econPOL FORUM

4
2024

July
Vol. 25

ECONOMIC POLICY AND ITS IMPACT

Europe's Middle-Technology Trap
Anita Dietrich, Florian Dorn, Clemens Fuest, Daniel Gros, Giorgio Presidente, Philipp-Leo Mengel and *Jean Tirole*

INSTITUTIONS ACROSS THE WORLD

Entrepreneurship in the United States and Germany: Attaining the Promise of Innovation
David B. Audretsch

BIG-DATA-BASED ECONOMIC INSIGHTS

How Well-Intentioned Measures Have Unintended Consequences for Election Turnout
Jean-Victor Alipour and *Valentin Lindlacher*

POLICY DEBATE OF THE HOUR

How to Ensure Defense Capabilities for Europe? Economic and Fiscal Consequences

Roel Beetsma, Marco Buti and *Francesco Nicoli, Lucas Hellemeier* and *Kaija Schilde, Niklas Helwig* and *Tuomas Iso-Markku, Nicholas Marsh, Bruno Oliveira Martins* and *Jocelyn Mawdsley, Mikkel Vedby Rasmussen, Lucie Béraud-Sudreau*

CESifo ifo INSTITUTE

EconPol is CESifo's economic policy platform. With key support from the ifo Institute, it seeks to leverage CESifo's globe-spanning network of 2 000 high-ranked economists – at least a dozen of whom have won the Nobel Prize – and ifo's decades-deep research expertise to provide well-founded advice to European policymakers. Drawing on the wide range of specializations of its members, EconPol's mission is to contribute to the crafting of effective economic policy in the face of the rapidly evolving challenges faced by the European economies and their global partners.

EconPol Forum
ISSN 2752-1176 (print version)
ISSN 2752-1184 (electronic version)

A bi-monthly journal on European economic issues
Publisher and distributor: CESifo GmbH, Poschingerstr. 5, 81679 Munich, Germany
Telephone +49 89 9224-0, telefax +49 89 9224-1409, email office@cesifo.de
Annual subscription rate: €50.00
Single subscription rate: €15.00
Shipping not included
Director EconPol Europe: Florian Dorn
Editor of this issue: Chang Woon Nam

EconPol Europe: www.econpol.eu

4/2024 econPOL FORUM

Russia's invasion of Ukraine has raised the question of whether the issue of external border security and defense needs to be more closely integrated within the European Union. Many proposals are under discussion aimed at assigning the EU with tasks that are currently performed at national level. Most EU members have increased their defense spending in the past year or plan to do so soon. However, whether an EU defense union is politically achievable remains controversial. It entails additional costs and – even more importantly – the member states would have to give up some of their sovereignty. The project is linked to the plan to build a robust and efficient defense industry. This is because European arms production has so far suffered from national fragmentation and chronic underfunding.

In this issue of EconPol Forum, our authors take a critical look at the needs of the common EU defense policy. They examine how it should be efficiently financed and coordinated at EU and national level. They also provide insights into the role of the European defense industry in a single market and its strengths and weaknesses in a global context. Furthermore, they shed light on the financing of R&D and technology through the EU's coordinated defense policy and its expected impact on growth, productivity, and competitiveness.

In "Economic Policy and Its Impact," the authors examine how the reform of EU innovation policy can help to escape the "middle technology trap," i.e., the traditional dominance of the same companies, mostly from the automotive sector. In "Institutions Around the World," they compare the strengthening of incremental innovative entrepreneurship in Germany versus the continuous promotion of radical and disruptive entrepreneurship in the US. In "Big-Data-Based Economic Insights," the authors show that well-intentioned measures such as polling place reassignments can have unintended consequences, such as a shift from in-person to postal voting and a temporary decline in overall voter turnout.

POLICY DEBATE OF THE HOUR

How to Ensure Defense Capabilities for Europe? Economic and Fiscal Consequences

Introduction to the Issue on How to Ensure Defense Capabilities for Europe? Economic and Fiscal Consequences 3
Chang Woon Nam

Defense as a European Public Good: Delivery and Financing 5
Roel Beetsma, Marco Buti and *Francesco Nicoli*

Markets in Defense of Europe: Providing Public Goods in European Defense 11
Lucas Hellemeier and *Kaija Schilde*

The EU's Different Modes of Defense Governance: More European Defense, But How? 15
Niklas Helwig and *Tuomas Iso-Markku*

European Defense Spending: Trade-Offs and Consequences of Non-Alignment 20
Nicholas Marsh, Bruno Oliveira Martins and *Jocelyn Mawdsley*

Rearmament with a Purpose 24
Mikkel Vedby Rasmussen

Europe's Other Arms Production Problem: "New Defense" 28
Lucie Béraud-Sudreau

ECONOMIC POLICY AND ITS IMPACT

Europe's Middle-Technology Trap 32
Anita Dietrich, Florian Dorn, Clemens Fuest, Daniel Gros, Giorgio Presidente, Philipp-Leo Mengel and *Jean Tirole*

INSTITUTIONS ACROSS THE WORLD

Entrepreneurship in the United States and Germany: Attaining the Promise of Innovation 40
David B. Audretsch

BIG-DATA-BASED ECONOMIC INSIGHTS

How Well-Intentioned Measures Have Unintended Consequences for Election Turnout 45
Jean-Victor Alipour and *Valentin Lindlacher*

Introduction to the Issue on

How to Ensure Defense Capabilities for Europe? Economic and Fiscal Consequences

Chang Woon Nam

Recent stunning geopolitical events have triggered a wave of initiatives and proposals aimed at entrusting the European Union with tasks that are currently performed at the national level. In particular, the Russian invasion of Ukraine has given new impetus to EU defense integration, while defense is traditionally seen as a public good that can ideally be provided by the government. In addition, it is argued that the EU should take on a greater role in this policy area, where it provides greater value than its member states can do individually, as economies of scale are important here and/or the results of policies in one country have a strong impact on others. Furthermore, Europe can no longer rely on the US for its defense. The US criticized NATO allies for free riding on US military power and pushed for them to reach the 2 percent of GDP target for their defense spending.

Most EU members increased their defense spending last year or plan to do so in the near future. However, the political feasibility of the EU defense union remains controversial, as it may entail both additional financial costs and a loss of sovereignty. How can higher defense capacity be financed? Will this be at the expense of social spending ("weapons" vs. "butter") or of public investment and a green transformation? Moreover, the design of defense integration is inherently multidimensional and differs in terms of scope and level, governance, and sources of funding, among others, while also taking into account aspects of fiscal federalism.

The European Union is in the process of building a robust and powerful industrial defense base. However, European defense production has so far suffered from national fragmentation and chronic underfunding. In parallel to the European Defence Industrial Strategy, which is looking for ways to address this shortfall, the European Defence Fund supports companies in the member states to develop competitive and collaborative defense projects that will produce innovative and interoperable defense technologies and equipment. In this context, the important question of the future role of the European armament industry arises: will it play a leading role in R&D and technological progress, and be a strong growth factor for Europe?

This issue of EconPol Forum contains six articles on securing European defense capabilities as a European public good. They not only take a critical look at the needs of the common EU defense policy, but also shed light on the ways and challenges of how it should be efficiently financed and coordinated at the EU and national level. They also provide valuable insights into the role of the European defense industry in a single market and its strengths and weaknesses in a global context, and examine the potential impact on EU growth, productivity, and competitiveness expected from the promotion of R&D and technology through the EU's coordinated defense policy.

Roel Beetsma, Marco Buti and *Francesco Nicoli* argue that defense is a European public good par excellence. Despite the reluctance of a number of EU governments to share defense sovereignty, there is growing support for a common EU defense policy. Building a stronger EU commitment to defense should be based on a combination of delivery and funding at the national and EU level. Moreover, this will inevitably be a gradual undertaking. Concrete steps should be taken through the implementation of new EU fiscal rules, the planning of a successor to Next Generation EU, and the preparation of the new Multiannual Financial Framework. An EU defense policy should operate within the NATO framework and the EU's defense policy decisions would then be subordinated to those of NATO.

In the view of *Lucas Hellemeier* and *Kaija Schilde*, the EU is not yet a buyer of public defense goods, but generally a provider of public goods in the form of the internal market, which also includes security goods. Moreover, the provision of public defense goods involves a functioning defense market, but the European defense equipment market remains insufficiently integrated. EU regulation can reduce uncertainty in the defense market and incentivize R&D spending, ensuring the competitiveness of companies in the future. The EU should extend its regulatory powers in the defense sector and indirectly provide Europe with a defense market as a public good.

While there is broad agreement on the overall goal of strengthening European defense, both in terms of capabilities and industry, the ways and means to achieve this remain controversial. According to *Niklas Helwig* and *Tuomas Iso-Markku*, the lack of a unified vision for European defense is partly due to the division of the EU defense effort into different modes of governance, reflecting the varied interests of member states that have driven EU defense cooperation over the years. In the short term, there are tensions among

the different modes of EU defense policy: (1) the "legislative mode" focusing on market efficiency; (2) the "coordination mode" concentrating on the capability requirements of the armed forces; and (3) the "financial mode," which is geared toward the development of the defense industry. To overcome internal divisions and ensure that plans to strengthen the European defense industry meet the capability requirements of the member states' armed forces, the European Commission, the European Council, and the European Defence Agency must work hand in hand.

Nicholas Marsh, Bruno Oliveira Martins and *Jocelyn Mawdsley* argue that European states are not aligning their military spending priorities. For this reason, a simple increase in national defense spending does not automatically lead to a higher joint industrial and operational capacity of the EU but increases the risk of wasting the growing military resources. They emphasize four main defense risks arising from this context: increased fragmentation of the European defense industry, competition between different European companies for components and raw materials, the mismatch between operational needs and industrial supply, and the challenges of defining a common strategic autonomy.

Regarding the strategic thinking of European states, both individually and collectively, to prioritize the development and maintenance of future military capabilities, *Mikkel Vedby Rasmussen* highlights, among other things, that (1) European countries are investing in heavier, platform-centric forces that rely on technology rather than personnel; (2) Europe needs to expand military research and development to avoid investing in existing technologies; and (3) European governments should focus on acquiring the capabilities needed to achieve strategic goals rather than focusing solely on the percentage of GDP spent on defense.

According to *Lucie Béraud-Sudreau*, the "New Defense" – a diversification of private players in the defense market and a transformation of companies and business practices in the defense industry – is challenging the traditional defense industry with innovative, agile, and software-oriented companies. However, the lack of a European equivalent to the US tech giants raises serious concerns about future military capabilities and strategic credibility, as evidenced by the fact that military support to Ukraine from the European tech sector remains limited compared to that of the US.

We hope you enjoy this Policy Debate of the Hour!

Roel Beetsma, Marco Buti and *Francesco Nicoli*[*]

Defense as a European Public Good: Delivery and Financing

Following the Cold War, a peace dividend was enjoyed in Europe by cutting down on defense spending and dismantling large parts of the military infrastructure. However, recent geopolitical events, in particular the Russian invasion of Ukraine and the uncertainty injected by Trump about US protection of EU NATO allies, have driven home the urgency of the EU building up its own defense protection.

Although defense policy is largely a national prerogative subject to obligations toward NATO, increasingly calls are being made on the EU to take more initiative in this area, for example through joint procurement of military equipment. Availability of such equipment also requires rebuilding the EU's defense industry. Moreover, the strength of the EU's defense shield is to a large extent determined by its weakest parts. Hence, it is equally important to coordinate among member states as to who does what in terms of rebuilding defense capacity in order to avoid unnecessary duplication and fill blind spots.

In this contribution, we look at EU defense policy as a European public good (EPG). As we will argue below, from the perspective of the EU population, that an EU-wide defense policy fulfills the standard properties of a public good, being non-excludable and non-rivalrous. Furthermore, EU-level defense can provide considerable economies of scale, in principle allowing higher utility for the same amount of resources invested by reducing duplication, introducing standardization, centralizing procurement, and so on. From a subsidiarity perspective, it therefore makes sense to shift parts of defense policy to the level of the EU, in the form of tighter policy coordination and central financing, because at the national level the benefits from investing more in defense are underestimated as the positive spillovers in terms of more safety elsewhere are not internalized.

There *seems* to be widespread skepticism among parts of populations and governments about transferring more tasks to the EU level, while countries may perceive different benefits from a collective defense policy. For example, countries located far from Russia may perceive less of a threat than those further to the east. Overall, we still seem a long way from a fully-fledged financing of defense through EU resources. Nevertheless, survey evidence suggests that popular support for various forms of European defense integration is higher than one might expect based on the political discourse.

[*] The views expressed in this paper are the authors' personal views and do not necessarily coincide with those of the institutions they are or were affiliated with.

KEY MESSAGES

- **Defense qualifies as a quintessential European public good. It fulfills the standard properties of a public good, being non-excludable and non-rivalrous, and can provide considerable economies of scale and large positive spillovers**
- **Despite the reluctance of a number of EU governments to share defense sovereignty, opinion polls suggest strong support for common EU policies, including defense policy. Maybe somewhat surprisingly, support for the latter is roughly equal for Europeans living in the eastern and western parts of the EU**
- **Building a stronger EU involvement in defense should be based on the combination of delivery and financing at the national and EU level. These define genuine European public goods, where financing and delivery take place at the EU level, and other combinations, which define European public goods "by aggregation"**
- **While building a common defense policy will inevitably be a gradual endeavor, concrete steps via the implementation of new EU fiscal rules, the planning of a successor to Next Generation EU, and the preparation of the new multiannual financial framework should take place as a matter of urgency**
- **An EU defense policy should operate within NATO, and EU defense policy decisions would then be subordinated to NATO decisions. As not all EU member states may be willing to join from the beginning, a practical way to go forward would be to form a coalition of the willing and start with those building blocks for which the added value is obvious (air and missile defense, integrated logistics, some procurement)**

Progress in terms of centralizing defense policy is likely to take place only gradually. In the shorter run, alternative forms of incentivizing collective defense spending may need to be deployed, such as modifications to the EU fiscal rules and the availability of temporary funds, while in the longer run the multiannual financial framework would incorporate collective defense spending. As most EU member states are NATO members, a crucial consideration is how NATO will develop over time and, in particular, how much protection member states can expect from NATO. That said, a good alignment of EU defense policy with NATO will be crucial.

IS DEFENSE A EUROPEAN PUBLIC GOOD?

In line with the literature on fiscal federalism, we define an EPG as a public good (1) whose provision at the European level fulfills the standard criteria for a public good *when the public of reference* is the citizens of the EU, and (2) whose provision at the European level is superior, in at least some metrics, to decentralized provision at the national level, either because it internalizes some externalities of national provision, or because it results in efficiency gains from economies of scale.

This definition is broadly consistent with that of Buti et al. (2023), who define seven criteria to identify an EPG under three broad categories: economic (non-rivalry and non-excludability, economies of scale and scope, and positive externalities), institutional (mutual interest and cross-border dimension), and political (mission-oriented and beyond subsidiarity).

Collignon (2014) and Claeys and Steinbach (2024) argue that goods should be provided at the EU level when preferences are similar and there is a strong efficiency case. They provide criteria for deciding at which level of government public goods are best provided. To this end, Claeys and Steinbach (2024) use a four-step procedure, first assessing externalities and how these could be internalized, followed by an assessment of the economies of scale, then an assessment of differences in preferences (with regard to level of provision and level of government), and finally a weighing of these elements.

