending reduces the resources available for consumption and productive investment. It absorbs a significant part of a country's limited capabilities in research, technology, human skills, capital accumulation and finance. In the case of the US, this has led to business practices that have inflated costs, prices and profits, and reduced efficiency (Melman, 1988). It has been argued that *'in the United States military spending acts as a de facto industrial policy, and (...) the poor performance of the economy results from the distortions brought about by this reliance on military-led investment and innovation'* (Markusen 1986: 496).

Empirical studies on the economic effects of military spending have not led to a conclusive answer. In some countries and periods, it has been associated with greater economic growth; other investigations have documented negative impacts on economic performance, no effect on unemployment and a reduction in the resources available for other areas of public spending (Dunne and Smith, 2020).

In the long term, emphasising the military reduces the possibilities for alternative development trajectories. It may also have authoritarian effects on the nature of a country's institutions, political cultures, and society, with a possible erosion of democracy (Galtung, 1985; Thorpe, 2014).

In arms production and procurement, very close relationships develop between governments and the arms industry. Public procurement is the dominant source of demand for companies – either private or state-owned – operating in the military sector. These companies are organised in a few large corporate groups with powerful influence over the market,

increasing the potential for inefficiencies, excessive costs, pricing and profits, collusion and corruption. A ‘revolving door’ practice has become common, with politicians, generals and business leaders often moving from one position of responsibility in government, the armed forces or industry to another, blurring boundaries, raising conflicts of interests and further reducing public accountability.

States protect national firms – even when they are inefficient – in order to preserve arms production capacity. Decisions regarding arms exports and imports are the result of both corporate economic considerations and government political strategies. In the context of arms races, military production emphasises the performance of high-tech weaponry, leading to large arms-related research efforts where the risks are borne by governments rather than companies. This approach reduces the ability of military firms to compete successfully in commercial markets where efficiency and innovation in useful products are important.

In the years since the end of the Cold War, when limited reductions of military expenditures took place in Europe, military industries have consolidated their processes at the national and European levels and internationalised through mergers, joint ventures, and collaborative programmes. State-owned firms have largely been privatised, listed on stock markets and operated with a greater emphasis on profit and financial logic. From a global perspective, SIPRI data show that the market share of the world’s top 10 arms producers has increased from 37% in 1990 to 50% in 2021 (SIPRI, 2023).

European producers accounted for 12.7% (19.9% when we include UK companies) of the value of arms sales by the top 100 defence companies in 2020; in 2021 the top three European military companies were BAE (UK), Leonardo (Italy) and Airbus (France-Germany-Spain) (SIPRI, 2023).

The European Union has traditionally devoted fewer economic resources to military activities than the United States, with its role as the global superpower. However, significant growth in Europe’s military expenditures is underway – has only accelerated since the start of the war in Ukraine in 2022.

While the European Union has long considered military R&D and spending as sovereign matters for its member states, in 2017, EU budgets also began funding military research and production activities. The European Defence Fund has a €7.9 billion budget for 2021-2027; €2.7 billion have been assigned to the European Defence Research Programme, about €500 million per year for collaborative weapons research; the European Defence Industrial Development Programme has resources totalling €5.3 billion, about €1 billion per year for technological projects related to arms

SUCH POLICIES BRING EUROPE CLOSER TO THE US MODEL OF A ‘MILITARY- INDUSTRIAL COMPLEX’

acquisitions, with member states expected to provide additional funding for such initiatives.

In 2021, outside the EU budget, EU countries also created the European Peace Facility under the Common Foreign and Security Policy. This programme has a €12 billion budget for the period 2021-2027 and is involved in funding military operations and assistance measures in countries on the European periphery, Africa and the Middle East. Since the start of the war in Ukraine, it has been a major tool for providing military aid and arms supplies to the Ukrainian government.

As part of its policy of ‘strategic autonomy’, the EU has also launched new initiatives that aim to control technologies with security relevance, monitor foreign reliance on strategic goods and support military projects.

These initiatives deflect financial resources away from the research, innovation, and industrial needs of European economies, favouring activities that are aiming at military power as opposed to economic development and sustainability. Such policies bring Europe closer to the US model of a ‘military-industrial complex’ – a highly inappropriate and ineffective perspective for Europe.

This report, commissioned by the three Greenpeace national offices in Germany, Italy and Spain, aims to gather sound evidence on current trends in European military expenditures and explore their economic and employment impact. It focuses on the trends in Germany, Italy, and Spain as a means to investigate overall patterns in NATO countries that are members of the European Union. This may contribute to a broader debate on national and European policies, on budgetary priorities, on the economic impact of growing military expenditures, and on desirable development models for European countries.

Methodology and sources

This report investigates the evolution and impact of military expenditure over the last ten years in the aggregate of NATO countries that are members of the European Union, and in Germany, Italy and Spain in particular. These three countries represent the largest EU economies that traditionally have an intermediate level of military activity – lower than the cases of France and the UK (now outside the EU), which are nuclear powers and have a history of neocolonial military activities and interventions abroad.

We use NATO's definition of military expenditure – also used by SIPRI – that provides a comprehensive picture and is associated with an available database; details are provided in the Appendix.

Military expenditures are mainly included in the budget of the Ministry of Defence. However, other expenditures of a military nature can also be found in the budgets of the Prime

Minister's Office, the Ministry of the Economy, the Ministry of Industry (arms development and procurement, support to military industries), the Ministry of Research (research and development for military applications) and other government departments. NATO's definition includes some, but not all, of these additional expenditures.

In turn, Ministries of Defence's budgets generally include expenditures for domestic public security functions that are removed from the aggregate of military expenditures.

One problem in assessing military budgets is that there is often a disparity between forecasts, budget allocations, and the actual expenditures that are documented ex-post; in many countries, there is a systematic increase as expenditures move along such a budgetary process (in Italy, this increase can reach 15%). Data used here refer to budget allocations, and use NATO budgetary forecasts for 2022 and 2023. Details on definitions, sources, and data are provided in the Appendix.

2.

MILITARY EXPENDITURES IN NATO EU COUNTRIES, GERMANY, ITALY AND SPAIN

This report investigates the evolution and impact of military expenditures in three EU countries – Germany, Italy, and Spain, in the context of patterns in NATO EU countries – in the last decade from 2013-2023.

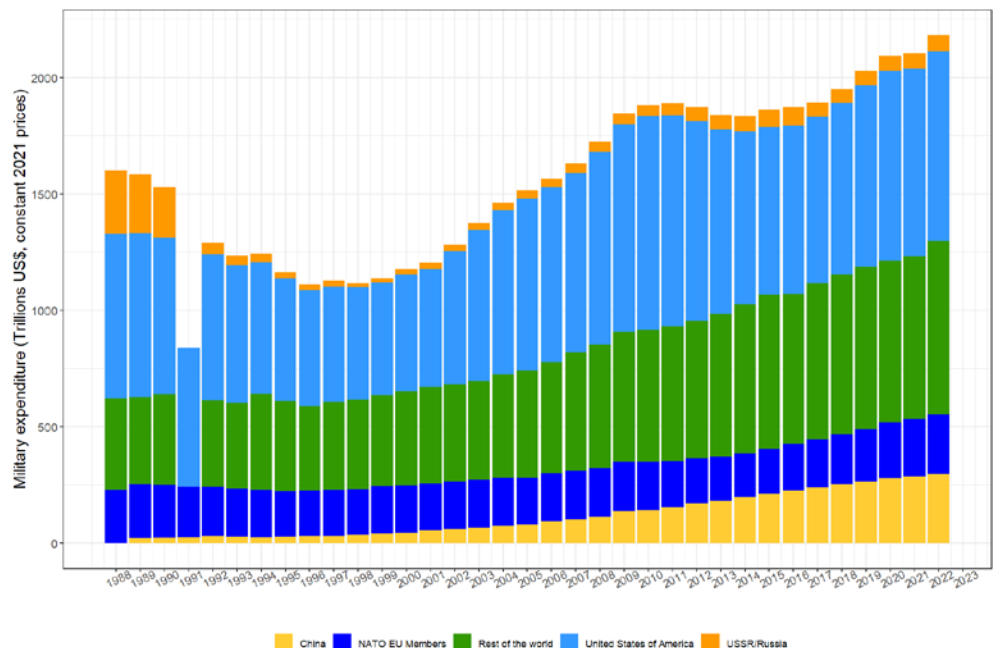
In this section, we investigate the evolution of military expenditures and their composition, comparing the trends in these three countries with the aggregate of NATO EU countries. In Section 3, we compare the rise in military and arms expenditures with other economic variables, in Section 4, we explore the impact that military and arms expenditures have on GDP and employment growth using input-output flows in the economy. We then compare the outcomes with possible expenditure outcomes for the environment, education, and healthcare.

Military expenditures in Europe have to be seen in the context of global trends since the end of the Cold War. The Stockholm International Peace Research Institute (SIPRI)

provides data on global military spending and Fig. 1 shows a limited fall from \$1,500 billion in 1988 (at constant 2021 prices) to \$1,100 billion in 1998. Since then, world military expenditures have doubled, reaching \$2,200 billion in 2022. The United States accounts for the largest share, with accelerating military expenditures in the 2000s – due to the wars in Afghanistan and Iraq – and in 2022 – with the war in Ukraine. Initially, NATO EU members gradually reduced their military spending before increasing these expenditures in the last decade (see also Fig. 2). China and the rest of the world (which includes the UK) have steadily increased their spending. In 2022, the US accounts for 38% of world military expenditures, NATO EU members for 12%, China for 14% and Russia for 3.4%. The rest of the world accounts for one third of world expenditures. Since 2014, NATO EU members have increased their defence expenditure by 48% in real terms. At the same time, the US expanded outlays by 3%, China by 62%, and Russia by 17%.

Fig. 1: World military expenditures

Source: SIPRI Military Expenditure Database



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Since 2014, NATO EU countries have continued to increase their military spending. The NATO data shown in Fig. 2 document patterns in NATO EU countries, Germany, Italy and Spain; they include all expenditures for armed forces, military personnel, pensions, research, arms procurement, infrastructure, operations, missions abroad, and military aid, showing data in EUR billions at constant 2015 prices; data for 2022 and 2023 are NATO budget forecasts as opposed to actual outlays (see the Appendix for details).

EU NATO countries went from €145 billion of military expenditures in 2014 to €215 billion in 2023, a rise of 48% in real terms. Outlays have accelerated since the start of the war in Ukraine in 2022.

A turning point in policy for NATO EU countries came in 2014 when the NATO summit in Wales produced a declaration emphasising NATO policy guidelines for ending the reduction in military spending and increasing it to the target of 2% of GDP, with defence equipment reaching at least 20% of the budget.¹ NATO documents pointed at the 2014 annexation of Crimea by Russia as a factor motivating a push in military expenditure.

NATO EU countries first boosted spending from 2019 to 2020, with a 4.7% increase in real terms. This was followed by a lower increase with the pandemic in 2021, and then

a major push after the Russian invasion of Ukraine with a 9.5% increase in 2023, which included military aid, arms and munitions to Ukraine. According to the Kiel Institute, expenditure for military, financial, and humanitarian aid to Ukraine in the first year of the war reached 0.38% of the GDP of EU member states and 0.33% of US GDP.²

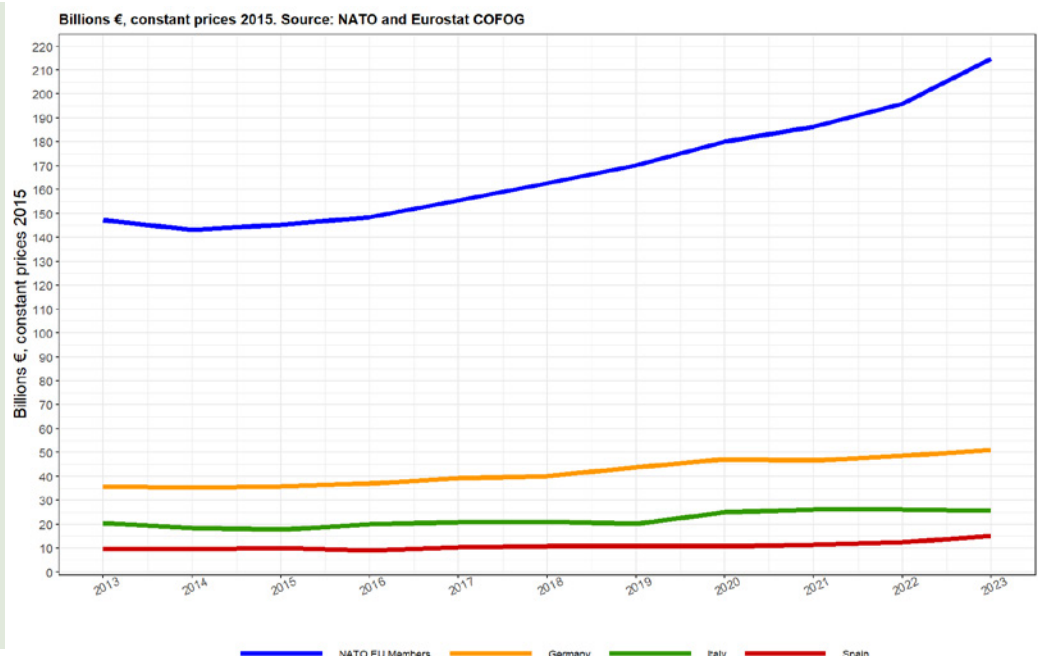
Germany, Italy, and Spain have all followed the upward trend of NATO EU countries – with different timings associated with national conditions.

In the European Union, this rise in military expenditures has been associated with pressure from NATO to increase defence contributions and strategies that aim to strengthen Europe's capabilities in key technologies and defence-related production. With the Ukraine war and the renewed role of the US in European affairs, the 2022 'EU Strategic Compass' outlines a policy of strong EU alignment with NATO and the US; increased military spending becomes a key condition for the implementation of such strategy.

Fig. 3 shows the evolution of total military expenditures and outlays for arms, equipment, operations and research for Germany, Italy and Spain. From 2013 to 2023, Germany increased military spending from €36 billion to €51 billion (+42%), Italy from €20 billion to €26 billion (+30%), Spain from €10 billion to €15 billion (+50%).³ In all countries,

Fig. 2: Military expenditures by EU NATO countries, Germany, Italy and Spain

Note: Values for 2022 and 2023 are NATO budgetary forecasts.



¹ NATO - Official text: Wales Summit Declaration issued by NATO Heads of State and Government (2014), 05-Sep.-2014, available at https://www.nato.int/cps/en/natohq/official_texts_112964.htm.

² Ukraine support tracker: a database for Military, Financial and Humanitarian aid to Ukraine, available at <https://www.ifw-kiel.de/topics/war-against-ukraine/ukraine-support-tracker/>.

³ These NATO data differ from official government data, due to the inclusion of expenditures of a military nature that are present in other Ministries' budgets. For instance, German government data for military spending in 2013 is €32.8 billion, as opposed to €36 billion in the NATO data. See the Appendix for details.

the increase has been entirely accounted for by higher expenditures on arms and equipment. It should be pointed out that over this decade, Italy and Spain were experiencing difficult situations in their public finances with strict European constraints on government deficits and debt. In spite of this, military budgets and arms procurement were able to increase at an unprecedented pace, further reducing the space for social and environmental public expenditures.

As shown in Fig. 4, the increases in military spending documented above, during a decade of slow economic

growth, meant that military expenditures rose as a share of GDP. For NATO EU countries, the percentage went from 1.4% in 2013 to 1.8% in 2023, with Germany and Italy moving closer to such levels and Spain maintaining a lower level. In 2023, NATO budgetary forecasts show that Germany is at 1.56%, Italy at 1.45% and Spain at 1.25%. The US has long asked NATO EU countries to reach the 2% of GDP target for military expenditures, and with the Ukraine war, Europe is getting close to such levels. The oscillations shown in this indicator by Italy and Spain are the results of slow GDP growth – including years of recession – and

Fig. 3: Total military expenditure and military expenditure on arms, equipment, operations and R&D

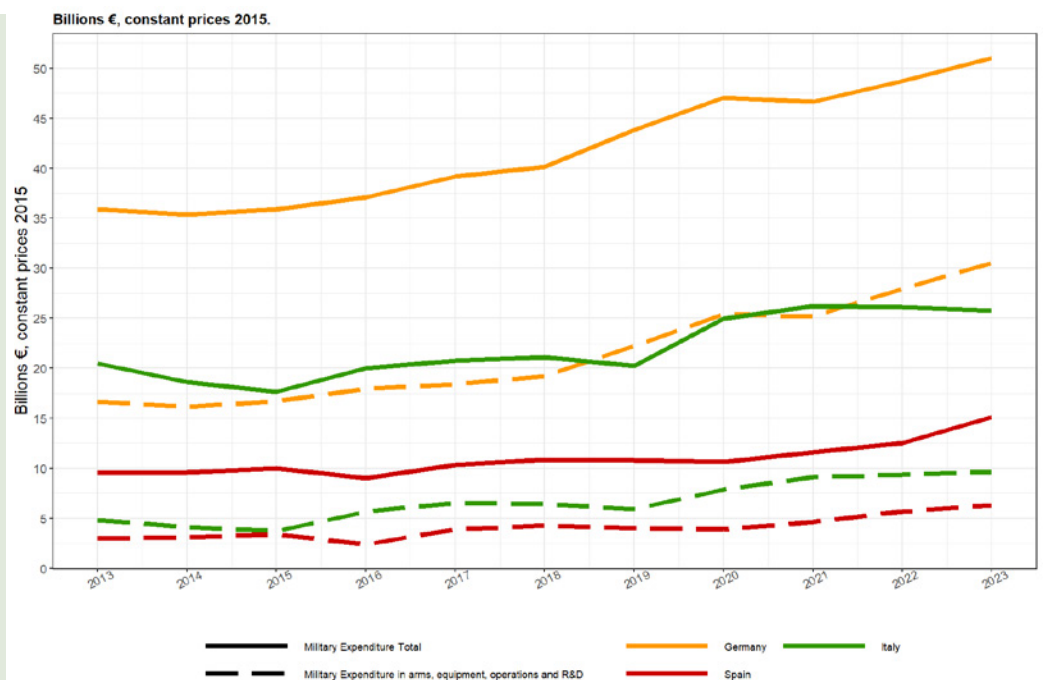
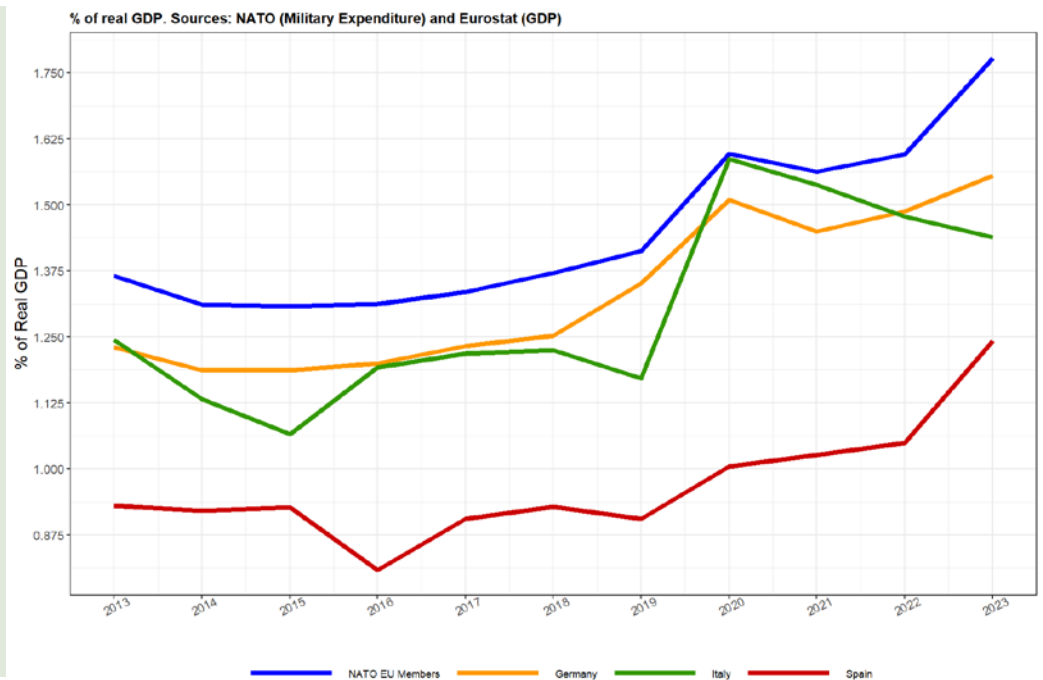


Fig. 4: Military expenditure as a percentage of GDP



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the budgetary constraints on public expenditures that also affected the space for military outlays.