We deviate from Claeys and Steinbach (2024) in that we acknowledge that the degree of heterogeneity in political preferences is key to understanding the political feasibility of EU-level provision of a good but is less relevant in assessing whether the good in question should or should not, *in principle*, be provided at the EU level.

Defense is in fact a prime example of an EPG. It can be reasonably argued that, for the EU population as a whole, EU-wide defense fulfills the standard properties of a public good, being non-excludable and non-rivalrous, in line with our definition above and Buti et al. (2023). Furthermore, EU-level defense can provide considerable economies of scale, in principle allowing higher utility for the same amount of resources invested by reducing duplication, introducing standardization, centralizing procurement, and so on, thus fulfilling our second criterion for defense to be an EPG. Finally, EU-level defense provides for some degree of internalization of externalities, which national defense provision fails to internalize when the community of reference is Europe: since parts of the benefits of defense spending are enjoyed abroad, as collective defense is more effective than each country defending itself on its own, defense spending will be under-provided at the national level because the utility gained by citizens abroad will not enter into the decisions of national governments.

Typically, arguments against the integration of European defense capabilities build around four possible criticisms. First, an integrated European defense would constitute a serious step toward the transformation of the EU into statehood, which some see as problematic and at any rate should not happen by “stealth” or as a policy afterthought. Second, opponents of integrated European defense often raise the issue of the lack of a legal basis to proceed. On the one hand, the EU treaties currently do not provide a fully-fledged legal basis for a proper EU defense; on the other hand, several national constitutions (including the German, Italian, Irish, and others) include clauses that limit what can be jointly achieved in terms of defense, and these constitutions might need changing to allow EU defense integration. In this regard, however, one should note that both Germany and Italy are part of NATO; even though NATO is short of having a common army, it includes many elements of joint forces and intensive cooperation, and it has been consistently shown to be compatible with national constitutions, suggesting that there is broad scope for expanding military integration in Europe within the existing national constitutional frameworks. Third, and relatedly, some fear a pointless replication of the capabilities already existing within NATO, or a paralysis should EU defense constitute

Roel Beetsma

is Dean of the Faculty of Economics and Business of the University of Amsterdam, Member of the European Fiscal Board, Member of the Supervisory Board of a.s.r. Vermogensbeheer, and former Member of the Supervisory Board of the Dutch Retail Pension fund.

Marco Buti

holds the Tommaso Padoa-Schioppa Chair in European Economic and Monetary Integration at the European University Institute, where he coordinates the EMU Lab. He was previously Director-General at the European Commission and Chief of Staff of Commissioner Gentiloni.

Francesco Nicoli

is Assistant Professor of Political Economy at the Polytechnic of Turin and Ghent University, as well as a Visiting Fellow at the Bruegel Institute and at the University of Amsterdam. His work focuses on the relationship between crises and European integration, as well as on the experimental analysis of public preferences.

a European pillar of NATO while including countries that are outside NATO (e.g., Ireland, Austria). In this regard, any EU defense that works as a European pillar of NATO would by necessity have to exclude these countries, while the potential relationship with non-EU NATO countries (such as UK, Norway, Iceland, Turkey) remains uncertain. Fourth, some fear that European defense would be dominated by the industrial interests of countries like France or Germany, which have pushed their domestic defense industries for reasons of strategic autonomy and not solely on the grounds of their capabilities; this would then limit the autonomy of other countries to procure their equipment elsewhere, for instance in the US.

DO EUROPEAN CITIZENS SUPPORT A COMMON DEFENSE POLICY?

While the case for factoring in explicitly political preferences in the definition of defense as an EPG is doubtful in our view, it is nonetheless important to see whether the public would support a stronger involvement of the EU in its own defense, as that influences the likelihood that defense policy or part if it can be shifted to the level of the EU (Olson 1965).

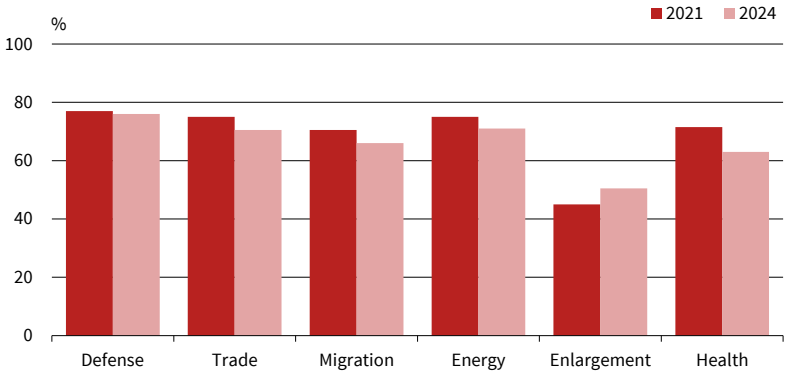
The common perception is that, because having own defense forces is strongly linked to national sovereignty, the political appetite for transferring more powers in this area to the EU level is low. However, political and popular appetite are not necessarily equal. Figures based on the Eurobarometer in 2021 and 2024 suggest strong support for common EU policies, including defense policy (see Figures 1 and 2). Maybe somewhat surprisingly, support for the latter is roughly equal for Europeans living in the eastern and western parts of the EU.

It is interesting to see what the support for EU defense policy among the citizens of the different EU countries is. This question is important, as transferring decision-making power likely requires the consent of all member states. Table 1 provides a breakdown by member state, showing strong support for common defense and security policy in each of the individual member states. Moreover, the support seems to be stable over time. This stable support has also been reported in Mérand and Angers (2014), while Graf (2020) shows that perceiving threats from the military activities of Russia in Ukraine increases support for creating a common European army.

Of course, a common defense policy can come in many potential formats, and popular support is likely to depend on its specific design. One could envision many different components and variants of a European defense policy. In Figure 3, we report the results of an experiment that allows us to understand how public support increases or decreases when some of these features are added or removed from a specific defense cooperation proposal. This figure reports the results of a conjoint experiment (Burgoon et al. 2023) assessing

Figure 1

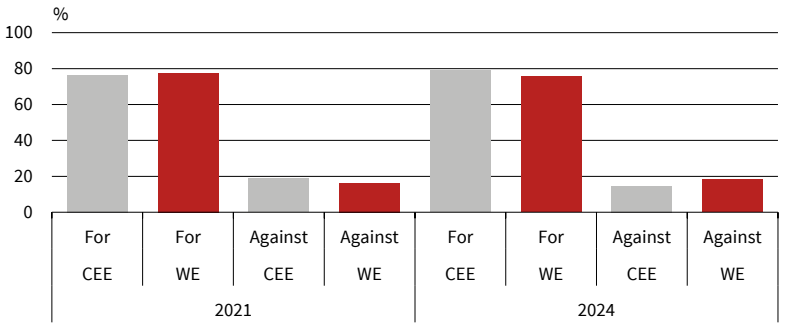
Share of Europeans in Favour of Having a Common Policy, by Type of Policy & Year



Source: Eurobarometer. © ifo Institute

Figure 2

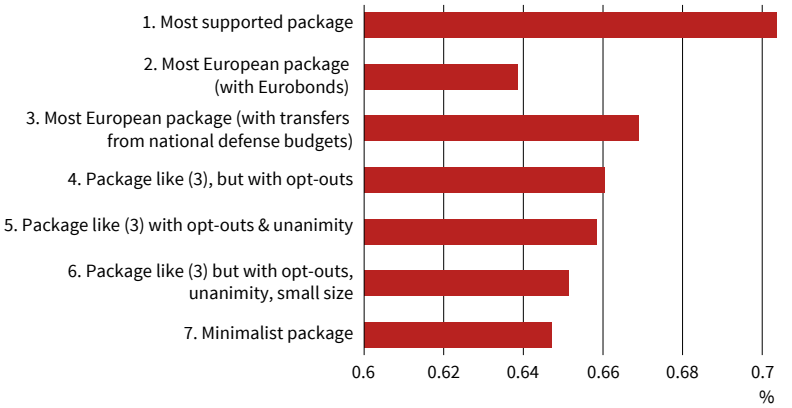
Share of Europeans in Favour of Having a Common Security Policy, by Year and Region



Note: CEE: Central Eastern Europe; WE: Western Europe.
Source: Eurobarometer. © ifo Institute

Figure 3

Levels of Support for Specific Defense Plans



Source: Burgoon et al. (2023). © ifo Institute

the level of support for or opposition to certain defense policy packages, excluding those respondents who are neutral about the package. The experiment was conducted on a representative sample of French, Dutch, German, Italian, and Spanish citizens in November/December 2022, hence during the Russian invasion of Ukraine.

To differentiate many different alternative versions of a defense cooperation agreement, such defense policy is "split" into a number of separate policy dimensions, each of which can be assessed separately

Table 1

Opinions on EU Defense and Security – Country Breakdown

	Spring 21 For	Spring 21 Against	Spring 24 For	Spring 24 Against
Eastern Border				
BG	70	16	83	14
PL	75	18	80	15
FI	73	27	82	10
HU	75	20	70	23
LT	90	10	87	6
RO	67	24	69	22
SK	80	15	77	15
SI	85	13	79	16
Eastern border average	76	19	79	15
Western Europe				
FR	74	16	71	20
BE	91	8	83	14
DK	71	24	78	16
DE	83	11	81	15
EL	79	19	79	17
ES	84	8	82	12
IT	75	21	78	17
AT	63	30	56	37
PT	73	18	65	22
LU	83	11	82	10
MT	73	13	68	27
NL	81	18	85	13
Western Europe average	77	16	76	18

Source: Authors' calculations based on Eurobarometer data.

in its effect on public opinion. The dimensions include a defense policy scope (proper EU armed forces or coordination of national armed forces), its financing (via increases in taxation, Eurobonds, or repurposing of national expenditure), the voting mechanism (unanimity, majority voting in the Council, majority voting in both Council and Parliament), whether opt-outs are allowed for some countries, whether there are joint procurement schemes, and whether it pertains to a small or large armed contingent.

The first row in Figure 3 reports the level of support for the package that is the most supported. This includes EU-level armed forces, of relatively large size, financed via transfers from national defense budgets. Governance is confederal (majority voting in the Council), there are no opt-outs, and there is joint procurement. The second row reports the level of support for the most European package. This is like Row 1, but with Eurobonds as a source of financing rather than transfers, and with federal (rather than confederal) governance (majority voting in both Council and Parliament). The third row is like Row 2 but foregoes Eurobonds for transfers from national defense budgets. The fourth row is like Row 3 but allows countries to opt out. The fifth row is like Row 4 but allows countries to express vetoes. The sixth row is like Row 5, but the joint armed forces are small in size. Finally, the last row includes small size, coordination of national armed forces, vetoes, opt-outs, no joint purchases, and financing via transfers from national budgets.

When it comes to the specific issue of procurement of ammunition and other armaments, Figure 3 suggests that there is generally substantial support for a European defense policy (around 65 percent and 70 percent of respondents express support), whether or not it involves the joint procurement of ammunition. In fact, nearly all packages with joint procurement of ammunition (Rows 1 to 6) exhibit slightly higher support than a minimalist package without (Row 7); and, even then, removing joint procurement reduces support even for the package included in Row 2.[1]

The bottom line is that there appears to be substantial popular support for lifting important parts of national defense policies to the EU level. However, decisions on centralizing defense policy are taken at the political level. If there is such a strong popular interest in centralizing defense policy, then why has this not materialized? There are number of potential, non-exhaustive reasons for this. First, politicians may be insufficiently aware of their populations' support for a

[1] In particular, the neutrals are counted as opposed, which is the most conservative position taken; it is likely that a fraction of them would support the policy packages if forced to make a choice between supporting and not supporting.

European defense policy. Second, more than their populations they may be aware of the practical and financial complications. Coordination efforts at the central level may be substantial and designing an appropriate financing framework is complicated. Third, politicians may be under pressure from their own defense industry, which fears the greater distance to EU-central decision-makers who would be more inclined to organize competition at the EU level. Nicoli and Beetsma (2024) provide leads for organizing procurement at the EU level that may help to overcome this obstacle.

Table 2

Classification of Defense as an EPG

		Delivery	
		National	EU
Financing	National	(A) Incentivizing national defense spending via the new EU fiscal rules	(B) Joint procurement to buy ammunition and defense capabilities
	EU	(C) Fund outside the multiannual financial framework to finance specific national defense projects	(D) EU budget to finance "genuine" defense EPGs (air defense, nuclear deterrent, space access)

Source: Authors' elaborations.

FINANCING AND DELIVERING ON EUROPEAN DEFENSE

Currently, both delivery and financing of defense take place overwhelmingly at the national level. However, the degree of protection against external threats depends not only on the strength of a country's own defense, but also on that of neighboring countries, implying that, from a purely national perspective, the benefits of investing in defense will be insufficiently internalized. Hence, the question is how these benefits can be better internalized. In this respect we distinguish between the financing and the delivery of defense goods – see Table 2. The different entries of this table can co-exist, while their relative importance may change as an increasing part of defense policy is undertaken at the EU level.

A way to increase the incentives to allocate more national resources to defense within an agreed EU framework is through the revised EU fiscal rulebook. This would correspond to quadrant (A) in Table 2. The new fiscal rules require countries to devise medium-term fiscal-structural plans for a period of four years, which may be extended to seven years conditional on reforms and investments fulfilling certain conditions. The new rulebook emphasizes debt sustainability and is centered around the net primary expenditure indicator. One possibility would be to exclude defense spending from the indicator, possibly on the ground of it being an investment in protection against external aggression. However, such a possibility was explicitly excluded during the negotiations on the reform of the fiscal rules.[2] A second possibility is that defense spending forms part of the package giving countries an extension of their adjustment period from four to seven years. The potential objections to the former solution are well-known: (i) governments may have an incentive to disguise other types of spending, in particular government consumption, as defense spending; and (ii) any elements taken out of the net primary expenditure measure will further obscure the integral budget trade-offs – assessments of debt sustainability would require all spending items to be taken into account. The second route is also a bit of a stretch. Investment in the defense industry as such would expand an economy's productive capacity, but it is not clear how this would improve the economy's growth potential or fiscal sustainability. However, while defense was not mentioned explicitly among the examples of eligible reforms, the regulation refers to delivery on EU priorities as a general criterion. Hence, stepping up investment in defense appears to be eligible for an extension of the plans.

Joint procurement would correspond to quadrant (B) in Table 2. As already discussed in the previous section, it would enjoy the strong support of EU citizens. The concept of jointly developing and purchasing military goods has a long history in joint weapons programs and associated framework contracts – both within Europe, such as the Eurofighter program, and transnationally, as in the case of the F-35. Joint procurement is one of the missions of the European Defence Agency (EDA). It has its legal basis in Article 39 of Directive 2024/24/UE (Caranta 2023). However, its impact and size remain limited – see Nicoli and Beetsma (2024) for a discussion.

The disadvantage with national financing of defense spending is that the beneficial externalities of spending on defense are unlikely to be fully internalized. Also, the composition is unlikely to be optimal – see Beetsma et al. (2020), for related criticism on Next Generation EU (NGEU).

Another option, corresponding to quadrant (C) in Table 2, is to finance defense spending through a separate fund, not formally part of the EU budget. The design of NGEU, in particular the conditionality attached to the design of the plans and the disbursement of the money, may provide leads for the design of the fund. Elsewhere, in a series of contributions (Bakker and Beetsma 2023; Bakker et al. 2024a and 2024b), we have proposed a collective fund (the "Fund") financed by EU member states that finances public investments with positive cross-border spillovers conditional on countries adhering to the fiscal rulebook. Each country has its own envelope in the Fund, and if it is unable to fulfill these conditions, then its compartment in the Fund will be distributed among the other countries' envelopes. The legal foundation for the Fund would be provided by Article 122 of the TFEU, whereby the Council, upon a proposal by the Commission, "may decide, in a spirit of solidarity between member states, upon the measures appropriate to the economic situation,

[2] The new regulation on excessive deficits mentions the increase in defense as a "relevant factor" when assessing an excess of the deficit over the 3 percent of GDP reference value.

in particular if severe difficulties arise in the supply of certain products, notably in the area of energy." The conditionality would be derived from the Conditionality Regulation introduced January 2021 in the context of NGEU. Its objective is to protect the financial interests of the European Union and, in doing so, it may lead to the suspension of payments to member states that do not respect the principles of the rule of law. In the context of the Fund, the conditionality regime would be redefined to link access to the Fund to fiscal discipline at home based on the idea that EU resources, as an expression of solidarity, are to be used in compliance with the obligations under the EU Treaty, including the new economic governance framework. Conditionality would then cover respect of fiscal targets, and reform and investment commitments in the case of plans with an extended horizon. The logic of the Fund could in principle be extended to a fund for collective defense spending. However, it deviates in two ways from the investment projects. First, the defense spending financed by the envisaged new fund should be complementary to existing military facilities. Second, it may be in the interest of the entire EU not to be too strict on conditionality if it is desirable that each country is able to contribute to defense.

The final possibility, corresponding to quadrant (D) in Table 2, is to include (a substantial amount of) defense spending in the EU's multiannual financial framework (MFF). This would be politically the most difficult to realize, but also the most durable one if it succeeds. It would either mean reducing other allocations in the MFF or raising the EU budget (or both). From a subsidiarity perspective, the case for including defense spending in the MFF should be compelling. It would facilitate the provision of genuine EPGs that benefit the entire EU, but that also require large investments with long lead times, and regular maintenance and upgrading. Examples are a common air defense, common nuclear deterrent, and military applications of space technology. Centralization of both delivery and funding facilitates an EU industrial policy for defense, with sufficient distance between EU procuring bodies at the EU level and national producers of defense systems (Nicoli and Beetsma 2024), allowing for more competition when compared to procurement at the national level and allowing for public-private collaborations that involve the more suitable private partners from the entire EU.

POLICY CONCLUSIONS

This contribution has argued on several grounds (externalities, efficiency, effectiveness, etc.) that a defense policy has the natural features of an EPG and, as such, it should be organized at the EU level. However, a national defense policy is often seen as a core element of national sovereignty. Treating defense policy as an EPG does not mean transferring all responsibilities to the EU. We have put forward a conceptual framework that entails different combinations of EU delivery and financing, going from a stepping up of national coordination efforts, notably using the opportunities offered by the new EU fiscal rules, all the way to the longer-run goal of direct involvement of the EU in defense policy by enshrining it in the multiannual financial framework.

While the arguments for considering defense as an EPG are, in our view, compelling, political resistance to elevating defense to the EU level is likely to be stiff. A practical way to move forward would be to form a coalition of willing EU member states to start a common defense policy and to gradually build up the common defense policy starting with those building blocks for which the added value is obvious (air and missile defense, integrated logistics, some procurement).

As most EU member states are also members of NATO, an EU defense policy should operate within NATO. A possibility to go about this is to view the set of those EU countries that were to participate in an EU-level defense policy as a single NATO member (like, for example, the UK). Non-EU NATO countries could become observers and, for example, participate in joint procurement with the EU bloc.

REFERENCES

Bakker, A. and R. Beetsma (2023), "EU-wide Investment Conditional on Adherence to Fiscal-structural Plans", *VoxEU*, 3 November, https://cepr.org/voxeu/columns/eu-wide-investment-conditional-adherence-fiscal-structural-plans.

Bakker, A., R. Beetsma and M. Buti (2024a), "The Case for a European Public-Goods Fund", *Project Syndicate*, 4 March, https://www.project-syndicate.org/commentary/public-goods-fund-could-finance-green-transition-and-ensure-fiscal-responsibility-by-age-bakker-et-al-2024-03.

Bakker, A., R. Beetsma and M. Buti (2024b), "Investing in European Public Goods While Maintaining Fiscal Discipline at Home", *Intereconomics* 59, 98–103.

Beetsma, R., L. Codogno and P. van den Noord (2020), "Next Generation EU: Europe Needs pan-European Investment", *VoxEU*, 9 November, https://voxeu.org/content/next-generation-eu-europe-needs-pan-european-investment.

Burgoon, B., D. van der Duin and F. Nicoli (2023), "What Would Europeans Want a European Defence Union to Look Like?", *Bruegel Working Paper* 09/2023.

Buti, M., A. Coloccia and M. Messori (2023), "European Public Goods, *VoxEU*, 9 June, https://cepr.org/voxeu/columns/european-public-goods.

Caranta, R. (2023), "The EU's Role in Ammunition Procurement", *European Papers* 8(3), 1047–1056, https://www.europeanpapers.eu/en/europeanforum/eu-role-ammunition-procurement.

Claeys, G. and A. Steinbach (2024), "A Conceptual Framework for the Identification and Governance of European Public Goods", *Bruegel Working Paper* 14/2024.

Graf, T. A. (2020), "Unity in the Face of Threat? Exploring the Empirical Relationship between Strategic Threat Perceptions and Public Support for a Common European Army in Germany", *European Security* 29, 55–73.

Mérand, F. and K. Angers (2014), "Military Integration in Europe", in P. Genschel and M. Jachtenfuchs, eds., *Beyond the Regulatory Polity? The European Integration of Core State Powers*, Oxford University Press, Oxford, 46–65.

Nicoli, F. and R. Beetsma (2024), "Joint Public Procurement as a Tool for European Industrial Policy at Times of Crisis", *Bruegel Policy Brief*, Forthcoming.

Olson, M. (1965), *The Logic of Collective Action. Public Goods and the Theory of Groups*, Harvard University Press, Cambridge MA.

Lucas Hellemeier and *Kaija Schilde*

Markets in Defense of Europe: Providing Public Goods in European Defense

Defense has often been defined as the purest of public goods (Samuelson and Temin 1976). Usually considered a core state power, governments provide non-excludable defense goods for a specified territory (Tilly 1985). However, 21st-century nation-states are not exclusive goods providers: they rely on public as well as non-public entities to provide defense goods. Long gone are the days of government arsenals and war mobilization based on taxation and extraction from domestic populations. This also applies to public defense goods in the European Union (EU) and European states. European states have different organizational structures of their defense industrial ecosystems, but they depend upon defense contractors – either domestic, foreign, or a mix of both – to supply the equipment of choice. A modern state's role as a public goods provider therefore goes beyond the more traditional idea of taxation to generate defense goods, via resource extraction and manufacturing, and to deploy armed forces; instead, its role in generating defense public goods also encompasses the organization and structuring of private defense markets. A recent example of this is the US Second Offset Strategy, where US officials have attempted to harness the commercial economy's innovation capacity in order to generate better defense equipment as a public good.

The EU, as a supranational institution *sui generis*, does not have armed forces nor does it procure defense equipment for itself or its member states. However, it is a public goods provider as a market regulator. Historically, state-building has often been motivated by providing security as well as markets for specified territories and populations (Kelemen and McNamara 2022). The primary EU public good for member states is the single market. Given its market orientation, and its function as a public goods provider, the EU is well-positioned to provide a functioning defense market. Since the February 2022 Russian invasion of Ukraine, the question of a functioning European defense market that more efficiently provides states with the goods and services necessary for survival has taken center stage. The EU is not a classic state in that it is not yet a defense public goods *buyer*, but an emergent defense public goods *provider*, particularly as a result of its market and regulatory powers.

In this essay, we examine the economic logic of EU defense public goods. We outline the various "costs of non-Europe in defense" and challenges facing European defense cooperation. We then turn toward policy recommendations for increasing EU defense goods provision to prevent further market distortion and toward European strategic autonomy. We recommend the EU increase its regulatory authority over defense markets to reduce market uncertainty and incentivize corporate innovation. We also anticipate the need for industrial policy to fill in strategic needs and correct for market failures. As industrial policy will inevitably produce domestic (and European) winners and losers, EU strategy should account for and anticipate such externalities.

KEY MESSAGES

- **The EU is not yet a defense public goods *buyer*, but it is generally a public goods *provider* in the form of the single market, which includes security goods**
- **Public defense goods provision includes a functioning defense market, but the European market for defense equipment remains insufficiently integrated**
- **EU regulation can reduce defense market uncertainty and incentivize R&D spending, ensuring future company competitiveness**
- **The EU should expand its regulatory authority in defense and indirectly provide Europe with a defense market as a public good**
- **Eventually, the EU should work toward consolidating demand and supply, which would further reduce inefficiencies and meet the challenge of secular rises in costs for defense**

Lucas Hellemeier

is a PhD Candidate at Freie Universität Berlin's John F. Kennedy Institute. He researches European defense industrial policies in a transatlantic context.

Kaija Schilde

is an Associate Professor, Associate Dean of Studies, and Jean Monnet Chair of European Security and Defense at Boston University's Pardee School of Global Studies.

THE COSTS OF NON-EUROPE IN DEFENSE PUBLIC GOODS

European states have historically excluded formal defense market cooperation from EU single market authority, carving out national exceptions for defense markets from EU competition. There have always been countervailing concerns, however, that national sovereignty creates market distortions that limit optimal defense goods. These concerns were present in the negotiations leading up to the 1952 European Defence Community, the 1986 Single European Act, and the 1992 Maastricht Treaty. An unpublished 1992 report for the European Commission, titled "The Cost of Non-Europe in Defence," argued that member-state market sovereignty would distort defense markets, resulting in replication, redundancies, and suboptimality (Hartley and Cox 1992).

Defense industrial consolidation is therefore a long-standing theme in Europe. The post-Cold War consensus has prescribed market restructuring in the face of decreasing or stagnating defense budgets and secular increases in unit costs. Through various market-oriented measures, the EU Commission had tried to defuse the market-distorting effects of Article 346 of the Treaty on the Functioning of the European Union (TFEU), which allows governments to circumvent European competition for public tenders on national security matters. The idea was to increase competition and the process of natural selection would ideally create supply-side consolidation in the form of European defense champions. National governments have, however, been reluctant to effectively implement measures such as the 2009 Defence Directive, and numerous examples point to the persistent market-distorting effects of Article 346.

As a result, Europe finds itself entangled in an oversupply of weapons systems. The costs of weapons overcapacity have often been increasingly offset by exports outside of Europe, in tension with other policy objectives such as global human rights promotion. The combined EU has a sufficient volume of weapons production; however, they are just not the right weapons to meet the strategic demand from EU member states and NATO. The inability to effectively address the post-2022 surge in national demand demonstrates that the issue at hand is not an overabundance of production capacity, but rather an excess of suppliers grappling with limited production capacity and artisanal manufacturing instead of industrial production.

The solution to this status quo overproduction of duplicated, redundant weapons systems across Europe has been circulating since at least 1992: the EU is the ideal political and market entity to incentivize multinational weapons platforms. A consolidated European demand side would streamline defense equipment toward fewer but more optimal weapons systems. It would also create winners and – more importantly – losers among defense industrial interests. This relative-gains dilemma (Simón 2017) arises because Europe's defense industries find themselves in competition with one another as well as with non-European suppliers. Defense industrial capacity is unevenly distributed across the EU and Europe, particularly if one includes the UK and Norway. EU countries with Europe's largest defense companies face the dilemma of retaining their defense industrial capacity while offering industrial participation to attract more customers. EU countries with smaller defense industries, on the other hand, fear subordination in an internally seamless and externally protectionist European defense market. By keeping the market open to non-European suppliers, smaller defense industrial players retain the chance to carve out niches as specialized producers in collaboration with global partners (Calcara and Simón 2021).

Movement toward a European common market in defense will have to reckon with these relative and absolute competition winner and loser dynamics with policies designed to anticipate these externalities. States will be intolerant of the extinction risk their defense industries face as losers from EU market consolidation. First, states pursue inefficient autarky strategies in their defense markets to ensure future security of supply in the case of interstate warfare or international supply chain disruption. Second, states without functioning defense industries are less likely to be able to sustain political support for defense spending requirements within alliances such as NATO, due to a lack of domestic benefits and interests if they incur the pure costs of only importing weapons from abroad (Guiberteau et al. 2024). For security and political reasons, member states have to maintain their domestic defense industrial bases, even as the EU moves toward the provision of European defense public goods.

The European Commission is not new to this game, however. It has worked around EU treaty barriers to partially govern European public security and dual use goods for decades, using their market powers in adjacent sectors such as internal security and dual-use defense equipment. The inception of the European Defence Agency (EDA) in 2004 established a dedicated institution capable of articulating collective capability requirements and catalyzing collaborative efforts in the development and procurement of next-generation defense equipment exemplified by projects like the Eurodrone. Building on this foundation, the EDA has assumed a central role since 2017 in orchestrating initiatives such as the Coordinated Annual Review on Defence (CARD) and the European Capability Development Plan (CDP). These strategic frameworks serve as platforms for member states to evaluate opportunities for both military and industrial cooperation, effectively functioning as institutional or market mechanisms that mitigate transaction costs. By exercising oversight over third-party engagement in EU defense initiatives, the Commission has bol-

stered its authority in delineating the contours of the European defense market.

POLICY RECOMMENDATIONS

Public Goods Provision in the Form of Regulation

As discussed above, the EU is currently a significant regulator of security and dual-use markets, which has shaped defense markets around the margins. Moving forward, it should leverage its regulatory prowess to foster a conducive regulatory environment for the European Defence Technological and Industrial Base (EDTIB) to flourish. This should partially mitigate some of the supply bottlenecks we have witnessed since February 2022.

Russia's war in Ukraine underscores the importance of mass production for wars with great power involvement. It has also revealed how unprepared Western defense industries were in supplying basic equipment such as ammunition in large quantities over a longer time span. Besides hesitant financial commitments for long-term production, ineffective standardization has impeded the production and procurement in large quantities of such products. For example, NATO's "standard" 155mm artillery shell features 14 national deviations, thus impeding bulk purchases. Ammunition and other relatively simple products can and should be considered defense commodities that compete on price rather than product specification (Caverley 2023). The status quo insistence on national deviations prevents desperately needed commodification of simple defense products. Effective standardization would not only ensure interchangeability and interoperability, but could also transform ammunition into a true defense commodity, enabling bulk purchases and efficiency gains.