These data can be compared to those provided by SIPRI (with a slightly different definition) for other countries. From 2014 to 2022, military expenditures as a share of GDP decreased in the United States from 3.7% to 3.4%, in China from 1.7% to 1.6%, and in India from 2.5% to 2.4%, also due to their strong GDP growth over the decade. In Europe, Poland is the largest spender, moving from 1.9% to 2.4%, with a plan to reach 3% in a few years; facing the war, Ukraine jumped from 2.2% to 33.5% of GDP devoted to military activities.

The same trend is found when we look at military expenditures per capita in Fig. 5. In 2023, every citizen of NATO EU countries contributed an average of €508 to military spending compared to €330 in 2013. In 2023, for German citizens, the military costs were higher, €581 per capita, as opposed to €436 in Italy and €317 in Spain.

The composition of military expenditures across the considered countries is documented in Fig. 6. These data include military and civilian personnel; defence equipment, arms and R&D; military infrastructures; operations and maintenance (including training, ammunitions, and spare parts). Personnel accounts

Fig. 5: Military expenditure per capita

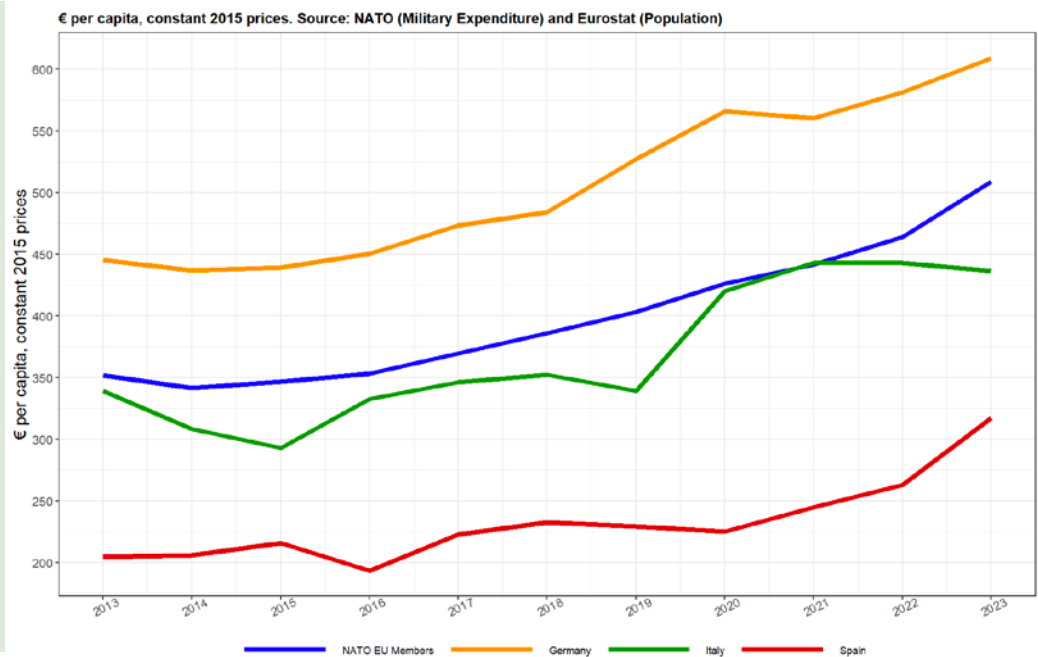
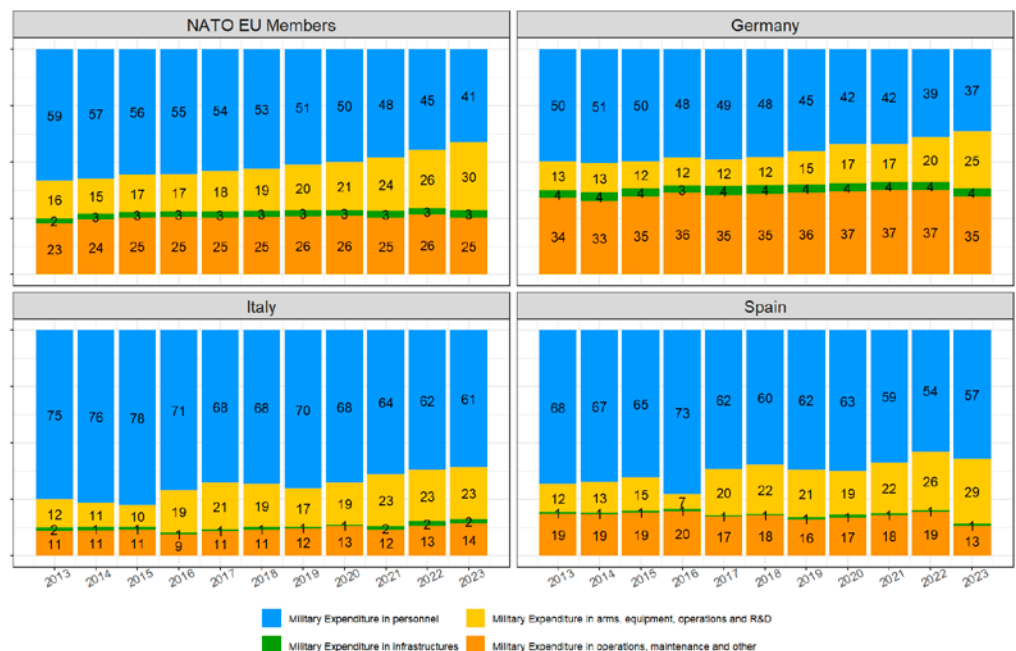


Fig. 6: The composition of military expenditures



for the largest – but rapidly declining – share of military expenditures; in NATO EU countries, falling from 59% to 41% over a decade. Arms and equipment are rapidly rising and have doubled since 2013, reaching 30% in 2023. Operations and maintenance are stable at about one quarter of total expenditures, and while infrastructures play only a minor role (about 3%). Germany closely follows these patterns, while Italy and Spain maintain a larger – but also declining – share of personnel expenditures and lower operation costs. In these countries, policies for reducing personnel costs have included a reduction of the civilian personnel – mainly in defence establishments and military bases – through the outsourcing of operational services and secondary activities. The growth in arms expenditures – whose share has doubled in all countries over a decade – is the most relevant common feature of European countries.

When we look at absolute values of expenditures, however, we find that personnel outlays have in fact remained rather stable in real terms over the period, at about €19 billion in Germany in 2023, €16 billion in Italy, and €8 billion in Spain (with a jump in 2023). The increase in total expenditures has been driven by the doubling of outlays on arms and equipment.

Looking more closely at the jump in expenditures for arms and equipment, Fig. 7 shows some impressive performances. Germany tripled its spending on arms and equipment from €4.5 billion in 2013 to €13 billion in 2023; Italy went from €2.5 billion to €5.9 billion; Spain raised its outlays from €1.2 billion to €4.3 billion. NATO EU countries as a whole increased their expenditures for arms and equipment from €24.1 billion in 2013 to €64.6 billion in 2023, with an increase of 267%.

Fig. 7 shows additional information on the imports of arms and equipment recorded by the three countries. In the scaling up of military arsenals, it is virtually impossible to produce all advanced weapon systems, electronic equipment and high technology components nationally; procurement from the US – as in the case of F35 fighter jets, missile systems, etc. – or from other Western countries becomes increasingly relevant.

In Fig. 7, we report data on arms imports by combining information from the World Military Expenditure and Arms Transfer database and the SIPRI arms transfer database (see the Appendix for details). According to our estimates, arms imports have increased in Germany, from about €2.5 billion in 2013 to €3.5 billion in 2023. As a share of total arms spending, imports have fallen from about half to a little more than a quarter of German expenditures in this area.

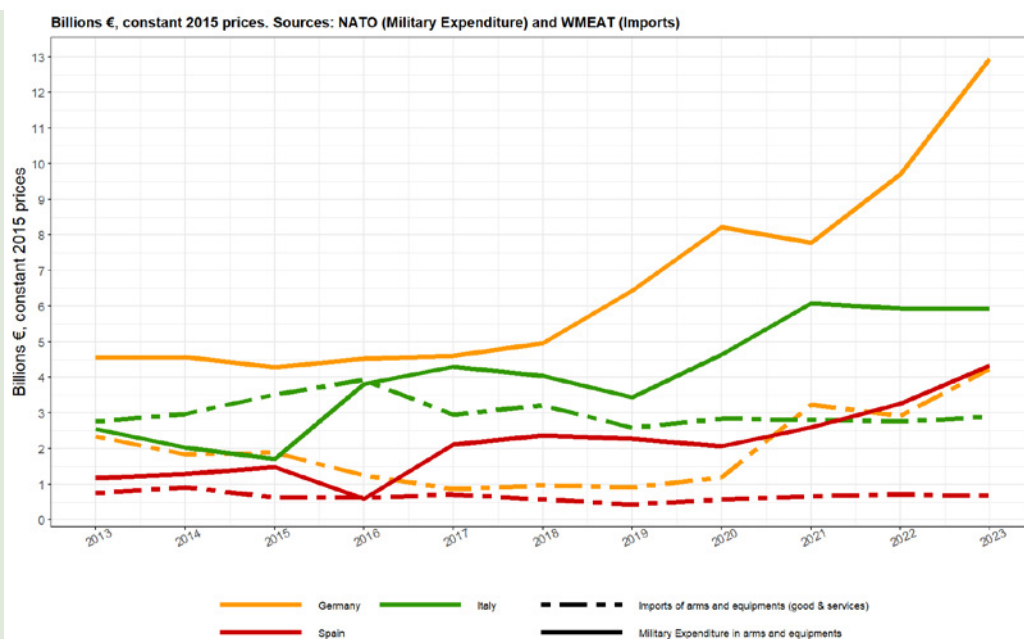
The case of Italy is somewhat different. Here, arms imports have long been in the same order of magnitude as arms expenditure, starting at about €2.8 billion in 2013 for both variables (multi-year arms transfer contracts can be recorded differently in military budgets and trade statistics). Again, arms imports have on the whole remained stable in real terms and now represent about half of total arms procurement in military budgets.