The EU Commission published the first European Defence Industrial Strategy (EDIS) in March 2024. EDIS proposes the Structure for European Armament Programme (SEAP) as an instrument to foster joint procurement and maintenance. SEAP features financial incentives such as VAT exemption for jointly procured and operated defense equipment. It could be harnessed to promote standardization to incentivize only standardized military equipment as exempt from VAT. Market-distorting deviations that protect individual companies at the expense of a public good would be subject to financial penalties. Just as the EU enforces a common standard for charging mobile devices, it should enforce standards for simple defense products, creating a functioning defense commodities market.

Efficiency gains for simple defense products would free up resources for national and EU R&D investments and thus safeguard the industry's long-term viability or competitiveness. Existing EU regulation has encouraged European defense companies to increase self-funded R&D investments. As a "modern regulatory state," the EU can provide defense as a public good without having direct political authority in this field (Schilde 2023). The EU has a track record of setting regulatory standards that generate consumer benefits and secure markets for producers at the same time.

An optimized regulatory environment includes industry access to capital. EDIS underscored the importance of aligning EU regulations on sustainable finance with the goal of fostering private investment in the defense sector. Criticism directed at the European Investment Bank's (EIB) stringent lending policies highlights the pressing need for reform (Butler 2024). This acknowledgment reflects the challenges faced by companies in accessing vital investment capital. Addressing these issues requires concerted regulatory efforts aimed at facilitating a more conducive environment for investment.

Public Goods Provision in the Form of R&D Support

Industry R&D and private capital are not enough to generate optimal European defense goods. A more robust industrial policy in the form of public R&D investments is also necessary because the enduring challenge of defense inflation (i. e., real unit cost increases of 5–10 percent per annum) persists for high-end defense equipment such as the next generation of fighter aircraft systems. The market for such equipment, often termed "tournament good" because of its highly specified character in contrast to defense commodities, works differently and requires more active state intervention to correct for market failures. If let alone, the markets for tournament goods trend toward high levels of concentration or monopolies, as illustrated by the increasing number of European countries that have chosen to procure the F-35 fighter aircraft instead of European alternatives. Life cycles are also longer than those of commercial goods, with more possibilities of market failure without government intervention and investment and less risk tolerance on the part of private actors to delay profit.

Launched by the Juncker Commission in 2016, the European Defence Action Plan paved the way for the European Defence Fund (EDF) as an R&D funding tool financed by the EU budget. The next Multiannual Financial Framework (MFF) for the 2028–2034 period should feature an increase in the EDF's financial volume. This necessitates debt-financed expenditures – a highly controversial topic within the EU. But the economic recovery package established during the pandemic (Next Gen EU) proves that breaking from established fiscal rules and conventions is possible in times of severe crisis, and allows for European public goods investments that reinforce rather than undermine national investments. A EUR 100 billion defense fund backed by Eurobonds, as proposed by Estonian prime minister Kaja Kallas, might gain traction after

the European Parliament elections and the outcome of the US elections in November 2024.

Public Goods Provision in the Form of Consolidation Support

Long-term instruments such as the EDF have the potential to set European equipment standards, especially if they are coupled with instruments to generate joint military capabilities such as the Permanent Structured Cooperation (PeSCo). On the other hand, the EDF prescribes geographical dispersion, which may run counter to the long-term goal of consolidating supply. At some point when it comes to actual product development, the EU and its member states will need to make decisions on European champions.

The EU needs to consolidate its public goods provision and also be a public goods buyer in order to control prices. The uncoordinated manner in which Europe has been re-arming only exacerbates pre-2022 problems. Larger defense budgets gloss over these structural problems only temporarily. Without demand consolidation, defense inflation will return with a vengeance due to market distortion. The situation is analogous to the consolidation of the US defense market: prior to key reforms like the Packard Commission and the Goldwater-Nichols Act, inefficiencies and cost issues plagued the acquisition policies of individual US services. After procurement reforms consolidated demand, the US government became a more effective provider of public goods in the defense sector.

Unfortunately, European procurement patterns since February 2022 point toward further fragmentation of the European defense industrial field. The vast majority of procurement contracts have been awarded to non-European suppliers (Maulny 2023). In addition, many of these contracts feature license production agreements through which the procuring countries seek to bolster their domestic defense industry. They aim to climb the metaphorical ladder of production and transform their industries into suppliers. For governments as well as industry, licenses to produce non-European defense equipment may seem like a more attractive tool than European cooperation.

Data on international arms transfers as well as on European defense companies reveals existing export dependence on non-European demand for Europe's defense industrial heavyweights (Wezeman et al. 2024). If Europeans trade less defense equipment among themselves and increase domestic production capacity, they will become even more export dependent once domestic demand dwindles. Resource-rich countries such as the Gulf states have become "buyers of last resort" for European arms manufacturers. If non-European demand is necessary to support European defense industrial capacity, Europe remains far from providing security and defense as a public good.

Outlook

Economic exigencies underscore the imperative for an expanded EU footprint in European defense affairs. While member states may attempt to mitigate the costs of non-Europe in defense through temporary boosts in spending, the persistent specter of defense inflation looms large, posing an obstacle to the sustainable provision of defense as a public good at the national level. A more substantial EU involvement in this domain hinges upon the willingness of member states to relinquish defense market protectionism. By further positioning the EU as a public goods provider of defense markets, policymakers can overcome the "costs of non-Europe" in defense that currently limit European strategic autonomy and produce unnecessary price and inefficiency pressures facing European member states.

REFERENCES

Butler, E. (2024), "EU States Urge European Investment Bank to Rethink Defence Policy", *Euronews*, 18 March, https://www.euronews.com/business/2024/03/18/eu-states-urge-european-investment-bank-to-rethink-defence-policy.

Calcara, A. and L. Simón (2021), "Market Size and the Political Economy of European Defense", *Security Studies* 30, 860–892.

Caverley, J. D. (2023), "Horses, Nails, and Messages: Three Defense Industries of the Ukraine War", *Contemporary Security Policy* 44, 606–623.

Guiberteau, J., L. Hellemeier and K. Schilde (2024), "Defense Industrial Policy in a Changing International Order: Rethinking Transatlantic Burden-Sharing", *Defence Studies* 24, 166–173.

Hartley, K. and A. Cox (1992), *The Cost of Non-Europe in Defence Procurement: Study Carried out for the Commission of the European Communities*, Brussels.

Kelemen, R. D. and K. R. McNamara (2022), "State-Building and the European Union: Markets, War, and Europe's Uneven Political Development", *Comparative Political Studies* 55, 963–991.

Maulny, J. P. (2023), "The Impact of the War in Ukraine on the European Defence Market", *Policy Paper*, Institut de Relations Internationales et Stratégiques, https://www.iris-france.org/wp-content/uploads/2023/09/19_ProgEuropeIndusDef_JPMaulny.pdf.

Samuelson, P. A. and P. Temin (1976), *Economics*, 10th Ed. McGraw-Hill, New York.

Schilde, K. (2023), "Weaponising Europe? Rule-Makers and Rule-Takers in the EU Regulatory Security State", *Journal of European Public Policy* 30, 1255–1280.

Simón, L. (2017), "Neorealism, Security Cooperation, and Europe's Relative Gains Dilemma", *Security Studies* 26, 185–212.

Tilly, C. (1985), "War Making and State Making as Organized Crime", in P. B. Evans, D. Rueschemeyer and T. Skocpol, eds., *Bringing the State Back In*, Cambridge University Press, Cambridge, 169–191.

Wezeman, P. D., K. Djokic, M. George, Z. Hussain and S. T. Wezeman (2024), *Trends in International Arms Transfers*, 2023, Stockholm International Peace Research Institute, https://www.sipri.org/publications/2024/sipri-fact-sheets/trends-international-arms-transfers-2023.

Niklas Helwig and *Tuomas Iso-Markku*

The EU's Different Modes of Defense Governance: More European Defense, But How?

Russia's full-scale invasion of Ukraine has exposed the unpreparedness of most European states for a major military conflict. While almost all EU member states have committed themselves to supporting Ukraine's fight against the invader, both their stockpiles and their defense industrial capacity have proven insufficient to meet the needs of the battlefield, let alone to bolster their own deterrence and defense (Aries et al. 2023).

After decades of uneven defense spending and a perennial lack of cooperation, the European defense landscape is characterized by fragmentation, gaps, redundancies, and inefficiencies. Europe's defense worries are compounded by increasing international strategic competition, with global powers seeking control of key technologies, raw materials, supply chains, and markets.

Under these circumstances, the EU's defense dimension is facing growing expectations. Although NATO remains Europe's primary defense organization, the European Union possesses both regulatory and financial tools as well as political cooperation frameworks to enhance European military capabilities, and to ensure a competitive and technologically advanced European defense technological and industrial base (EDTIB) (Iso-Markku 2024).

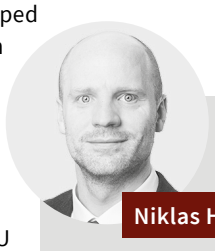
In March 2024, the European Commission published its vision to create a stronger European defense. The European Defence Industrial Strategy (EDIS) and the accompanying proposal for a European Defence Industrial Programme (EDIP) seek to incentivize EU member states to invest more in their defense, to prioritize the procurement and development of European defense capabilities, and to approach defense matters in a more coordinated and collaborative manner. These measures are hoped to support the development of the European defense industry.

However, while there is broad agreement on the overall objective of strengthening European defense in terms of both capabilities and industry, the means and ways to get there remain contested. The EU has so far not pursued a unitary vision of European defense cooperation. Instead, the Union's defense efforts can be divided into three separate but partly overlapping modes of governance: (1) a "legislative mode" focused on market liberalization, (2) a "coordination mode" concentrating on the collaborative development of military capabilities, and (3) a "financial mode" geared toward the strengthening of the European defense industry.

The different modes of defense governance reflect the varying rationales that have driven EU defense cooperation over the years as well as the diverging interests and positions of the member states. They also imply different interpretations of the role of the EU in defense matters and, by extension, of

KEY MESSAGES

- **While there is broad agreement on the overall objective of strengthening European defense in terms of both capabilities and industry, the means and ways to get there remain contested**
- **The lack of a unitary vision on European defense is partly due to the division of EU defense efforts into different modes of governance. They reflect the varying rationales and diverging member states' interests that have shaped EU defense cooperation over the years**
- **In the short run, there are tensions between the different modes of EU defense governance. While the "legislative mode" aims for market efficiency, the "coordination mode" prioritizes joint capability development projects. The "financial mode," by contrast, is geared toward the development of defense industry**
- **To overcome existing divisions, the Commission, the Council, and the European Defence Agency must work hand in hand to ensure that current plans for bolstering the European defense industry adhere to the capability needs of the member states' militaries**



Niklas Helwig

is a Leading Researcher at the Finnish Institute of International Affairs. He is also an Associate Professor in International Relations at Tampere University. His research focuses on EU foreign and security policy, German foreign and security policy, as well as EU–US relations.

Tuomas Iso-Markku

is a Senior Research Fellow at the Finnish Institute of International Affairs. His research focuses on the EU's role in security and defense policy, European security and defense cooperation, as well as EU–NATO relations.

the relationship between the EU and NATO. The three modes of defense governance can be distinguished by the processes and logics by which they try to advance European defense, as well as by the actors involved and their competences.

In the following, we will present the three modes of defense governance in more detail and discuss the interplay between them. In addition, we analyze to what extent the current EU institutional cycle until 2029 presents an opportunity to better align the different modes of defense governance and to decisively advance EU defense cooperation.

THE LEGISLATIVE MODE OF EU DEFENSE GOVERNANCE

The legislative mode comprises the EU's and, above all, the European Commission's attempts to apply its competences and experience in opening and regulating markets to the defense sector. The idea to boost intra-European competition in the armament sector and thereby increase the efficiency of the defense industry received greater attention in the Commission over the 2000s. In 2009, the EU adopted a "defense package" of two directives that sought to advance the integration of the defense market by regulating the public procurement and intra-European trade of defense equipment (Marrone and Nones 2020).

However, using the methods that have worked in civilian trade in the defense sector has proven difficult. With national governments acting as the main buyers and sellers of defense equipment, incentives for cross-border trade have remained low. In essence, the European defense market still consists of separate national defense markets. All member states with significant industrial capacity of their own tend to favor national defense companies in the development and procurement of military capabilities. Indeed, the 2009 defense directives failed to reach the intended effect (Marrone and Nones 2020), as EU member states continue to make systematic use of the exemptions under Article 346 TFEU. These allow them to forgo public procurement rules to protect their essential security interests.

Despite its limited success, the legislative mode of defense governance aligns well with the EU's core competences and strengths, which are often seen to reside primarily in economic affairs and trade. Importantly, the legislative mode does not touch upon NATO's core tasks or challenge its primacy in organizing European defense, thereby bearing little conflict potential in EU–NATO relations. The legislative mode of defense governance remains attractive especially to some of the EU's smaller and mid-sized member states. They see an open and integrated market as providing opportunities for their small but often highly specialized defense companies. However, during recent years, the legislative mode has mostly been stuck.

THE COORDINATION MODE OF EU DEFENSE GOVERNANCE

The coordination mode of defense governance focuses on collaborative development of military capabilities. Beginning in the early 2000s, increased cooperation was needed to provide the necessary military (and civilian) capabilities for the EU's crisis management efforts. The European Defence Agency (EDA) was established in 2004 exactly to this end, working to promote coordination and cooperation between the member states in capability development.

Unlike the legislative mode, the coordination mode is not characterized by top-down regulation or market logic. Instead, the EU's activities here fall largely under the inter-governmentally organized Common Security and Defence Policy (CSDP). In a bottom-up spirit, the requirements of national defense planners are the starting point for trans-European cooperation in the coordination mode. These are hoped to give rise to joint projects that would be out of reach for individual member states – and that could, ideally, prove more cost-effective.

The coordination mode gained traction in the 2010s. The financial and economic crisis resulted in cuts to national defense budgets, which pushed EU member states to look at joint projects as a central path to generate efficiency and savings. A string of crises added to the pressure, as the instability in the EU's southern neighborhood, Russia's first invasion of Ukraine in 2014, Brexit, and the disruptive term of Donald Trump as US president highlighted the need to increase Europe's – and the EU's – credibility as a military actor.

Starting in 2017, the EU launched the Coordinated Annual Review on Defence (CARD) and the Permanent Structured Cooperation (PESCO). The former seeks to harmonize the member states' national defense planning processes to identify potential areas for cooperation, whereas the latter is a policy framework for defense cooperation, consisting of both joint commitments and concrete cooperation projects. While PESCO led to a flurry of cross-border capability development projects, these have mostly remained at the low end of the military spectrum and failed to meet the member states' most urgent needs. Moreover, PESCO has suffered from the member states' low level of compliance with the joint commitments (Biscop 2020).

A key challenge in the coordination mode is also the relationship between the EU and NATO. For almost all EU member states, NATO remains the primary setting for dealing with defense matters, and NATO's defense planning process is the only collective defense planning process that the member states pay close attention to. Consequently, the EU's capability development goals and projects should be closely aligned with those of NATO to succeed. However, for various reasons coordination and cooperation between the EU and NATO remains limited (Iso-Markku 2024).