The case of Spain again starts with the value of arms imports close to the total budget for arms expenditure in 2013, and with imports stable at about €0.8 billion. With the accelerating rise in arms budgets in recent years, this figure has reached about €4.4 billion in 2023.

Fig. 7: Expenditure and imports of arms and equipment

Note 1: Values of military expenditure for 2022 and 2023 are NATO budgetary forecasts.

Note 2: Values of arms import from 2020 to 2023 are estimated using SIPRI trend indicator values.



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Using a different data source, the SIPRI database on transfers of major weapon systems, which are calculated in trend indicator values rather than in dollars, we see a common increase in arms imports for the three countries since 2019, and a doubling of imports compared to 2013. Arms acquisitions from the US have increased in parallel and are particularly high for Italy. In previous years, trends differed. Italy experienced an exceptional expansion of arms imports in 2016 - 2017, returning later to the previous growth trend; Germany and Spain temporarily reduced their imports between 2016 and 2018.

For NATO EU countries as a whole, SIPRI arms transfer data show that imports have jumped since 2018, with an increase of more than three times between 2018 and 2022 (these data also include imports from other European countries); half of the total imports came from the US.

The relevance of imports from the US is particularly relevant in qualitative terms. In advanced weapon systems, the importance of high technology components is growing rapidly and most of them – especially in electronics – have to be imported from the US. In the expansion of Europe's arms procurement and military industry, the reliance on US weapons and components appears to remain a key element. In fact, these developments suggest that Europe is moving along the same road of higher military expenditures and an increasing military orientation of the economy that is typical of the US. EU arms producers are becoming more involved in the web of NATO weapons standards, subcontracting activities for the largest US corporations, and relying on foreign-made advanced components.

3.

MILITARY EXPENDITURES AND ECONOMIC PERFORMANCE

The relevance of the increases in military expenditures and arms procurement in Europe has to be assessed in the context of broader economic performance. In this section, we compare such variables with changes in gross domestic product (GDP), total investment (gross fixed capital formation, GFCF) and employment. We then compare military outlays with other components of public expenditures, considering environmental and social priorities.

This analysis may shed light on whether the rise in military expenditure has been associated – over a long period – with successful economic performance in Europe. Military expenditures are a part of GDP, and expenditures in arms and equipment are a part of a country's gross fixed capital formation. By comparing these two sets of variables, we can assess whether a general growth of the economy has allowed the expansion of military activities or whether the latter has taken place through subtraction of income and investment resources from the countries' social and environmental priorities.

The data sources used here are provided by Eurostat (see the Appendix for details). As before, we consider NATO EU countries, Germany, Italy, and Spain. We focus on the

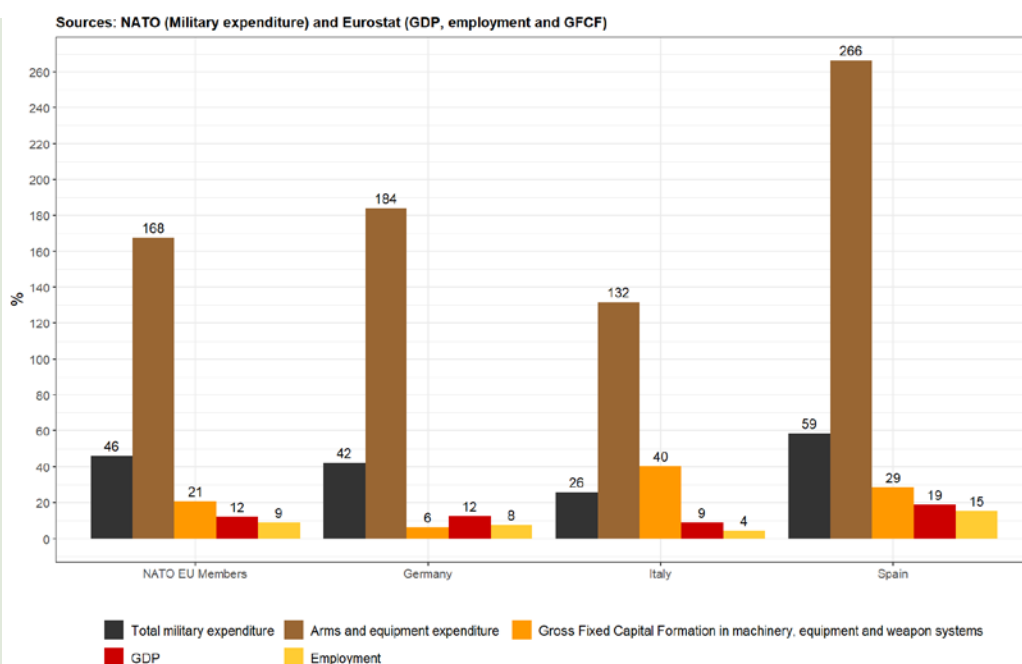
period 2013-2023 and calculate the percentage change in real terms over the period as a whole. NATO data for 2023 are budgetary forecasts for total military expenditures and for arms and equipment outlays. Eurostat data for gross domestic product (GDP), gross fixed capital formation (GFCF) and employment are not available for 2023 and have been estimated by projecting the linear trend of 2013-2021. We have also calculated changes for the 2013-2021 period when all data are available and no estimates were required. The trends are very similar, and the major gaps between the rise in military expenditures and overall economic performances are confirmed.

Fig. 8 shows a striking contrast between the record increases in military expenditures and arms procurement and the stagnation of GDP, investment, and employment; these patterns are very similar in NATO EU countries, Germany, Italy, and Spain.

In the period from 2013 to 2023, in the aggregate of NATO EU countries, real GDP has increased by 12% (just over 1% per year on average), total employment by 9% and military expenditures by 46% – four times faster than national income. Considering the resources for new investment,

Fig. 8: Percentage change in military expenditures and economic performance, 2013-2023

Note: for Eurostat variables the last available data is 2021. Values for 2023 are estimated by linearly projecting the trend 2013-2021.



the rise in capital formation has been 21%, but within this aggregate, arms acquisitions have increased by 168%, eight times as fast. In other words, arms are absorbing a rapidly increasing proportion of the resources that countries devote to building the future – including new production capabilities, new technologies, new infrastructures, environmentally sustainable processes, etc.

Germany is quite close to the NATO EU aggregate (being the largest economy clearly affects the EU aggregate). However, while the GDP growth over the decade is aligned with the NATO EU mean (both show a 12% increase), the average investment growth is only +6%. Furthermore, Fig. 8 clearly shows an above-average concentration in arms procurement (a +184% increase), confirming the move towards building military production capabilities.

Italy is the worst performer in these economic indicators, with stagnating GDP and jobs; however, it has an above-average investment growth (+40%, that includes the recent projects funded by the EU-funded Recovery Programme) and a below-average rise in arms procurement (+132%) that is more than three times as fast as the expansion of capital formation.

Spain appears as the most dynamic economy over that decade, with 19% GDP growth and 15% employment growth, but also shows the largest percentage increase (starting from rather low levels) of military expenditures (+59%), a rise that is three times faster than aggregate GDP expansion. Significant growth in investment (+29%) is overshadowed by skyrocketing arms expenditures (+266%, albeit starting from a rather low level), with an increase that is nine times as fast as that of capital formation.

NATO Europe and the three countries we consider in this report have all expanded their military activities much faster than GDP and employment, and have concentrated national investment in arms production capabilities. This process has accelerated over more recent years. The fact that such moves towards a more militarised economy have not been associated with high economic performances may suggest that military expenditures are unlikely to be a driver of faster economic growth.

At a time of economic stagnation or slow growth, such a concentration of resources in military spending comes at the expense of other types of public expenditures. In Fig. 9, we compare the data on the percentage changes in military expenditures (shown above) with changes in total public expenditures and in selected fields of state activities: environmental protection, education, and health. Public expenditure data are drawn from the Eurostat COFOG database that reports data on budgets of government ministries; we include here both current and capital

NATO EUROPE COUNTRIES HAVE ALL EXPANDED THEIR MILITARY ACTIVITIES MUCH FASTER THAN GDP AND EMPLOYMENT

expenditures from government budgets (see the Appendix for details).

Again, all data are calculated as the percentage change in real terms for the period 2013-2023. Missing values for 2023 are estimated as linear projections of the 2013-2021 trend. If we consider the 2013-2021 period only, using available data, the gaps between the rise in military spending and other types of expenditures appear to be more contained as they do not reflect the faster rate of increase since the start of the Ukraine war.

In the aggregate of NATO EU countries, between 2013 and 2023, total government expenditures increased in real terms by 20% (about 2% per year on average), with lower increases in outlays for education (+12%) and for environmental protection (+10%, including waste management, water, pollution, protection of biodiversity and landscape, environmental R&D), and a faster growth of health expenditures (+34%). Military expenditure over the same years increased by 46%: two and a half times as fast as total public budgets, almost one and a half times as fast as health outlays, and more than four times the increase of environmental expenditures.

Germany has experienced a more dynamic pattern of public expenditures, with a 32% increase in total public budgets and a 44% rise in health outlays, as opposed to a 42% increase in military expenditures. Again, education and environmental protection are losing ground in the expansion of public spending.

Italy has had a major public finance crisis over the decade and shows modest changes; total expenditures have increased by just 13%. Expenditures on public health have risen by 11%, while changes in education and environmental spending have been minimal (+3% and +6%, respectively). In contrast, military expenditures have grown by 26% – two times the pace of growth of total public outlays.

Spain shows a more balanced picture of changes in public expenditure, with a 24% rise in total budgets and above-average increases in education (+28% for Spain against +12% for the NATO EU Members), health and environment outlays (+30% for Spain against +10% for the NATO EU Members); in turn, military expenditures have grown by 59%, almost two and a half times as fast as the total, when we consider the jump in NATO budgetary forecasts for 2023.

An additional investigation can compare the investment dynamics of public expenditures. We have seen that arms procurement has the nature of capital investment as it is part of a country's gross fixed capital formation. Eurostat COFOG data include information on capital expenditure in each function of government: the investment resources spent on building schools, hospitals, or water treatment facilities. This effectively indicates what type of future European governments envision: one where education, health or environmental protection are expanding, or a society with larger arms arsenals.

Again, we consider the percentage changes in real terms for the 2013-2023 period; 2023 arms expenditure data are NATO budgetary forecasts data; 2023 COFOG data are estimated with a linear projection of the 2013-2021 trend.

In NATO EU countries, total government capital investment increased by 35% over the period, with education showing moderately lower (+24%) and health showing moderately higher (+45%) patterns; remarkably, investment in environmental protection fell in real terms by 5% during the decade. At the same time, arms procurement increased by 168%, around 4.8 times faster than total public investment.

Germany shows a comparable pattern here with a 67% increase in public investment, similar to the expansion of health capital expenditures (+78%), while environmental investment is basically unchanged. In contrast, arms procurement has increased by 184%, almost three times the rate of government capital expenditure as a whole.

Italy's government finance crisis is clearly visible in public investment data; the 105% increase in total public capital outlays is entirely accounted for by increases in the most recent years, when EU funds for the Recovery Programme have become available. Investment in health has grown by 33%, investment in education is unchanged, there is a fall in environmental spending, while arms procurement increases by 132%.

In terms of total public expenditure, Spain presents a more balanced distribution of government investment across the different areas, with an overall increase of 55%, equally distributed to education and health; Spain is the only country with some growth in environmental investment (+21% over the decade). The exceptional growth of 266% in expenditures for arms and equipment is the result of the projected rapid increase in arms procurement in 2023.

As pointed out above, the public budget constraints experienced by Italy and Spain led to a stagnation of public investment in the first half of the decade, and to a recovery in more recent years only.

In the last decade Europe has experienced widespread problems with public finance and poor economic performances. These factors have shaped the context for

Fig. 9: Military expenditures vs environmental and social expenditures

Percentage change in real terms, 2013-2023

Note: for Eurostat variables the last available data is 2021. Values for 2023 are estimated by linearly projecting the trend 2013-2021.

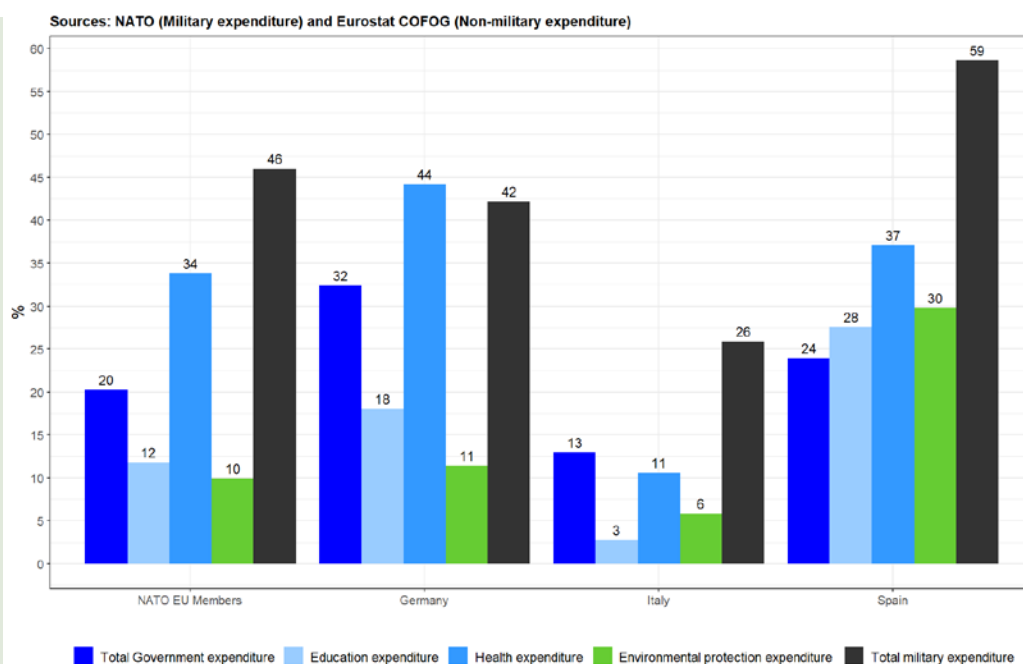
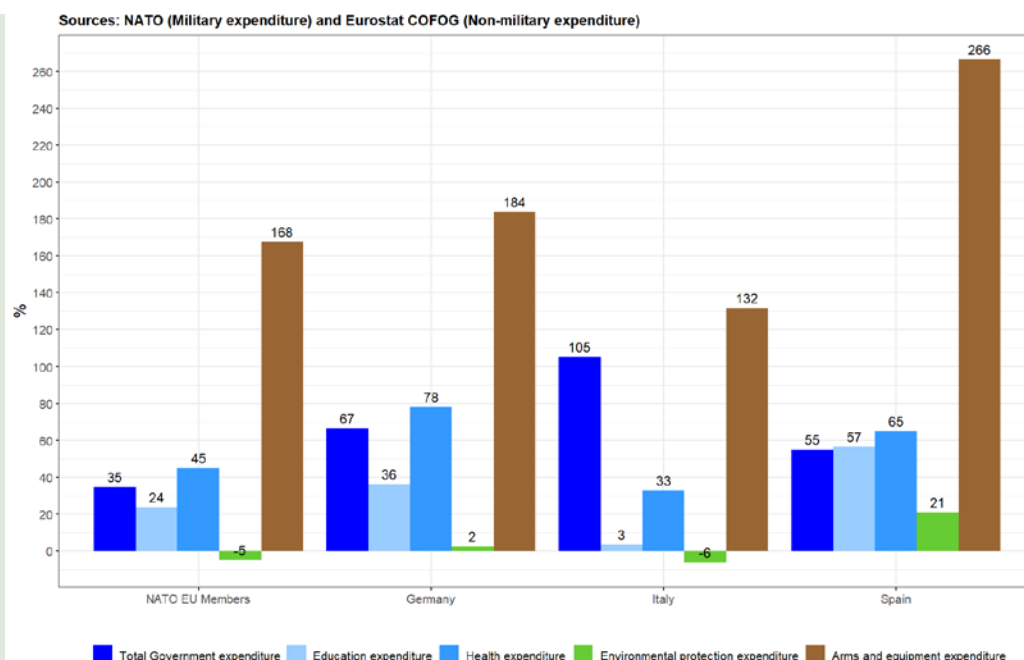


Fig. 10: Arms expenditures vs investment in the environment, education and health

Percentage change in real terms, 2013-2023

Note: for Eurostat variables the last available data is 2021. Values for 2023 are estimated by linearly projecting the trend 2013-2021.



difficult policy choices regarding public spending priorities. It is remarkable that all NATO EU countries, and even countries experiencing difficult economic conditions, such as Italy and Spain, have allowed military expenditure and investment in arms procurement to take priority over environmental and social objectives. The increasing military orientation of European economies is likely to be problematic in terms of social quality and environmental sustainability, as well as in terms of its impact on economic and employment performance.

The disparity between the jump in arms procurement and the stagnation of investment in environmental protection is particularly striking. In contrast to the €157 billion spent on the military by NATO EU countries in 2021, spending on environmental protection amounted to only €102 billion (in constant 2015 prices), when estimates by the World Health Organization show that in the same year some 1.4 million people lost their lives due to climate change and pollution in Europe¹. A major reassessment of national and European priorities has to be urgently set in motion.

¹ World Health Organization (2023), "Clear air + green planet = good health for all", 5 July 2023 available at <https://www.who.int/europe/news/item/05-07-2023-clean-air---green-planet---good-health-for-all>.

4.

THE ECONOMIC IMPACT OF MILITARY EXPENDITURE AND THE ALTERNATIVES

What is the economic effect of military expenditure on growth of the economy as a whole? To address this question for the countries we investigate, we use the methodology based on the *input-output approach*¹. This aims to estimate the effect that €1,000 million expenditure in one sector of the economy has on the production of intermediate inputs in the rest of the economy, given the actual patterns of flows of goods and services from each industry to all the others.

This analysis focuses on the effects on direct and indirect demand for intermediate inputs within the national economy that are activated by the initial expenditure. Other effects emerge in the demand for goods and services produced by other nations and imported by the national economy being considered. These contribute to increasing output and employment in foreign countries. This analysis does not consider the demand effect of the incomes and wages paid by a given industry, as consumption patterns are likely to be similar for wages earned in any industry. Finally, input-output approaches assume stable relationships among industries, based on the flows of material requirements for production at given prices; they do not consider flows of knowledge, changes in technologies and other systemic effects.

In this section, we present the analysis of input-output multipliers and estimates of the impact of €1,000 million in different areas of public expenditure: a) arms acquisition; b) capital expenditure for the environment in water services, waste management and remediation services; c) capital expenditure for education; d) capital expenditure for health (arms acquisition data are based on NATO sources; all other data are taken from the Eurostat COFOG database; all data have already been used in the previous analyses).

Several methodological problems must be addressed. Input-output data from ICIO tables produced by the OECD for Germany, Italy, and Spain provide information on the requirements of intermediate inputs in the domestic economy for environmental, education, and health activities.

Data for military expenditure and arms production are not

provided. However, the United States Bureau of Economic Analysis has published input-output tables for 2018-2022 with information on the input requirements of “Federal national defense: Gross investment in equipment” (<https://www.bea.gov/industry/input-output-accounts-data>) that basically refers to arms production. We assumed that in arms production the intermediate inputs from other sectors of the economy in Europe are similar to those in the US. We calculated the average requirements for 2018-2022 in the US, and found that three sectors – Computer and electronic products (software, controls, surveillance), Motor vehicles (tanks and armoured vehicles), and Other transportation equipment (aircraft, ships) – accounted for an average of 90% of all inputs for arms acquisitions in the US during this period. If we concentrate on these three industries, we can assume that the input flows for arms production in European countries are as follows: Computer and electronic products 39%; Motor vehicles 13%; Other transportation equipment 48%.

The arms industry can be considered a combination of these three industries with the relative weights being the shares of the three industries listed above. OECD input-output tables for Germany, Italy, and Spain provide data on the input requirements of the three industries above; we apply such weights to the input requirements of the three industries from the rest of the economy, and we estimate the input requirements and the multiplier effect of expenditure in arms procurement.