A further problem of the coordination mode is the lack of economic incentives for cooperation, as most money for defense capability development remains at the national level and cannot be easily translated into EU funding. This is where the financial mode of EU defense governance becomes relevant.

THE FINANCIAL MODE OF EU DEFENSE GOVERNANCE

The financial mode of defense governance started to develop in the 2010s and decisively took off with the European Commission's proposal to set up the European Defence Fund (EDF), which was tabled in 2017. The creation of the EDF as well as many of the steps taken by the EU after the start of Russia's war on Ukraine are signs of an active industrial policy that takes advantage of the Union's financial instruments and resources to further the European defense technological and industrial base (Fiott 2024a).

For a long time, the financial mode of EU defense governance was held back by Article 41(2) TEU, which prevents "expenditure arising from operations having military or defense implications" from being funded from the EU budget. However, to what extent non-operational expenditure, for example for infrastructure for the EU military headquarters, could be covered has been subject to repeated discussions. With the EDF and its precursors, the Commission found a way to overcome treaty-based obstacles by justifying its actions with the need to support the competitiveness of EU industry as well as R&D (Rodrigues 2023).

The financial mode gained further prominence following the start of Russia's full-scale invasion of Ukraine in February 2022. In July 2022 the Commission proposed the European Defence Industry Reinforcement through common Procurement Act (EDIRPA) with a budget of EUR 310 million. EDIRPA seeks to facilitate the joint procurement of urgently needed defense equipment and thereby help the European defense industry adapt its production capacity to the grown demand. EDIRPA was followed by the Act in Support of Ammunition Production (ASAP) with a budget of EUR 500 million for investments in production capacity for various kinds of ammunition needed by the Ukrainian defense forces.

The European Defence Industry Programme (EDIP) proposed by the Commission is meant to consolidate the processes initiated by EDIRPA and ASAP. It would add another EUR 1.5 billion to use for common procurement as well as for defense industrial initiatives. These initiatives suggest an increased freedom to use EU funds for defense expenditures.

At the same time, doubts remain as to whether the amount of EU-level funding is enough to incentivize joint capability development or procurement, as the size of the EU instruments represents only a fraction of the member states' national defense budgets. Another potentially problematic issue with the financial mode concerns the prominent role of the European Commission, which not every member state feels comfortable with. Some of the industrial policy goals of the Commission's defense industrial strategy, such as procuring at least 40 percent of defense equipment in a collaborative manner by 2030, have been met with skepticism in the expert community (Grand 2024).

There are also concerns that by focusing on EU-based defense companies only, the EU misses important cooperation opportunities with key third countries, including the UK. The extent to which third states can participate in EU initiatives remains a particularly important and sensitive issue for NATO, which seeks to defend the interests of those NATO allies that are not members of the EU.

THE INTERPLAY BETWEEN THE DIFFERENT MODES OF EU DEFENSE GOVERNANCE

The three modes of defense governance are not mutually exclusive, and in the long run, their objectives could be aligned, as an integrated European defense market and an efficient and strong European defense industry would be able to better serve the needs of national defense planners.

In the short run, however, there are tensions between the different modes of EU defense governance. One tension concerns the objectives and priorities of EU defense cooperation. While the legislative mode aims for market efficiency, the coordination mode prioritizes joint capability development projects. The financial mode, by contrast, is geared toward the development of the defense industry, even though it also increasingly seeks to address concrete capability gaps. Both the legislative and the financial mode envisage a central role for the European Commission, whereas the coordination mode follows the intergovernmental model of EU policymaking with the member states firmly in the driving seat.

Unsurprisingly, the member states' perspectives on the different modes of EU defense cooperation vary, even though the dividing lines may not always be clear-cut. The industrial policy focus of the financial mode is strongly supported by France, which does not shy away from promoting its defense industrial interests at the EU level. This raises suspicion in the smaller and mid-sized member states as well as among defense companies from Europe's periphery (Mölling and Hellmonds 2023). These fear that the financial mode will end up favoring "European champions" that would be mostly located in Germany, France, Italy, and Spain. Smaller member states and SMEs thus advocate for a more merit-based distribution of EU funds that would reward the best technology, not the largest platform or producer (Helwig and Iso-Markku 2020). Member states with a clear threat perception may show greater support for the coordination mode, as it is more focused on capabili-

ties and allows them to cooperate on those that they see as being relevant for themselves while opting out from others.

NEW COMMISSION, A NEW WINDOW OF OPPORTUNITY?

Russia's full-scale invasion of Ukraine has created a new awareness among the European public and EU policymakers of Europe's difficult security environment. During the first two years after the start of the war, many EU member states have increased defense spending or announced plans to do so. Moreover, they have invested in new defense equipment. However, reflecting long-standing trends in European defense, these steps have been largely uncoordinated and are set to benefit above all defense companies from outside the EU (Koenig et al. 2023; Schnitzler 2024). With the new measures adopted by the EU and proposals being discussed, is a more coordinated approach in the cards?

In the run-up to the European Parliament elections of June 2024, security and defense policy discussions were more prominent in the campaigns than ever before. To highlight the Commission's previous work and future plans regarding security and defense, Commission President Ursula von der Leyen announced the plan to create the post of a defense commissioner were she to be re-elected after the elections.

Despite von der Leyen's ambition, a more streamlined EU defense will be difficult to achieve. The incoming Commission will face the above outlined fragmentation of EU defense governance. At the time of writing, it remains an open question what the role of a "defense commissioner" (or a "defense industry commissioner") would look like, as the Commission's competences in relation to defense are limited to the legislative and financial mode of defense governance. This begs the question how he or she would coordinate the Commission's activities with the EU High Representative / Vice-President of the Commission (HRVP), who coordinates the intergovernmental side of the EU's foreign, security, and defense policies and acts as the Head of the EDA. If the Commission wants the EU to pursue a more coherent and unitary defense agenda, the defense commissioner and the HRVP will need to work closely together.

Close cooperation between the financial and coordination modes of defense governance would also help in addressing some of the concerns related to the EDIS and EDIP. While their ambitions have been relatively well received in the expert community (Fiott 2024b), their implementation will depend on member states' buy-in. Whether member states trust, and feel represented by, the Commission will ultimately determine whether they are willing to increase the monetary firepower of the EU needed to provide real incentives for cross-border cooperation.

However, for any of this to happen, it would also be necessary for the member states to achieve a more unified stance among themselves. Up to this day, a basic strategic divide inhibits the EU member states from making efficient European defense cooperation a reality. A Europeanist group of countries (mainly France, but also some other big EU defense industrial players) are in favor of increasing the EU's strategic autonomy in defense matters and becoming less reliant on the US. The Europeanist faction's view of EU defense cooperation is largely in line with the Commission's activities in the financial mode of EU defense governance. In contrast, Atlanticist member states (in particular the Baltic states and Poland and, to a somewhat lesser extent, the Nordic states) focus more on the actual defense capabilities at their disposal. Consequently, they value close cooperation with the military giant US and want to see the EU focus on collaborative projects that can concretely increase the credibility of European defense. Within this group, the Commission's top-down activism in strengthening the European industry is viewed with some suspicion.

POLICY CONCLUSIONS

Considering the security environment that Europe currently faces, the strategic division should not prevent the EU from forging a more joined-up approach. In the current institutional cycle, two aspects of better integrating the EU's different modes of defense governance are particularly important. First, the Commission, the Council, and the EDA must work hand in hand to ensure that the Commission's plans for bolstering the European defense industry adhere to the capability needs of the member states' militaries. Second, EU member states need to strike a balance between their desire to quickly close existing capability gaps, including through procurement from third states, and the need to prop up the Europe defense industry for the long haul. For this purpose, the member states should develop a joint understanding of capabilities and technologies that would need to be developed within Europe and of capabilities for which it is less risky to depend on third-country providers.

REFERENCES

Aries, H., B. Giegerich and T. Lawrenson (2023), "The Guns of Europe: Defence-industrial Challenges in a Time of War", in The International Institute for Strategic Studies (IISS), ed., *Survival: June-July* 2023, Routledge, London, 7–23.

Biscop, S. (2020), "European Defence and PESCO: Don't Waste the Chance", *EU IDEA Policy Papers* 1, https://www.egmontinstitute.be/app/uploads/2020/05/euidea_policy-paper1-SvenBiscop-mei2020.pdf?type=pdf.

Fiott, D. (2024a), From Liberalisation to Industrial Policy: Towards a Geoeconomic Turn in the European Defence Market?", *JCMS: Journal of Common Market Studies* 62, 1012–1027.

Fiott, D. (2024b), "Beyond Strategy? Industrial Strategy and the Future of European Defence", *ARI* 57/2024, Elcano Royal Institute, https://www.realinstitutoelcano.org/en/analyses/beyond-strategy-industrial-strategy-and-the-future-of-european-defence/.

Grand, C. (2024), "Opening Shots: What to Make of the European Defence Industrial Strategy", *ECFR Policy Alert*, 7 March, https://ecfr.eu/article/opening-shots-what-to-make-of-the-european-defence-industrial-strategy/.

Helwig, N. and T. Iso-Markku (2020), "National Expectations Regarding the European Defence Fund: The Finnish Perspective", *ARES Group Comment* 52, https://www.iris-france.org/wp-content/uploads/2020/05/ARES-52.pdf.

Iso-Markku, T. (2024), "EU-NATO Relations in a New Threat Environment: Significant Complementarity But a Lack of Strategic Cooperation", *FIIA Briefing Paper* 380, https://www.fiia.fi/en/publication/eu-nato-relations-in-a-new-threat-environment.

Koenig, N., L. Schütte, N. Knapp, P. Köhler, I. Kump and J. Pauly (2023), *Defense Sitters: Transforming European Militaries in Times of War", Special Edition of the Munich Security Report on European Defence*, https://securityconference.org/assets/01_Bilder_Inhalte/03_Medien/02_Publikationen/2023/European_Defense_Report_-_Defense_Sitters/Defense_Sitters_European_Defense_Report_MSC.pdf.

Marrone, A. and M. Nones (2020), *The EU Defence Market Directives: Genesis, Implementation and Way Ahead*, Istituto Affari Internazionali, Documenti IAI, 28 September, https://www.iai.it/en/pubblicazioni/eu-defence-market-directives-genesis-implementation-and-way-ahead.

Rodrigues, S. (2023), "Financing European Defence: The End of Budgetary Taboos", *European Papers – A Journal on Law and Integration* 8, 1155-1177.

Schnitzler, G. (2024), *"Wartime Economy": From Buzzword to Reality? - Changes in European Defence Industrial Strategies Since February 2022*, Institut des Relations Internationales et Strategiques, https://www.iris-france.org/wp-content/uploads/2024/03/ProgIndusDef_1.pdf.

Nicholas Marsh, Bruno Oliveira Martins and *Jocelyn Mawdsley*

European Defense Spending: Trade-Offs and Consequences of Non-Alignment

KEY MESSAGES

- **European states are not aligned in their military spending priorities, and for this reason, simply increasing national defense spending will not automatically translate into higher common EU industrial and operational capacity**
- **As long as EU and member state priorities remain unaligned, the risks of wasting growing military funds are considerable and should be more widely debated at the political level**
- **There are four main defense risks emerging from this context: worsened fragmentation of the European defense industrial base; competition between different European companies for components and raw materials; mismatch between operational needs and industrial supply; and challenges to the definition of a common strategic autonomy**
- **The economic impacts of an increasing militarization of commercial and civilian industry and increased challenges for green transition should also be considered**
- **Risk mitigation strategies should favor efforts promoting strategic alignment and political convergence rather than simply agreeing on higher national expenditure targets**

The February 2022 invasion of Ukraine by Russia led to a sea change in European countries' attitudes to arms production. Many European states and the EU sought to dramatically improve their own military readiness and capability and provide Ukraine with the arms and ammunition it needed to fight against Russia. National governments and the European Commission rapidly discovered that their defense industries lacked the capacity to produce arms in the quantities needed for the first high-intensity war in Europe for almost 80 years (Fiott 2023; Håkansson 2024).

This realization led to a series of national decisions to increase defense spending as well as EU initiatives spearheaded by the European Commission to incentivize and coordinate, culminating in the Spring 2024 European Defense Industrial Strategy (EDIS). More money to spend may generate the impression that Europe will increase its capacity and solve most of its strategic challenges. Yet, agreeing to spend more does not mean that member states and EU institutions are on the same page regarding what to do with it, and increased spending may be wasted and not lead to increases in defense production. As we will argue here, increasing defense expenditure in Europe does not automatically translate into increased common capacity.

UNEVEN SPENDING INCREASES

Data from the Stockholm International Peace Research Institute (SIPRI) on military expenditure suggests that EU member states have, overall, responded to the February 2022 Russian invasion of Ukraine with increased defense budgets. Collectively, military expenditure numbers in 2022 were 3.03 percent higher compared to 2021 (after adjusting for inflation) and rose again by 11.03 percent in 2023 (SIPRI 2024).[1] That increase followed year-on-year increases since the 2014 Russian seizure of Ukrainian territory; since then, EU NATO countries' military expenditure (that is, without Cyprus, Austria, Ireland and Malta, as well as Finland and Sweden as they only recently joined NATO) has increased by almost 50 percent, from EUR 145 billion in 2014 to a forecast EUR 215 billion in 2023 (measured in constant 2015 prices) (Stamegna et al. 2024).

However, increased defense spending was not a common, harmonized European response. Instead, a handful of countries appeared to have been galvanized into action, while a larger group lacked the same sense of urgency. The overall increase between 2021 and 2023, therefore, masks considerable differences among EU/European NATO members. While most of the 27 EU member states increased their defense expenditure, many did so only slightly. Just ten members of both the EU and NATO met NATO's target of spending 2 percent of GDP on defense in 2023, up from six in 2021. Exceptionally large increases were recorded in Poland (up 75 percent between 2022 and 2023) and Finland (up 54 percent between 2022 and 2023) (Tian et al. 2024). Conversely, defense expenditure in four EU member states (Italy, Greece, Cyprus, and Romania) decreased in 2023 compared to 2022 (SIPRI 2024).

Another important way to assess countries' defense expenditure commitment is the speed at which defense spending increases are planned. Some of those states that have announced large increases are unlikely to make fast progress. For example, in Janu-

[1] Authors' calculations based upon data downloaded from the SIPRI military expenditure database. Accessed from https://milex.sipri.org/sipri June 10, 2024.

ary 2023, President Macron announced a planned medium-term increase of about one-third in the French defense budget. While France is due to meet the target 2 percent of GDP spent on defense in 2025, which had been agreed to by NATO members in 2014, the full increase will not be complete until 2030 (Rose and Achi 2023). While the planned large-scale investments in capabilities like drones and military intelligence would clearly augment the French armed forces, the envisioned timescale means that they are a medium-term investment rather than a response to the current crisis. Italy is operating on an even longer timescale. Unlike France, Italy is a long way from the 2 percent goal as reported by its defense minister in November 2023, and no year was given as to when that might be achieved – Stamegna et al. (2024) point to Italy's ongoing public finance problems and the Eurozone's public debt criteria as causes. Poland, meanwhile, has already embarked upon a significant spending increase: in 2023, defense spending rose by 75 percent compared to the previous year, and will reach 3.9 percent of GDP in 2024, almost twice the 2 percent target (Strzelecki and Pawlak 2023). It remains to be seen whether this level of spending can be sustained, and whether Poland is able to use the extra money effectively, but it is clear that some states are moving toward a war economy, whereas others are not.