Table 1 shows the multiplier effect in terms of output of expenditure on arms (as a weighted average of the values of the three component sectors of computers, motor vehicles, and other transport industries), as well as in the fields of the environment (water supply, sewerage, waste management, and remediation activities), education and health. In order to make a closer comparison with the type of investment commonly found in arms procurement, we consider government capital expenditures only for the environment, education and health; input-output tables provide data on the flows of material requirements for such expenditures.

¹ For an introduction to the input-output approach, see Miller and Blair (2009); the methodology for calculating multipliers can be found in D'Hernoncourt, Cordier, Hadley, (2011); applications for military expenditures have been carried out by Peltier (2017, 2019, 2023), and for environmental expenditures by Garret-Peltier (2017).

Table 1. The multipliers of expenditures for arms, environment, education and health
Arms procurement vs. public capital expenditure for education, health and the environment

	Germany	Italy	Spain
Arms*	1,62	1,82	1,65
Computer, electronic and optical equipment	1,49	1,69	1,57
Motor vehicles, trailers and semi-trailers	1,74	1,93	1,76
Other transport equipment	1,70	1,90	1,69
Environment**	1,77	1,91	1,83
Education	1,27	1,26	1,19
Health	1,38	1,56	1,39

Note: Output multipliers show the effect of a € 1 increase in final demand for domestic production

(*) = Weights are: 38.86% for *Computer, electronic and optical equipment*; 12.76% for *Motor vehicles, trailers and semi-trailers*; 48.38% for *Other transport equipment*

(**) = Water supply, sewerage, waste management, and remediation activities

Table 2. The impact of €1 billion expenditure for arms, environment, education and health on output and employment
Arms procurement vs. public capital expenditure for education, health and the environment

Germany	Arms	Environment*	Education	Health
Additional expenditure (millions €)	1000	1000	1000	1000
Percentage of imports of final goods (%)	24,21	0,86	0,41	0,08
Expenditure going to the domestic economy (millions €)	757,89	991,36	995,90	999,18
Domestic output effects (millions €)	1230,58	1752,28	1265,12	1382,36
Domestic employment (FTE) effects (thousands ppl.)	6,15	11,36	17,62	15,20
Italy	Arms	Environment*	Education	Health
Additional expenditure (millions €)	1000	1000	1000	1000
Percentage of imports of final goods (%)	59,28	0,53	0,10	0,06
Expenditure going to the domestic economy (millions €)	407,23	994,66	998,98	999,40
Domestic output effects (millions €)	741,64	1900,32	1254,86	1562,51
Domestic employment (FTE) effects (thousands ppl.)	3,16	9,96	13,89	12,30
Spain	Arms	Environment*	Education	Health
Additional expenditure (millions €)	1000	1000	1000	1000
Percentage of imports of final goods (%)	22,30	0,37	0,11	0,07
Expenditure going to the domestic economy (millions €)	777,03	996,29	998,90	999,30
Domestic output effects (millions €)	1284,61	1827,80	1193,33	1385,75
Domestic employment (FTE) effects (thousands ppl.)	6,58	11,89	16,44	15,30

(*) = Water supply, sewerage, waste management, and remediation activities

FTE = Full time equivalent

THE RESULTS CONFIRM THAT INVESTMENT IN ENVIRONMENTAL AREAS HAS A HIGHER EFFECT THAN ARMS IN ALL THREE COUNTRIES

In the Appendix we provide details on data and methodology; the relevant parts of input-output tables at the source of these calculations are included in the Appendix.

The results shown in Table 1 confirm that arms procurement has a significant multiplier effect for other economic activities, but investment in environmental areas has a higher effect than arms in all three countries. Health has an intermediate effect and education has the lowest multiplier, as it requires fewer intermediate inputs in goods and services from other industries, and is more labour intensive. However, such expansionary effects could be directed to other countries if increased public expenditures lead to larger imports.

Table 2 shows how we can estimate the effect that €1 billion of expenditure in each of these sectors has on total output and employment. For each of the three countries, we start in the first line with the value of the additional public expenditure that is envisaged: €1,000 million. We then subtract the percentage of such public expenditure that goes to imports; the shares are calculated from NATO data in the case of arms (using the average for the 2018-2021 period) and Eurostat trade data at the industry level for the remaining variables. We can see that the share of imports is much greater in arms production – ranging from 59% in Italy to 22% in Spain – while the other three sectors have all shares of imports below 1% of total output, due to the domestic rootedness of service industries, to lower needs for intermediate material inputs, and to a greater labour intensity.

The third line shows the resulting amount of expenditure that is directed to the domestic economy. This expenditure will set in motion purchases of intermediate goods and services from other industries – direct and indirect – that will multiply demand and production.

In the fourth line, we multiply the value of expenditure in the domestic economy by the input-output multipliers from Table 1 (above); the result is the impact in million euros that the original €1,000 million of public expenditure has on the domestic economy.

We can see that for Germany a €1,000 million expenditure in arms procurement sets in motion an increase in domestic output of €1,230 million. In Italy the resulting increase is €741 million only, as a large part of the expenditure goes to imports, increasing other countries' output. In Spain, the increase in domestic output is €1,284 million.

Finally, we estimate the impact on employment. In the Appendix tables, we report the actual output of each sector and the amount of employment (in total work hours) required to produce it. We can therefore compute, in the fifth line of Table 2, the total employment that is required to produce the

additional output in each country reported above. Results (expressed as the number of full-time employees) equate to about 6,000 additional jobs in Germany, 3,000 in Italy, and 6,500 in Spain.

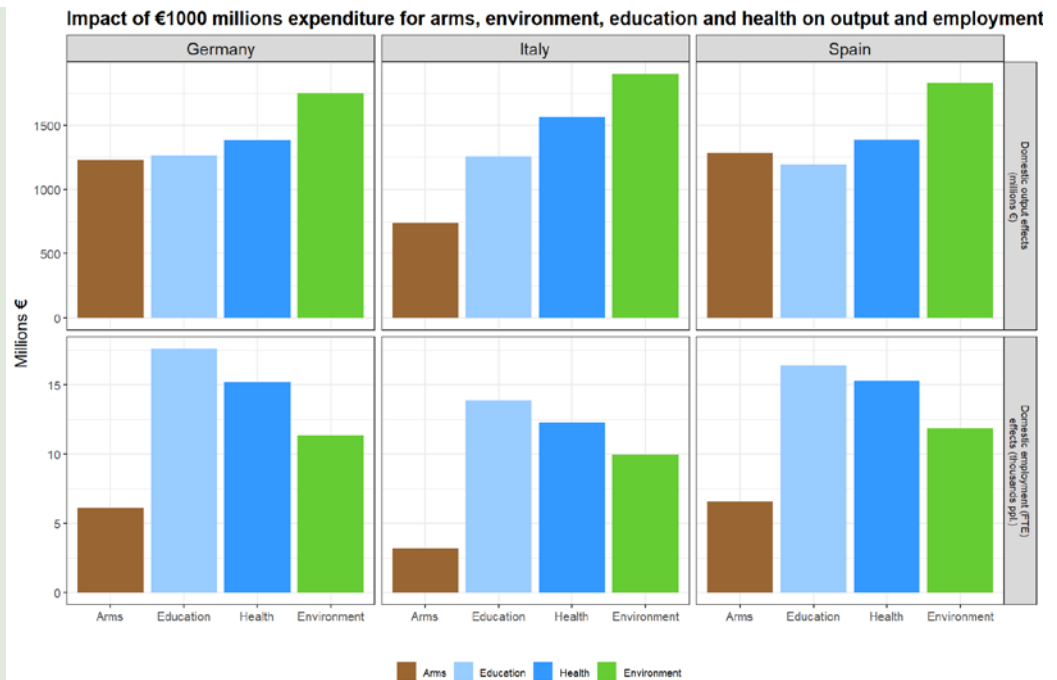
How do these results compare with alternative destinations of the original €1,000 million in public expenditure? We calculated the effects of a similar expenditure for environmental protection, education, and health. These sectors are characterised by service activities in the domestic economy, with a much lower relevance of imports, less need for intermediate inputs, and a higher employment intensity. The multiplier effect in terms of output and employment for each of the three alternative public expenditures is generally greater than the economic effect of increased arms procurement, except for education expenditure in Spain. In terms of output, the highest results are found for environmental protection, with an increased output of €1,752 million in Germany, €1,900 million in Italy, and €1,827 million in Spain. For education and health, the additional output ranges from €1,190 million to €1,380 million.

Looking at the impact in terms of additional employment, the original €1,000 million in public expenditure could lead to the creation of 11,000 new jobs in the environmental sector in Germany, almost 18,000 jobs in education, and 15,000 jobs in health services. This employment impact is between two and three times the effect expected from increased arms procurement.

In Italy, the new jobs created would range between about 10,000 in environmental services to almost 14,000 in

Fig. 11: The economic and employment impact of military and civilian expenditure

Arms procurement vs. public capital expenditure for education, health and the environment



education – three to four times higher than the employment impact of increased arms procurement.

In Spain, the employment effect would range between 12,000 new jobs in the environment to 16,000 in education. Indeed, in the latter, the higher labour intensity more than compensates for the lower multiplier effect of the sector; there would be twice as many new jobs generated here as those potentially created by increased arms procurement.

A summary of these results is reported in Fig. 11, using the data from the last two lines of Table 2. The results for the three countries are rather similar, and the contrast between arms expenditure and other priorities is evident.

These results show that the current drive to increase European military expenditures is having problematic economic consequences. In European countries characterised by constraints on public expenditures, policies that concentrate limited public resources in the military have negative outcomes in several regards. They result in larger imports

for arms and high-tech components, mainly from the US; they lead to a lower availability of public resources for environmental and social priorities; and they have a significantly lower effect in terms of domestic growth of output and employment compared to other potential destinations of public expenditures.

In *quantitative* terms, considering the performances of economic and employment growth, the findings show that increased military expenditures – associated with the prospect of a stronger European ‘military-industrial complex’ – may slow down Europe’s development, compared to trajectories based on increased environmental and health expenditures.

In terms of the *quality* of Europe’s development, more expenditures on education, health and the environment bring improvements in wellbeing and sustainability that are even more important than the quantitative gains we may estimate.

5.

CONCLUSIONS

In the last decade, Europe has taken the road of increases in military spending. This has accelerated dramatically since the start of the war in Ukraine in 2022. In 2023, military spending by NATO EU countries amounted to €215 billion (in constant 2015 prices), as opposed to €145 billion in 2014 – a rise of 48% in real terms. Germany, Italy and Spain together account for about 40% of these expenditures and have experienced increases ranging from 30% to 50% over the last decade.

Such a trajectory of militarisation can hardly be justified on the basis of Europe's security needs. Security in Europe is best assured by political and diplomatic agreements, conflict prevention and resolution initiatives, arms control, and disarmament processes. In fact, a militarisation strategy could lead to new arms races, with the immediate effect of further destabilising the international order around Europe. Moreover, security must not be understood solely in military terms. The United Nations adopted the concept of "human security" in Resolution 66/290 of 10 September 2012. According to this, civil, political, economic, social and cultural rights must be respected in order to create and maintain peace. The conditions allowing the protection of such rights must be financed, and the rise in military expenditures is reducing the resources available. The emergence of novel conceptions of security – including ecological security and human security – has been pointed out by the UN Institute for Disarmament Research (UNIDIR) and SIPRI (Kuimova et al., 2023); military expenditures do not contribute to such new perspectives.

The results of our study show that militarisation is also a 'bad deal' in purely economic terms. More military expenditures are leading Europe along a trajectory of lower economic prosperity, less job creation, and poorer quality of countries' development.

The alternatives – more expenditures for the environment, education, and health – would have more positive economic effects on output and employment. More importantly, they would bring major benefits in the quality of life and of the environment. The larger policy choice European countries are facing is between a more militarised economy on the one hand, and the pursuit of sustainability and wellbeing on the other hand. The choice is ours.

THE RESULTS OF OUR STUDY SHOW THAT MILITARISATION IS ALSO A 'BAD DEAL' IN PURELY ECONOMIC TERMS

MORE MILITARY EXPENDITURES ARE LEADING EUROPE ALONG A TRAJECTORY OF LOWER ECONOMIC PROSPERITY, LESS JOB CREATION, AND POORER QUALITY OF COUNTRIES' DEVELOPMENT

APPENDIX

DATA SOURCES AND METHODOLOGY

This Appendix provides information on the sources of data, the definition of variables, the methodology used to calculate them, and points out critical issues. Countries considered include Germany, Italy, Spain and NATO EU countries. The latter group includes: Belgium, Bulgaria, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain. The period covered in the database is from 2008 to 2023. Data are mainly reported for the last decade, 2013-2023. The database we have produced is available on request for interested scholars.

The database has been constructed by combining data from four main institutional sources:

- North Atlantic Treaty Organization (NATO) Defence Expenditure database (available at the link https://www.nato.int/cps/en/natohq/topics_49198.htm);
- Eurostat databases;
- World Military Expenditure and Arms Transfers (WMEAT) database (available at <https://www.state.gov/world-military-expenditures-and-arms-transfers/>);
- Stockholm International Peace Research Institute (SIPRI) arms transfer database (available at <https://armstrade.sipri.org/armstrade/page/values.php>)

NATO military expenditure variables

From the NATO database we gathered information about the military expenditure of countries at both the aggregate and sectoral levels. By sectoral, we mean the division of total defence expenditure into four principal breakdowns, that is personnel, equipment and arms, infrastructures, and other expenditures.

The list of variables collected from NATO database is as follows:

- Total military expenditure (million €, constant 2015 prices and millions in national currency, current prices), military expenditure per capita (thousand €, constant 2015 prices), military expenditure share of real GDP (0-100% of GDP), and military expenditure annual real change (% of year-to-year annual real change)
- Military personnel (thousand persons)

- Military expenditure breakdown: equipment, personnel, infrastructures and other expenditures (million €, constant 2015 prices and 0-100% of total defence expenditure).

As reported in the official documentation provided by NATO, values for 2022 and 2023 are budgetary estimates/forecasts computed by NATO itself.

NATO has adopted a common definition of defence expenditure since the early 1950s. The definition is agreed by all NATO Allies. It is regularly reviewed, most recently in early 2023. Defence expenditure is defined by NATO as payments made by a national government (excluding regional, local and municipal authorities) specifically to meet the needs of its armed forces, those of Allies or of the Alliance.

It includes:

- Expenditure for the military component of mixed civilian-military activities, but only when the military component can be specifically accounted for or estimated. For example, these include airfields, meteorological services, aids to navigation, joint procurement services, research and development;
- Military and financial assistance by one Ally to another, specifically to support the defence efforts of the recipient, should be included in the defence expenditure of the donor nation and not in that of the recipient;
- R&D costs, in turn including expenditure for those projects that do not successfully lead to production of equipment;
- Equipment expenditure includes major equipment expenditure and R&D devoted to major equipment;
- Payments for Armed Forces financed from within the Ministry of Defence budget. Armed Forces include land, maritime and air forces as well as joint formations, such as Administration and Command, Special Operations Forces, Medical Service, Logistic Command, Space Command, Cyber Command. They might also include parts of other forces such as Ministry of Interior troops, national police forces, coast guards etc. In such cases, expenditure is included only in proportion to the forces that are trained in military tactics, are equipped as a military force, can operate under direct military authority in deployed operations, and can, realistically, be deployed outside national territory in support of a military force. Expenditure on other forces financed through the budgets of ministries other than

MoD is also included in defence expenditure;

- Retirement pensions made directly by the government to retired military and civilian employees of military departments and for active personnel;
- Operations and maintenance expenditure, other R&D expenditure and expenditure not allocated to the above-mentioned categories;
- Maintenance and construction of NATO common infrastructures and national military construction;
- Expenditures for stockpiling of war reserves of finished military equipment or supplies for use directly by the armed forces;
- War damage payments and spending on civil defence.

To avoid any ambiguity, the fiscal year has been designated by the year which includes the highest number of months: e.g. 2022 represents the fiscal year 2022/2023 for Canada and United Kingdom, and the fiscal year 2021/2022 for the United States. Because of rounding, the total figures may differ from the sum of their components.

Eurostat economic and social variables

From Eurostat, we gathered information about relevant social and macroeconomic indicators connected to defence expenditure and military investments. In particular, we collected information about the economic level of countries, public expenditure at sectoral level, and demography.

The list of variables collected from Eurostat database is as follows:

- Gross Fixed Capital Formation and Gross Fixed Capital Formation in machinery and equipment and weapons systems (millions €, constant 2015 prices);
- Gross Domestic Product (million €, constant 2015 prices);
- GDP implicit deflator national currency base 2015 (index, year base = 2015);
- Total employment (thousand persons) using the national concept. It covers all persons engaged (employees and self-employed) in some productive activity (within the production boundary of the national accounts);
- Population (thousand persons) using the national concept on January 1st. It consists of all persons, nationals or foreigners, who are permanently settled in the economic territory of the country, even if they are temporarily absent from it, on a given date;

- Business R&D expenditure, i.e. BERD (million €, constant 2015 prices): gross domestic expenditure on E&D at the national level from the business enterprise sector;
- Government R&D expenditure, i.e. GERD (million €, constant 2015 prices): gross domestic expenditure on E&D at the national level from the government sector;
- Total R&D expenditure R&D (million €, constant 2015 prices): gross domestic expenditure on E&D at national level from all sectors of performance;
- Defence R&D government budget allocations (million €, constant 2015 prices): it measures government support to military/defence research and development (R&D) activities, and thereby provides information about the priorities that governments assign to different public R&D funding activities;
- Total R&D government budget allocations (million €, constant 2015 prices): it measures government support to research and development (R&D) activities, and thereby provides information about the priorities governments assign to different public R&D funding activities.

Eurostat General Government Expenditure by Function (COFOG) variables

The list of variables collected from Eurostat-COFOG database is as follows:

- Total general government (million €, constant 2015 prices): this is the sum of COFOG for general public services, defence, public order and safety, economic affairs, environmental protection, housing and community amenities, health, culture, education, and social protection;
- General public services (million €, constant 2015 prices): includes executive and legislative organs, financial and fiscal affairs, external affairs; foreign economic aid; general services; basic research; R&D related to general public services; general public services (other); public debt transactions, transfers of a general character between different levels of government;
- Environmental protection (million €, constant 2015 prices): includes waste management; water waste management; pollution abatement; protection of biodiversity and landscape; R&D related to environmental protection. The breakdown of environmental protection is based upon the Classification of Environmental Protection Activities (CEPA) as elaborated in the European System for the Collection of Economic Information on the Environment (SERIEE) of the Statistical Office of the European Communities (Eurostat);
- Health (million €, constant 2015 prices): includes medical

products, appliances and equipment; outpatient services; hospital services; public health services; R&D related to health;

- Education (million €, constant 2015 prices): includes pre-primary, primary, secondary and tertiary education, post-secondary non-tertiary education, education non-definable by level, subsidiary services to education; R&D related to education.

Notes and issues regarding Eurostat and Eurostat-COFOG data

1. COFOG expenditure is divided into capital expenditure (sum of gross capital formation, acquisition less disposable of non-produced assets, and capital transfers) and current expenditure according to the ESA 2010 nomenclature;

2. For all the Eurostat variables, the last available year is 2022. Values for 2023 are estimated as follows:

1. Values for 2023 for 'Population' and 'Total employment' are assumed to be equal to the values for 2022;

2. GDP annual growth rates for 2023 are provided by the "Spring GDP growth estimates for 2023-2024" provided by Eurostat;

3. GDP values for 2023 are computed by multiplying the estimate of the 2023 Y-to-Y GDP growth rate and the GDP values for 2022;

4. GDP per capita values for 2023 are computed by dividing the 2023 estimates of the GDP by the estimate of population for 2023;

5. GDP implicit deflator for 2023 is computed using NATO data on defence expenditure. In particular, the implicit deflator 2023 is computed as the ratio between the total defence expenditure at current prices and the total defence expenditure at constant 2015 prices;

6. Euro/ECU exchange rate for 2023 is assumed to be equal to the Euro/ECU exchange rate of 2022;

3. For all the 'EURO COFOG' variables, the last available data is 2021. Values for 2022 and 2023 are estimated by linearly projecting the 2013-2021 trend.