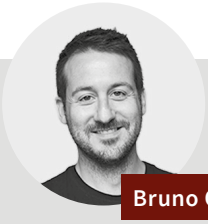
In other words, there does not seem to be a Europe-wide consensus on whether there needs to be substantial and sustained increases in defense expenditure or how quickly this needs to happen. This may undermine the ability of the European Commission to marshal significant long-term resources toward defense production, despite its ambition to do so. The EU's long list of programs and policies employed and/or introduced since the beginning of the war indicates that there is a growing willingness among EU institutions to step up their commitment to defense matters, both in terms of arming Ukraine and strengthening European military capabilities (Håkansson 2024). However, that has not translated into a common understanding of the scale of the military threat and how this should be addressed from an industrial perspective. For reasons such as different threat perceptions among national electorates, different international defense commitments, tensions between political and economic logics, and industry constraints, EU countries are not aligned in their rearmament priorities, and are largely following national imperatives (Fiott 2023). This is particularly noticeable in Central and Northern European states where threat perceptions of Russia are highest (Chovančík and Krpec 2023).

The EDIS proposals of March 2024 represent an attempt to plan what an EU-led transition to an economy preparing for war might look like (European Commission and High Representative 2024). However, it has long been observed that EU initiatives on defense industry and procurement favor the larger Western European arms-producing states and firms (Mawdsley 2008). Chovančík and Krpec (2023) argue that Western European firms are better integrated and thus better placed to benefit from EU initiatives like the European Defense Fund (EDF). EDIS also seems to echo the French vision of an autonomous Defense Technological and Industrial Base (DTIB), even though economists question whether highly internationalized supply chains make this impossible (Kleczka et al. 2024), as well as whether purely EU firms could fulfil demand rapidly enough (Wolff 2024). EDIS is likely to have three areas where member states disagree: (1) the Commission taking on war powers; (2) finance; and (3) whether it is more important to build up capacity at speed or autonomously. The latter two are areas where the lack of consensus on threats will cause conflict, as the 2024 Czech initiative to procure ammunition globally for Ukraine, when purely EU efforts failed, shows.

In theory, increased European military spending might be expected to lead to general industrial development, intra-EU or NATO cooperation enabling economies of scale, and an increase in EU or NATO political leverage over states' national defense policies and decisions. But so far this has not happened. In fact, there are several risks associated with an uncoordinated increase in military spending, and this has received far less attention than the issue deserves.

Nicholas Marsh

is a Senior Researcher at the Peace Research Institute Oslo. His work usually encompasses aspects of military and security technology.



Bruno Oliveira Martins

is Senior Researcher at the Peace Research Institute Oslo, where he co-leads the Security & Technology Research Group.

Jocelyn Mawdsley

is Professor of European Politics at Newcastle University. She is Co-editor of the Journal European Security and works on the political economy of European defense.

POLICY CONCLUSIONS

The Consequences of European Defense Fragmentation

Worsened fragmentation of the European defense industrial base – An increase in available funds may lead to higher levels of fragmentation of the already fragmented European defense industrial base. It is likely that the uneven increases in defense spending, linked to differing threat perceptions, will be accompanied by traditional European government preferences to spend on national champion defense companies. This is logical – as DeVore (2017) argues, even small national defense industrial sectors can offer an important advantage in times of war, especially increased military adaptability (as we have seen in Ukraine). But as each country tries to maximize domestic economic benefit, they will collectively forfeit opportunities to build a more productive, autonomous, and efficient European defense industry.

Competition between different European companies – The fragmentation described above has other consequences. Poland's acquisitions from South Korea are a good example of a national growth strategy for DTIBs (Chovančík and Krpec 2023). However, while such purchases are rational responses to filling urgent military capability gaps, there are signs that competition and duplication among EU countries are driving prices up, rather than triggering economies of scale that a coordinated effort could allow. A scenario of competition between different EU countries would thus probably lead to an actual increase in prices of raw materials and components (Fiott 2022). Mader et al. (2024) show how public support for European security and defense spending is cost sensitive – a prolonged period of high military expenditure preparing for a potential conflict could reduce public support.

Mismatch between operational needs and industrial supply – Some of the recent pre-war EU initiatives, chiefly the European Defense Fund (EDF), have received criticism for prioritizing industrial objectives over operational ones. The EDF put the focus on innovation and industrial development, and its priorities appear to be based on industrial preferences, rather than the operational needs of European armed forces (Martins and Mawdsley 2021). The EDIS continues this pattern. One EDIS proposal, for example, focuses on enabling joint planning through a 'European Defense Industrial Readiness Board' with substantial industrial representation. If the new funding proposed in EDIS follows a similar logic, and with expected lack of coordination among EU countries, there could be a further mismatch between what is needed by Europe's militaries and what is produced by industry.

Challenges to the definition of a common strategic autonomy – A non-alignment in defense spending across Europe will further complicate the narratives around the EU's concept of strategic autonomy. If different spending priorities are a consequence of different threat perceptions and different visions about the future of EU defense, the idea of a single understanding of a European strategic autonomy is undermined even further. In other words, when we read "strategic autonomy," we need to ask, "for whom?"

Wider Economic Impacts

Excessive militarization – While attention has mainly been focused on low levels of European military spending, European leaders should also be wary of the risks of excessive militarization, or perceptions thereof. Defense spending represents a diversion of funds and resources from civilian production and welfare. While the defense economics literature has not reached a consensus on where the line can be drawn (see discussion in Dunne and Smith (2020)), spending more than is necessary could "crowd out" civilian industries upon which European prosperity and defense budgets ultimately depend, for example through shortages of specialized workers. Attempts to rapidly build up defense industry may also result in calls to provide governments with new powers to, say, suspend local democratic processes concerning planning and building construction. Moreover, military funding of dual-use technologies, as well as military funding of civilian research environments, have been seen as a threat to science and technology and problematic to the freedom and autonomy of scientific research, while military funding of civilian tech companies such as Google has triggered protests from tech workers (Sainato 2024). More directly, perceptions that Europe has excessive military spending would be likely to further undermine the ability of European leaders to reach a consensus or coordinate their efforts, given that political polarization is rising in many European states. It is therefore important that the EU and European governments are seen to deliver value for money and not to be wasting taxpayers' money on inefficient and ineffective spending.

Challenges for green transition – There is a particular risk that European attempts to meet the urgent challenge of improving defense production and military capability act against the equally important long-term goal of decarbonizing European industrial and energy sectors. If that were perceived to be happening, it may be even harder to achieve a European consensus on military expenditure. There is a risk that funding will be redirected away from developing and implementing green technology and toward defense and military sectors that have been criticized for being high carbon emitters (Egeland 2023). For example, President of the European Council Charles Michel has proposed cutting the EU renewables fund from EUR 10 billion to EUR 1.5 billion and diverting those funds into military investments (Gavin et al. 2023). It also remains to be seen whether the leadership of the EU and European states are up to the

task of undertaking two ambitious transformations of European industry simultaneously.

Increases in defense spending will not automatically translate into higher common EU industrial capacity. In fact, as long as priorities remain poorly aligned, the risks of wasting the growing availability of military funds are considerable and should be more widely discussed at the political level. Risk mitigation strategies should favor efforts promoting strategic alignment and political convergence rather than simply agreeing to make more funds available.

REFERENCES

Chovančík, M. and O. Krpec (2023), "Cloaked Disintegration – Ukraine War and European Defence-industrial Co-operation in Central and Eastern Europe", *Defense and Security Analysis* 39, 369–386.

DeVore, M. R. (2017), "Commentary on the Value of Domestic Arms Industries: Security of Supply or Military Adaptation?", *Defence Studies* 17, 242–259.

Dunne, J. P. and R. P. Smith (2020), "Military Expenditure, Investment and Growth", *Defence and Peace Economics* 31, 601–614.

Egeland, K. (2023), "Climate Security Reversed: The Implications of Alternative Security Policies for Global Warming", *Environmental Politics* 32, 883–902.

European Commission and High Representative (HR) of the Union for Foreign Affairs and Security Policy (2024), *A New European Defence Industrial Strategy: Achieving EU Readiness through a Responsive and Resilient European Defence Industry*, Brussels, 5 March 2024, JOIN (2024) 10 final, https://defence-industry-space.ec.europa.eu/document/download/643c4a00-0da9-4768-83cd-a5628f5c3063_en?filename=EDIS percent-20Joint percent20Communication.pdf.

Fiott, D. (2022), "The Fog of War: Russia's War on Ukraine, European Defence Spending and Military Capabilities", *Intereconomics* 57, 152–156.

Fiott, D. (2023), "In Every Crisis an Opportunity? European Union Integration in Defense and the War on Ukraine", *Journal of European Integration* 45, 447–462.

Gavin, G. et al. (2023), "EU's Green Funds Are under the Guillotine", *Politico*, 15 December, https://www.politico.eu/article/eu-renewable-energy-green-lacking-funds-budget-guillotine-defense-immigration-climate-change/.

Håkansson, C. (2024), "The Ukraine War and the Emergence of the European Commission as a Geopolitical Actor", *Journal of European Integration* 46, 25–45.

Kleczka, M., L. Vandercruysse, C. Buts and C. Du Bois (2024), "The Spectrum of Strategic Autonomy in EU Defence Supply Chains", *Defence and Peace Economics* 35, 427–447.

Mader, M., M. Neubert, F. Münchow, S. C. Hofmann, H. Schoen and K. Gavras (2024), "Crumbling in the Face of Cost? How Cost Considerations Affect Public Support for European Security and Defence Cooperation", *European Union Politics*, Ahead of Print, https://doi.org/10.1177/14651165241236777.

Martins, B. O. and J. Mawdsley (2021), "Sociotechnical Imaginaries of EU Defence: The Past and the Future in the European Defence Fund", *JCMS: Journal of Common Market Studies* 59, 1458–1474.

Mawdsley, J. (2008), "European Union Armaments Policy: Options for Small States?", *European Security* 17, 367–385.

Rose M. and C. Achi (2023), "Macron Boosts French Military Spending by Over a Third to 'Transform' Army", *Reuters*, 20 January, https://www.reuters.com/business/aerospace-defense/frances-macron-proposes-big-hike-military-spending-2024-2030-2023-01-20.

Sainato, M. (2024), "Workers Accuse Google of 'Tantrum' after 50 Fired over Israel Contract Protest", *Guardian*, 27 April, https://www.theguardian.com/technology/2024/apr/27/google-project-nimbus-israel.

SIPRI (2024), *Military Expenditure Database*, https://milex.sipri.org/sipri.

Stamegna, M., C. Bonaiuti, P. Maranzano and M. Pianta (2024), *The Economic Impact of Arms Spending in Germany, Italy, and Spain*, Munich Personal RePEc Archive. https://mpra.ub.uni-muenchen.de/120608/1/MPRA_paper_120608.pdf.

Strzelecki, M. and J. Pawlak (2023), "Scope of Poland's Spending Spree in Focus as NATO Ups Defence Goal", *Reuters*, 12 July, https://www.reuters.com/world/europe/scope-polands-spending-spree-focus-nato-ups-defence-goal-2023-07-12/.

Tian, N. et al. (2024), *Trends in World Military Expenditure*, SIPRI Factsheet April 2024, https://www.sipri.org/sites/default/files/2024-04/2404_fs_milex_2023.pdf.

Wolff, G. (2024), *The European Defence Industrial Strategy: Important, But Raising Many Questions*, Bruegel, https://www.bruegel.org/analysis/european-defence-industrial-strategy-important-raising-many-questions.

Mikkel Vedby Rasmussen

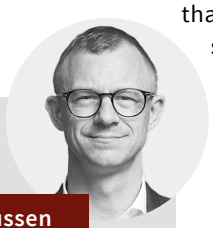
Rearmament with a Purpose

KEY MESSAGES

- **European countries are investing in heavier, platform-centric forces that rely on technology rather than personnel**
- **Europe must develop military R&D to avoid investing in existing technologies at the expense of future capabilities**
- **European governments should focus on acquiring the necessary capabilities to realize strategic objectives rather than focusing solely on the percentage of GDP spent on defense**
- **European governments must invest in armed forces that can be sustained after future funds for rearmament are redistributed**
- **European governments must develop strategic thinking, individually and collectively, to prioritize the development and sustainment of future military capabilities**

The first phase of the Ukraine war – from the Russian invasion in the spring of 2022 to the renewed Russian offensive in the winter of 2023 – seemed to reconfirm the power and purpose of the EU and NATO. The anticlimax thus hit European politicians particularly hard as that purpose began to falter, when the US Congress delayed supplies to Ukraine and the Russian army pressured Ukrainian forces on the frontline in eastern Ukraine and threatened to break down Ukrainian infrastructure by means of missile bombardments of Ukrainian cities.

The first phase of the war was defined by a renewed European commitment to defense spending; the second phase was defined by the realization that European governments might spend even more because American politicians might leave them to foot the entire bill for the continued campaign. The European governments also have to face another fact: not only might they need to pay for the defense of Ukraine but, for the first time since the Second World War, they may have to foot the entire bill for their own defense because the next American president might withdraw some or all of the US's security commitment to Europe.



Mikkel Vedby Rasmussen

is a Professor in International Relations at the University of Copenhagen. He previously served as Head of Policy Planning at the Danish Ministry of Defence. His publications on defense policy include *The Military's Business* (Cambridge 2015).

The political economy of European defense has been utterly transformed by the Ukraine war. This article deals with some of the consequences of that transformation, arguing that European governments must adopt an innovative and strategic approach to defense if their rearmament is to create real security benefits. In other words, the European governments must avoid the logic of the soft budget constraint that contributed to the lack of purpose in the decades after the end of the Cold War.

SOFT BUDGET CONSTRAINT

European governments have taken an accountant's rather than a strategist's view of defense spending: they are focused on the percentage of GDP spent on defense rather than on the capabilities needed to prevail on future battlefields. To understand why it is so, one must appreciate how defense spending has been debated among the NATO countries since the turn of the century.

In Europe, reinvestment in defense has been about the numbers rather than the strategic aims that better equipped armed forces are to serve. One reason for this is that the Russian invasion of Ukraine in February 2022 settled a discussion between the European NATO members and the US about how much to spend on defense. In budget terms, German Chancellor Scholz's *Zeitenwende* was an admission that Germany needed to spend at least 2 percent of GDP on defense (Scholz 2022). When Germany turned defense spending around, a number of smaller NATO-member countries hiding in Germany's shadow also increased their defense budgets. This effectively ended almost twenty years of debate within NATO on how much the allies should spend on defense.