World Military Expenditure and Arms Transfer (WMEAT) variables

From WMEAT and SIPRI, we collected information about the imports of equipment and arms at the worldwide level.

The following data were extracted from the WMEAT Report 2021, available at <https://www.state.gov/world-military-expenditures-and-arms-transfers/>:

- Exports of arms (good and services): million €, constant 2015

- Imports of arms (good and services): million €, constant 2015

WMEAT reporting of military expenditures attempts to follow the NATO definition.

The arms imports and exports statistics provided by WMEAT are estimates of the value of goods and services actually delivered during the reference year(s), in contrast both to payments and to the value of programs, agreements, contracts, or orders concluded during the reference year(s). Deliveries data represent arms transfers only to governments or to entities (typically enterprises) authorized by their countries' governments to receive them.

Arms transfers (arms imports and exports) represent the international transfer (under terms of grant, credit, barter, or cash) of military equipment and related services, including weapons of war, parts thereof, ammunition, support equipment, and other commodities designed for military use, as well as related services. Among the items included are tactical guided missiles and rockets, military aircraft, naval vessels, armored and non-armored military vehicles, communications and electronic equipment, artillery, infantry weapons, small arms, ammunition, other ordnance, parachutes, and uniforms. In principle, dual use equipment, which can have application in both military and civilian sectors, is included when its primary mission is identified as military. The building of defence production facilities and licensing fees paid as royalties for the production of military equipment, as well as equipment delivery, maintenance, operating, and training services, are included when they are contained in military transfer agreements. Military services such as training, supply, operations, equipment maintenance or repair, technical assistance, and construction are included where data are available.

Notes and issues regarding WMEAT data:

1. WMEAT data are only available from 2009 to 2019;

2. Values for 2020, 2021 and 2022 were imputed by linearly interpolating the empirical relationship with the Trend Indicator Values (TIVs) from SIPRI. In particular, for each individual country, we estimate the linear relationship between imports (or exports) of arms from WMEAT and TIVs from SIPRI in the subperiod 2012-2019. Then the estimated parameters were used to interpolate the missing values by computing the expected value of imports (or exports) conditioned to the observed values of TIVs for 2020, 2021 and 2022;

3. Values for 2023 were imputed as for the Eurostat data using the procedure discussed above. In particular, imports and exports for 2023 were estimated by linearly projecting the 2013-2022 trend.

Stockholm International Peace Research Institute (SIPRI) arms transfer variables

The following data were extracted from the SIPRI arms transfer database from all countries 1992-2022, available at <https://armstrade.sipri.org/armstrade/page/values.php>.

- Exports of arms: Trend Indicator Values (TIVs) in Millions at constant prices
- Imports of arms: Trend Indicator Values (TIVs) in Millions at constant prices

SIPRI data include only major conventional weapons and components.

SIPRI has developed a unique pricing system to measure the volume of deliveries of major conventional weapons and components using a common unit the SIPRI trend-indicator value (TIV). The TIV of an item being delivered is intended to reflect its military capability rather than its financial value. This common unit can be used to measure trends in the flow of arms between particular countries and regions over time – in effect, a military capability price index.

The SIPRI TIV neither reflects the actual price paid for weapons nor represents current dollar values for arms transfers. The TIV should therefore not be compared directly with gross national product (GNP), gross domestic product (GDP), military expenditure, sales values or the financial value of arms export licenses. However, TIVs can be used as the raw data for calculating trends in international arms transfers over periods of time.

Notes and issues regarding SIPRI data

1. SIPRI data are only available from 2012 to 2022;
2. Values for 2023 were imputed as for the Eurostat data using the procedure discussed above. In particular, imports and exports of 2023 were estimated by linearly projecting the 2013-2022 trend.

Input-Output Analysis

An inter-country input-output table is a representation of the flows of goods and services (in monetary values) across all countries' sectors in a given year. The rows of the table show the sales of the output of a country's sector to all domestic and foreign sectors. The columns show the intermediate demand of a country's sectors or the final demand for the output of all domestic and foreign sectors. Inter-country input-output data were extracted from the 2021 edition of OECD Inter-Country Input-Output (ICIO) Tables (available at <https://www.oecd.org/sti/ind/inter-country-input-output-tables.htm>).

We used the input-output matrix for the last available year (i.e. 2018) at the time this analysis was made. Data on total worked hours in 2018 were taken from the OECD STAN STructural ANalysis Database (available at https://stats.oecd.org/Index.aspx?DataSetCode=STANI4_2020, variable "HRSE: Hours worked - employees").

The data on inter-industry transactions and total hours worked allowed us to calculate the output multipliers for all domestic sectors (i.e. the effect of a €1 increase in final demand for a domestic industry's output) and the domestic output and employment effects of a €1000 million increase in expenditure for arms, environment (i.e. water supply, sewerage, waste management, and remediation activities), education, and health.

We calculated the output multipliers by going through the following steps.

1. From the original table, we extracted three separate input-output matrices for Germany, Italy, and Spain. For each country, productive sectors were aggregated into seven categories: "Computer, electronic and optical equipment", "Motor vehicles, trailers and semi-trailers", "Other transport equipment", "Water supply; sewerage, waste management and remediation activities", "Education", "Human health and social work activities", "Other domestic sectors". The first six sectors are at the level of aggregation provided by the OECD ICIO Tables. The last sector was obtained by aggregating all remaining domestic sectors. Foreign sectors aggregated by row are labelled "Intermediate imports". Foreign sectors aggregated by column are labelled "Intermediate export". Foreign final demand components were grouped together and labelled "Final export". Inter-industry monetary flows were converted into euros using the national currency-US dollar exchange rate provided by the OECD ICIO database.
2. We transformed the matrix of inter-industry monetary flows into a matrix of technical coefficients of production by dividing each entry by the corresponding industry's total output. The technical coefficients of production are the intermediate input requirements to produce one unit of output. Each entry of the matrix of technical coefficients then shows the amount of input produced by the industry in the row that is required to produce one unit of output in the industry in the column.
3. Following standard input-output methodology, we calculated the "Leontief inverse matrix" from the matrix of technical coefficients. Each entry of the Leontief inverse matrix shows the amount of output produced in the industry in the row as a result of €1 increase in expenditure for final output in the industry in the column. Output multipliers were then derived by calculating the column sums of the Leontief inverse matrix. The relevant sectors for our analysis are "Computer, electronic and optical equipment", "Motor vehicles, trailers

and semi-trailers”, and “Other transport equipment” for arms production (see step 4), “Water supply; sewerage, waste management and remediation activities” (environment), “Education”, and “Human health and social work activities” (health). Our results are reported in Table 1.

4. As the OECD ICIO database does not provide data for military expenditure and arms production, we calculated the multiplier effects of arms production by using information on input requirements provided by the Bureau of Economic Analysis (BEA) Input Output Tables (Use Tables, 71 Industries, available at <https://www.bea.gov/industry/input-output-accounts-data>). The BEA Input Output Tables show that the three main suppliers of intermediate inputs for arms production (i.e. “Federal national defense: Gross investment in equipment”) in the US are “Computer and electronic products”, “Motor vehicles, bodies and trailers, and parts”, and “Other transportation equipment”, which account for more than 90% of all inputs for arms production. Therefore, we assumed that: (1) the corresponding intermediate input suppliers in the NACE classification (i.e. “Computer, electronic and optical equipment”, “Motor vehicles, trailers and semi-trailers”, and “Other transport equipment”) provide all intermediate inputs for arms production in Germany, Italy, and Spain; (2) the shares of the three main suppliers of intermediate inputs in arms production in Germany, Italy, and Spain are the same as the average shares in the US over the period 2018-2022 (i.e. 38.86%, 12.76%, and 48.38% respectively). These assumptions imply that the output multipliers for arms production are equal to the weighted average of the multipliers for “Computer, electronic and optical equipment”, “Motor vehicles, trailers and semi-trailers”, and “Other transport equipment”, with weights being equal to the shares of each intermediate input supplier in arms production. Our results are reported in Table 1.

We derived the domestic output and employment effects of €1,000 million expenditure for arms, environment, education, and health via the following steps.

1. As part of the increase in final domestic expenditure goes to foreign sectors, we first calculated the percentage of imports of final goods (second line of Table 2). In the case of arms production, this was calculated from WMEAT and NATO data as the ratio of “Imports of arms (goods & services)” to “Defence expenditure in equipment”. In the case of environment, education, and health, it was calculated from

OECD ICIO data as the ratio of final demand going to the corresponding foreign sectors to total final demand.

2. We calculated the expenditure going to the domestic economy by multiplying the initial additional expenditure by one minus the percentage of imports of final goods derived from step 1 (third line of Table 2).
3. We multiplied the value of the expenditure going to the domestic economy by the multipliers in Table 1 to get the impact of the initial additional expenditure on domestic output (fourth line of Table 2).
4. We derived full-time equivalent (FTE) employment data for each sector by dividing the total worked hours in each sector by 1650 (OECD STAN data). Where OECD STAN provides data on total worked hours for 2018 at a higher level of aggregation than OECD ICIO – but data are available at a lower level of aggregation for 2017 – we extrapolated missing data by using 2017 data; where 2017 data are not available at a lower level of aggregation, we extrapolated missing data by using data on sectoral output for 2018.
5. We divided FTE employment by total output to get a vector of employment/output ratios. Each entry of the vector of employment/output ratios shows the number of FTE employees required to produce one unit of the corresponding industry’s output.
6. We transformed the Leontief inverse matrix into an “employment requirement matrix”. Each entry of the employment requirement matrix shows the increase in the number of FTE employees in the industry in the row as a result of a €1 increase in expenditure for final output in the industry in the column. The column sums of the employment requirement matrix then show the domestic economy-wide employment effects of a €1 increase in expenditure for the final output in the corresponding sectors.
7. To calculate the effects on domestic employment, we first multiplied our results from step 6 by the additional initial expenditure. For arms production, the additional initial expenditure is assumed to go to “Computer, electronic and optical equipment”, “Motor vehicles, trailers and semi-trailers”, and “Other transport equipment” according to the shares of the three suppliers of intermediate inputs in arms production (i.e. 38.86%, 12.76%, and 48.38% respectively). Finally, we scaled down our results by a factor equal to the percentage of imports of final goods (fifth line of Table 2).

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