NATO allies debated defense spending so heatedly because the US stopped its post-Cold War defense cuts in 2000. European countries either continued to reap the "peace dividend" or continued defense spending at the low level it had reached after defense cuts in the 1990s. Much of the increase in the US defense budget went to financing the wars in Iraq and Afghanistan. Still, one result of these conflicts was innovation in signals intelligence and the use of military drones. In the wake of the 2001 terrorist attacks, the Europeans spent much more on domestic intelligence and could thus, to a certain extent, argue that they did not neglect to invest in security; they just preferred not to invest in their armed forces. European politicians would say that they were not neglecting defense but rather focusing their resources on a globalized world, where the threat from globalized

crime syndicates and terrorists loomed larger than armed conflict. Not investing in defense reinforced a difference in worldviews between the US and the European allies, including the Canadians, a difference that might not have been so great if it had not been reinforced by budgetary logic. Perhaps the difference in money spent was always larger than the real difference in geopolitical analysis. In any case, the result was that the gap between European and American defense investment began growing from 2000 onward.

Thus, the European defense debate has been defined by the percentage of GDP spent on defense rather than on the capabilities needed to prevail on future battlefields. With good reason, perhaps, since debating futuristic capabilities might seem frivolous when 20 years of underinvestment in defense means that most European armed forces are in dire need of basics like artillery and tanks – not to mention that the barracks need a paint job. Playing catch-up, European governments risk defining success based on how much money they spend on defense rather than how well they spend it. During the NATO debates, the Europeans argued that the Americans were far too focused on the number of euros spent on defense instead of on the quality of the forces. This focus on quality was a rhetorical device rather than a defense strategy, evident from the fact that this argument was wholly forgotten when budgets rose. It was a good argument, however, and it deserves to be revisited if the Europeans want to avoid investing in the capabilities the Americans bought 15 years ago, and instead invest in the capabilities the Americans will buy in five years.

By focusing on the budget, the European governments are giving their armed forces a "soft budget constraint." The Hungarian economist János Kornai coined the term in the 1970s to describe how state-run companies in the planned, state-run economy of communist Hungary had no incentive to spend within their means because they did not know precisely what those means were (Kornai 1986). Unable to know how much money the state would take out of the company and how much it would reinvest in it, the firm's best strategy was to present lavish plans to secure higher funding. But there was little incentive to realize the plans, because failure to live up to them would not mean the drop in earnings you would expect in a free market. The government would pick up the bill and thus end up paying for the lofty ambitions as well as the failure to realize them.

European armed forces have a similar soft budget constraint. When the focus is on how much to spend, the generals' job is to provide a shopping list of military hardware that adds up to 2 percent of GDP. The generals know that budgets may fall, so their incentive is to make the list as long as possible to secure equipment as long as the budget is there. The armed forces have little incentive to provide a comprehensive plan for how to use the forces in the future, nor to spend money on R&D initiatives that might produce more effective capabilities at some future point, by which time funding may have disappeared.

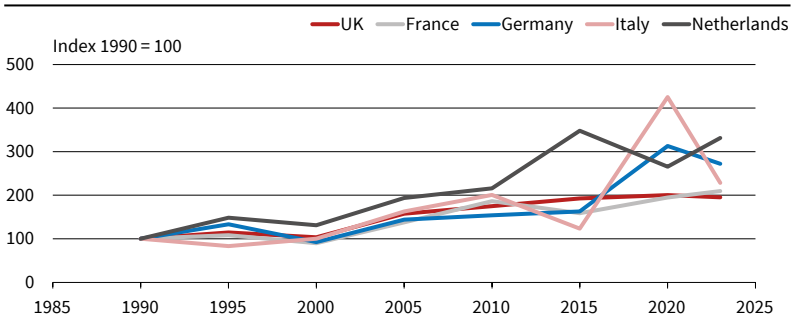
Because the Europeans are playing catch-up, investing in capabilities needed to compensate for many years of underinvestment makes sense. In May 2024, NATO concluded that the alliance had 5 percent of the air defense capabilities required to defend its eastern flank (Foy and Rathbone 2024). To invest in these capabilities is an obvious necessity. However, European politicians must stop treating defense budgets as a number and instead view them as an investment in a certain strategy. In Kornai's terms, the armed forces need a hard – or at least a harder – budget restriction. For armed forces, this means a political engagement with the strategic ends that the armed forces are to serve. In the context of these strategic ends, the armed forces add the punch to a number of national capabilities which, taken together, provide security. This broad-spectrum approach to security used to be a European hallmark. Still, as a part of the argument for small defense budgets, it was mobilized as an argument against investing in military power. Thus, it was left behind when the defense budgets rose. It is time to reinvent this broad-spectrum approach while recognizing the crucial importance of armed forces in European security policy after the Russian invasion of Ukraine.

PERSONNEL RATHER THAN PANZERS

To catch up with the US, the Europeans are investing in platforms – the military's way of distinguishing between the things (planes, ships, tanks) that deliver weapons and the software that guides them. At the same time, European countries are producing more ammunition to maintain Ukraine's war effort and replenish their own stockpiles. One might think this would revert the European armed forces to look something like the large, armored formations they could field during the Cold War. In fact, these investments reinforce the tendency for the European armed forces to become "heavier." By "heavy," we mean that

Figure 1

Selected NATO Countries: Ratio Between Total Defense Expenditure (Constant 2010 USD) and Armed Forces Personel



Source: NATO, Financial and Econommic Data Relating to NATO Defence, Press Release PR/CP(2011)027 and Press Release PR/CP(2015)093-COR1, Table 1 and Table 6. Defence Expenditure of NATO Countries (2014-2023), Table 2 and Table 7. Deflator: http://stats.areppim.com/calc/calc_usdlrxdeflator.php.

the European armed forces rely on platforms rather than personnel.

Figure 1 shows the ratio between the number of military personnel and the overall defense budget in selected NATO countries – in other words, how many euros or pounds are being spent per soldier. It is an easy (but by no means perfect) way to demonstrate how much of the defense budget goes to buying tanks and ships rather than paying salaries to the soldiers or sailors staffing them. It is thus a measure of how reliant a military is on technology as opposed to a force that generates firepower through massed troops.

Figure 1 demonstrates that the increase in defense spending has yet to translate into a large recruitment drive. The selected NATO countries, and this is true of the allies in general, still have much heavier forces in 2023 than in 1990. In fact, the British army is the smallest it's been since 1714. In most countries, the number of soldiers is half of what it was in 1990. France was able to field more than half a million soldiers, airmen, and sailors in 1990; in 2023, it was some 207,000. Since recruitment has not increased significantly, the money invested in military hardware has increased. Some of the spikes in Figure 1 come from sudden increases in investment. The Italian investments in equipment doubled from 2014 to 2023, whereas the German equipment budget went from 12 percent of the federal defense budget in 2014 to 25 percent in 2023. France and Britain have increased their equipment percentages and to the same degree. Both countries cut back on defense spending, but as of 2020 and 2021, respectively, they are back at 2014 levels (NATO 2023). Since materiel contributions to Ukraine count in NATO defense budgets, part of this investment in materiel is for the Ukrainian armed forces and should not be measured against the number of personnel in certain NATO countries. This reflects that, in the beginning at least, rearmament is precisely that: investments in new platforms rather than hiring more personnel.

The European countries are not recreating their Cold War militaries; they are investing in heavier, platform-centric forces that rely more on technology and less on personnel. With a soft budget constraint, there is a risk that this investment in heavy forces will leave the Europeans with many platforms and well-stocked arsenals without having the funds to train and deploy these forces. Since the 1970s, when the US opted for a smaller, all-volunteer force that achieved firepower through technology rather than massed troops, operations and maintenance have been the largest single item in the US defense budget. That item totaled USD 323,418 million in the Defense Department budget for 2024 – almost double the cost of procurement and salaries for military personnel, respectively (US Department of Defense 2024). European armed forces might not expect to deploy troops overseas to the extent US forces do. However, the heavier they become, the more costly expeditionary forces become and the more money they will need to maintain high-tech platforms. Beyond the current investments in new capabilities, European armed forces should thus expect to pay more for the upkeep of the forces, which means that European taxpayers will be presented with higher defense budgets. This is an illustration of the consequences of the soft budget constraint: much depends on the ability to invest in platforms that will serve the Europeans well on future battlefields.

THESE ARE NOT THE DRONES YOU'RE LOOKING FOR

The Ukraine war has demonstrated the capabilities of drones and missile defenses. Since these are technologies in which Europeans have neglected to invest over the last twenty years, while the US used its increased budgets to make these investments, Europeans are naturally focused on buying drones, Patriot air defense batteries, and similar capabilities. While procuring these systems is necessary, this focus on catching up means that the Europeans might invest in current capabilities at the expense of future capabilities. To avoid this, a robust R&D effort is needed. The European Commission has established the European Innovation Council as a part of its research funding body and, together with Germany, France has launched JEDI (Joint European Disruptive Initiative). JEDI is modeled on the American DARPA, which has invested in defense innovation for decades (Loesekrug-Pietri 2018). The European version of DARPA is civilian and military, but that means focusing on solving large-scale societal problems, which is a worthy pursuit but takes the focus away from developing military capabilities.

In this context, the JEDI mind-trick seems to be diverting attention away from military innovation and into innovations that serve either civilian purposes or contribute to basic research. Thus, the European innovation effort is also a victim of soft budget constraints. A strategic focus is needed to avoid defense investment funds being used as an excuse to fund research and civil innovation. If the task is to innovate, it is little wonder that researchers will pursue their agenda and expand on projects they are working on already. If the task is based on providing the means to achieve a certain strategic end, the relationship changes, and it will be possible to support European security.

With European armed forces becoming heavier, technology-based establishments, their societal role will change. Military personnel will increasingly work on operating and maintaining high-tech platforms, increasing demand for these skills and putting the military in competition with tech firms for people to employ. Demand for military tech will also stimulate European R&D. One lesson of the Ukraine war is how closely the US government has worked with private companies to support Ukraine, because these com-

panies could offer the software Ukraine needed to maintain communications, etc., during the Russian onslaught (Time 2024). An essential element in European rearmament will be the development of this public-private cooperation on security.

POLICY CONCLUSIONS: THE 10-FOOT BONSAI IN THE ROOM

Over the twenty years where the Europeans saved money on defense while the Americans reinvested in defense, the European armies grew so small that they became, in Christian Mölling's apt phrase, "bonsai armies" (Mölling 2011). That is, the European armed forces had all the elements of modern armed forces equipped with armies, navies, and air forces. However, they had so few tanks and ships that the European armed forces had the same relationship to a real fighting force as a bonsai has to a real tree. Now that the Europeans are finally rearming, the question is whether they are spending money on creating large bonsais or proper trees. To avoid paying billions of euros on repeating past mistakes on a larger scale, one must consider what strategic ends the armed forces will serve and appraise future technological development to avoid investing in legacy technologies.

The Europeans can use their lethargic approach to defense spending for the last twenty years to their advantage if they aim to invest in future technologies and capabilities instead of merely playing catch-up with the US. In this way, the Europeans might skip a generation and end up with state-of-the-art military forces because they have little legacy. Yet the European "bonsai forces" might rebel against this innovative approach, because if you have a few tanks, you might believe you'll have genuine capability if you buy a few more. This increase in the number of tanks matters less if they are not integrated into a system of capabilities with the software and hardware to deliver firepower at the right place at the right time. Developing such capabilities is beyond the capacity of individual European countries, and thus, rearmament opens up a new avenue of European cooperation. Projects on next-generation fighters, tanks, and other capabilities constitute the beginning of such cooperation, but they are platform-centric projects. Strategic innovation is of equal importance. Developing the concept of using armed forces as one element in national security capacity will decide whether the Europeans will get their euros' worth.

REFERENCES

Foy, H. and J. P. Rathbone (2024), "Nato Has Just 5% of Air Defences Needed to Protect Eastern Flank", *Financial Times*, 29 May, https://www.ft.com/content/5953405f-d91a-4598-8b6b-6345452ca328.

Kornai, J. (1986), "The Soft Budget Constraint", *Kyklos* 39, 3–30.

Loesekrug-Pietri, A. (2018), "Schriftliche Stellungnahme / Observations écrites", *Joint European Disruptive Initiative*, https://www.bundestag.de/resource/blob/556394/ff7f0a1f37e430410961b15ceb58e2b4/3--je-di-en-fr-data.pdf.

Mölling, C. (2011), *Europe without Defence - The States of Europe Have to Re-Evaluate the Interrelationship between Political Sovereignty, Military Effectiveness and Economic Efficiency*, https://www.swp-berlin.org/en/publication/europe-without-defence.

NATO (2023), "Defence Expenditure of NATO Countries (2014-2023)", *Press Release*, Brussels.

Scholz, O. (2022), *Policy Statement by Olaf Scholz, Chancellor of the Federal Republic of Germany and Member of the German Bundestag*, 27 February, https://www.bundesregierung.de/breg-en/search/policy-statement-by-olaf-scholz-chancellor-of-the-federal-republic-of-germany-and-member-of-the-german-bundestag-27-february-2022-in-berlin-2008378.

Time (2024), "How Tech Giants Turned Ukraine into an AI War Lab", 8 February, https://time.com/6691662/ai-ukraine-war-palantir/.

US Department of Defense (2024), *National Defense Budget Estimates for FY 2025*, https://comptroller.defense.gov/Portals/45/Documents/defbudget/FY2025/fy25_Green_Book.pdf.

Lucie Béraud-Sudreau

Europe's Other Arms Production Problem: "New Defense"

KEY MESSAGES

- **"New Defense," akin to "NewSpace," challenges the traditional defense industry with innovative, agile, software-first companies**
- **Lack of European equivalent to US tech giants raises concerns about strategic credibility**
- **European technology sector's military assistance to Ukraine remains limited compared to the US**
- **Europe's New Defense sector is critical for future military capabilities and strategic credibility**

The European Union (EU) released its "European Defence Industrial Strategy" (EDIS) on March 5, 2024, two years after the start of Russia's full-fledged invasion of Ukraine (European Commission 2024). One of EDIS's priorities is to steer EU member states and their arms industry towards more ammunition production and cooperative procurement. EDIS is the latest iteration of a long list of EU arms industrial policy plans and initiatives, which began in the 1990s and started concrete implementation in 2016 (Béraud-Sudreau and Pannier 2021).

Given the urgency of the war, EDIS focuses on ammunition production. The EU and its member states have been increasing ammunition production since February 2022, which is the immediate priority for Ukraine. However, European countries and their arms industries face another arms production issue: fostering the emergence of "New Defense" companies. Indeed, the defense market has transformed into what has been called "software-defined defense," where emerging technologies play a pivotal role (Soare et al. 2023).

Lucie Béraud-Sudreau

is Director of the Military Expenditure and Arms Production Program at the Stockholm International Peace Research Institute (SIPRI).

This shift in the foundations of military power puts traditional European arms companies (such as Leonardo, Dassault Aviation, and Rheinmetall, to name a few examples) in a "sandwiched" position. From the top down, technology giants lead innovation on information technology developments. Technology conglomerates (such as Alphabet, Amazon, Apple, Meta, or Microsoft) have more financial clout than the largest arms producers and hold the innovation advantage when it comes to, for instance, cloud computing or artificial intelligence (AI). From the bottom up, more agile start-ups entering the defense market are challenging traditional players.

The contribution of technology companies to a country's military capabilities has become visible with Russia's war against Ukraine. However, these contributions come predominantly from US-based firms. Have European "New Defense" companies provided military assistance to Ukraine? If not, does this reflect a lack of New Defense players in Europe?

This paper first describes the transformations in the arms industry under the effect of "New Defense," relying on previous research and using the example of the US technology sector's involvement in the war in Ukraine. It then tries to map whether European New Defense players were involved in the war in Ukraine like their US counterparts. It finally offers policy conclusions for European policymakers to strengthen strategic autonomy in this regard.

HOW "NEW DEFENSE" IS TRANSFORMING THE TRADITIONAL DEFENSE INDUSTRY

Emerging technologies have not only transformed the modern battlefield but also challenged the traditional setup of the arms industry, with the emergence of a "New Defense" sector. New entrants in the defense market have played a crucial role in assisting Ukraine against Russian aggression. However, the New Defense companies assisting Ukraine are mainly American. This leaves open the question of the state of play of New Defense in Europe.

Industry representatives Ek and Enders (2022) defined New Defense as "*well-funded defense technology companies*." To elaborate, the expression "New Defense" is borrowed from the concept of "NewSpace." According to Brockmann and Raju (2022, 4), "NewSpace" "*refers to new entrepreneurial businesses or start-ups in the global space sector, as well as the shifting dynamics of the sector's commercialization and the new business practices that these companies embrace.*" A similar approach can be applied to the defense sector, with the twin phenomenon of the militarization of emerging technologies and of disruptions in the business model of traditional defense companies – especially in the US. For the same authors, NewSpace "*signifies the diversification of actors and activities in the global space industry*," notably with the increase of private actors in the sector, both

conglomerates and start-ups (Brockmann and Raju 2022, 5). Again, the same observations apply to the defense sector. Another characteristic of NewSpace that Brockman and Raju (2022) identify also helps in understanding New Defense: innovation comes mainly from the private sector outside of the traditional defense companies. Ek and Enders (2022) also identified the difference in corporate culture as a key divide between traditional arms manufacturers and New Defense actors. They consider that "*New Defense companies are software-first, they pay for their own R&D and employ fast, agile and iterative development practices*," in contrast to traditional defense entities.

The existing literature has identified the transformations at play in the US arms industry. Dunne and Sköns (2021) studied the growing role of commercial technology companies in the US defense market. They gave the examples of Google, Microsoft, and Amazon, which increasingly gained contracts with the Department of Defense (DoD). They also cited the cloud computing sector, where civilian companies have become providers for military customers, rather than the traditional arms companies. These tech giants challenge arms manufacturers, not necessarily by taking their market share for military hardware (e.g., main battle tanks), but rather by preempting new market segments through supplying services where the traditional arms companies are not the first movers.

In the media, The Economist (2023a) described the other facet of the New Defense phenomenon, which also challenges arms producers: the creation of start-ups that challenge the traditional contract and business model, as in NewSpace. The Economist article refers to Anduril Industries, established in 2017. This company initially developed military software and entered the autonomous vehicles market segment. The Economist (2023b) further showed how this start-up challenges the missile sector with a reusable missile offering. Other US firms that could qualify as New Defense include Scale AI and Shield AI, Epirus, or Fortem Technologies (PR Newswire 2023).

These examples are US-based. Knowledge on how New Defense is developing in Europe remains limited, although some reports have warned about the growing gap in emerging military technology developments between the US and Europe. Barberini (2020) noted that about 90 percent of information and communication technologies firms are based in the US and that their role will be increasingly critical for military capabilities. Going more in-depth, Soare et al. (2023) showed that the UK's Ministry of Defence has relied on Palantir and Anduril for some of their military AI and machine learning programs. According to these authors, France seems to rely more on local firms (Capgemini, Atos, Thales, and Sopra Steria) for their future capabilities. Their report concludes that the transatlantic gap between the US and Europe in this field exists but is still "bridgeable" (Soares et al. 2023, 41). This gap can be further illustrated by looking at New Defense actors' provision of military assistance to the Ukrainian armed forces in their fight against Russian aggression.

EUROPEAN PRIVATE SECTOR INVOLVEMENT IN UKRAINE: WHERE ARE THE NEW DEFENSE PLAYERS?

Regarding the two sides of New Defense as they sandwich the traditional arms industry, where does Europe stand? Looking first at the top-down challenge, which relates to tech giants' involvement in defense markets, the lack of European equivalents there is already widely acknowledged (Pannier 2023). From the bottom up, the transatlantic gap in the New Defense ecosystem is highlighted by the case study of New Defense firms' involvement in the war in Ukraine.

Russia's war of aggression against Ukraine has been the topic of much analysis when it comes to the role of new technologies on the battlefield (see notably Franke and Söderström 2023). Such reports focus on what technologies and equipment are used by the warring parties. But the question of who provides such systems and software is less prominent. One notable exception is a study by Bresnick et al. (2024). These authors listed 18 technology companies that have provided military assistance to Ukraine: Amazon, Apple, Capella Space, Cisco, Clearview AI, Cloudflare, Fortem Technologies, Google, Mandiant (now part of Google), Maxar, Microsoft, Oracle, Palantir, Planet Labs, Primer, Recorded Future, SpaceX, and Tesla.

Whereas US companies' role can be clearly identified, what about the European technology sector's military assistance to Ukraine? If European countries were on the frontline, would they need to rely on these US-based businesses like Ukraine did? As the debate heats up on how and whether Europe would need to defend itself in the event of a second Trump presidency (Rhode 2024), the question of which companies provide such military-relevant services and where they are based is topical.

Most European arms manufacturers have been involved in the wake of their government's weapons donations to Kyiv, for shipments, spare parts, training, maintenance, etc. European companies listed in the world's top 100 largest defense firms (Liang, Scarazzato et al. 2023) include Rheinmetall of Germany and BAE Systems of the UK. Both have established local entities to support Ukraine's industrial war effort. Although such firms have developed their own software and emerging technology businesses, they represent the traditional arms industry rather than New Defense.

At the other end of the spectrum, European civilian businesses involved in the telecommunications sector have also helped Ukraine. For instance, French telecom companies Orange and SFR allowed free calls to Ukraine, while Bouygues and Free implemented

lower prices. These do not qualify as military assistance, however.

A series of think tank reports from the Defense AI Observatory (DAIO) explored the industrial landscape for the defense-AI sector. Three reports covering the European countries of France (Martin and Liversain 2023), Germany (Borchert et al. 2023), and Denmark (Graae 2023) give lists of companies who sell AI tools destined for defense uses. This provides a sample of New Defense actors in Europe, around 40 entities in all. However, of those 40, it was possible to find only three that had provided military assistance to Ukraine.

Helsing is the most prominent example. This German company specializes in AI services for military applications. It contributes, for instance, to the Future Combat Air System (FCAS) program co-developed by France, Germany, and Spain. In Ukraine, Helsing incorporates AI programs into Ukrainian uncrewed aerial vehicles (UAVs) (Ministry of Strategic Industries of Ukraine 2024), possibly among other activities (Meaker 2023). Another example, also from Germany, was the company Traversals. This AI start-up created a "Ukraine Dynamic Frontline Monitoring (UDFM) service to record military events in the war zone by reading and analyzing publicly available data" (Traversals 2024). In France, the company Preligens uses AI to analyze satellite imagery, although it is unclear from open sources to what extent the company's services are provided directly to the Ukrainian authorities (Preligens 2023; Chatham House 2022).

Outside of the defense-AI domain, the European private sector is also involved when it comes to UAVs. In France, Delair sent 150 drones to Ukraine, based on a contract from the French government (Delair 2024). The Danish firm Nordic Wing was also contracted by Ukraine's partners to supply its Astero ISR system (Nordic Wing 2024). The Portuguese company Tekever provided surveillance drones to Ukraine (Intelligence Online 2023; Gosselin-Malo 2023). In Germany, Quantum-Systems supplied reconnaissance drones to Kyiv (Quantum-Systems 2022). Drone warfare has been critical in the war so far; however, this type of technology is not comparable to the services provided by the 18 US companies identified in Bresnick et al. (2024).

The European tech sector's military assistance to Ukraine thus remains limited when compared to the US. The question remains as to whether the still relatively small scale of the New Defense sector in Europe creates a liability when it comes to military capabilities. Looking at the services provided to Ukraine by the 18 US firms mentioned above, how critical are they? Does their absence or limited scale in Europe undermine European strategic credibility? To a large extent, the assistance provided relates to cybersecurity (Amazon, Cisco Technologies, Google, Mandiant, Microsoft, Oracle, Recorded Future). Apple and Google deactivated their maps services, but it is unclear how critical this is from a military perspective. AI-related assistance came more clearly from Clearview AI, Palantir, and Primer.

Some of these companies are traditional telecommunications providers, but the list notably includes key players that could be seen as part of the New Defense trend, either the technology giants (GAFAM) or specialized newcomers (Palantir, Planet Labs, Fortem). It also includes, as frequently noted in the reporting on the war, Elon Musk's companies Space X and Tesla. According to Bresnick et al. (2024), some of services they provided to Ukraine had military value. For instance, Clearview AI supplied facial recognition services, Fortem Technologies deployed counter-UAS systems, Maxar provided imagery, Palantir assisted with targeting, and Space X famously deployed the Starlink satellites.

When it comes to some of the more defense-focused companies such as Palantir, Europe tries to build credible competitors. For instance, in France, Thales and Athos established the joint venture Athea, under government steering, to try to build a French equivalent to Palantir (Dèbes 2021). However, this effort appears to be domestically focused rather than a European-wide collaboration. European initiatives that try to foster such collaboration include the EU Defence Innovation Scheme (EUDIS).

POLICY CONCLUSIONS

New Defense is a diversification of private actors involved in the defense market and a transformation of businesses and procurement practices in the arms industry. Currently underway on both sides of the Atlantic, the process is more advanced in the US, as evidenced by the emergence of new key players in the defense sector.

The contribution of New Defense to military capabilities has become more obvious with their implications for the war in Ukraine. However, this concerns mostly US companies, not European ones. Although this paper relied on a limited sample, it was challenging to uncover military assistance from European technology companies to Ukraine, aside from a few examples (Helsing, Traversals, Preligens). It could be that deeper research would yield more results, or that some European New Defense companies are active in Ukraine but that this does not surface in open sources.

Lagging behind in the New Defense sector creates several challenges for Europe. First, the lack of an equivalent to GAFAM or Space X could create military vulnerabilities. While this absence is the focus of debates on European digital sovereignty (Madiega 2020), the gap this generates in terms of military capabilities deserves more focused attention. Second, the limited number of New Defense companies in Europe undermines the continent's strategic credibility. These new players will become part of the backbone of military

capabilities on future battlefields. As efforts to ramp up ammunition production are underway, the New Defense arena should not be forgotten.

REFERENCES

Barberini, P. (2020), *Military Technology: Risks and Opportunities for the Atlantic Alliance*, Istituto Affari Internazionali (IAI), https://www.iai.it/en/pubblicazioni/military-technology-risks-and-opportunities-atlantic-alliance.

Béraud-Sudreau, L. and A. Pannier (2021), "An 'Improbable Paris-Berlin-Commission Triangle': Usages of Europe and the Revival of EU Defense Cooperation after 2016", *Journal of European Integration* 43, 295–310.

Borchert, H., T. Schütz and J. Verbovsky (2023), *Master and Servant. Defense AI in Germany*, Defense AI Observatory Study 23/12, https://defenseai.eu/wp-content/uploads/2023/03/daio_study2312_master_and_servant_borchert_schuetz_verbovszky.pdf.

Bresnick, S., N. Luong and K. Curlee (2024), *Which Ties Will Bind? Big Tech, Lessons from Ukraine, and Implications for Taiwan*, Center for Security and Emerging Technologies (CSET), https://cset.georgetown.edu/publication/which-ties-will-bind/.

Brockmann, K. and N. Raju (2022), *NewSpace and the Commercialization of the Space Industry: Challenges for the Missile Technology Control Regime*, Stockholm International Peace Research Institute (SIPRI), https://www.sipri.org/publications/2022/policy-reports/newspace-and-commercialization-space-industry-challenges-missile-technology-control-regime.

Chatham House (2022), "Situational Assessment of Russia's Military Deployments against Ukraine", 17 February, https://www.chathamhouse.org/events/all/research-event/situational-assessment-russias-military-deployments-against-ukraine.

Dèbes, F. (2021), "Atos et Thales à l'assaut de Palantir avec Athea", *Les Echos*, 2 June, https://www.lesechos.fr/tech-medias/hightech/atos-et-thales-a-lassaut-de-palantir-avec-athea-1320262.

Delair (2024), https://delair.aero/press/delair-envoie-150-drones-aux-forces-ukrainiennes/.

Dunne, J. P. and E. Sköns (2021), "New Technology and the U.S. Military Industrial Complex", *The Economics of Peace and Security Journal* 16/2, 5–17.

Ek, D. and T. Enders (2022), "Europe's Need to Catch Up with Software-led New Defense", *Politico*, https://www.politico.eu/article/europes-need-to-catch-up-with-software-led-new-defense/.

European Commission, European External Action Service (2024), *A New European Defence Industrial Strategy: Achieving EU Readiness through a Responsive and Resilient European Defence Industry*, https://defence-industry-space.ec.europa.eu/edis-joint-communication_en.

Franke, U. and J. Söderström (2023), *Star Tech Enterprise: Emerging Technologies in Russia's War on Ukraine*, European Council on Foreign Relations (ECFR), https://ecfr.eu/publication/star-tech-enterprise-emerging-technologies-in-russias-war-on-ukraine/.

Gosselin-Malo, E. (2023), "Portuguese Firm to Provide Drones to Ukraine through British-led Fund", *C4ISR*, 16 June, https://www.c4isrnet.com/unmanned/2023/06/16/portuguese-firm-to-provide-drones-to-ukraine-through-british-led-fund/.

Graae, A. (2023), *Servers Before Tanks? Defence AI in Denmark*, Defense AI Observatory Study 23/18, https://defenseai.eu/wp-content/uploads/2023/11/daio_study2318_servers_before_tanks_andreas_graae.pdf.

Intelligence Online (2023), "Tekever Drones Become Kyiv's ISR Tool of Choice", 4 September, https://www.intelligenceonline.com/surveillance--interception/2023/09/04/tekever-drones-become-kyiv-s-isr-tool-of-choice,110038734-art.

Liang, X., L. Scarazzato et al. (2023), *The SIPRI Top 100 Arms-producing and Military Services Companies*, 2022, SIPRI, https://www.sipri.org/publications/2023/sipri-fact-sheets/sipri-top-100-arms-producing-and-military-services-companies-2022.

Madiega, T. (2020), "Towards a More Resilient EU. Digital Sovereignty for Europe", *European Parliamentary Research Service (EPRS) Ideas Papeer*, https://www.europarl.europa.eu/RegData/etudes/BRIE/2020/651992/EPRS_BRI(2020)651992_EN.pdf.

Martin, K. and L. Liversain (2023), *A Winding Road Before Scaling-Up? Defense AI in France*, Defense AI Observatory Study 23/17, https://defenseai.eu/wp-content/uploads/2023/09/daio_study2317_a_winding_road_before_scaling-up_kevin_martin_lucie_liversain.pdf.

Meaker, M. (2023), "A Battlefield AI Company Says It's One of the Good Guys", *Wired*, 28 July, https://www.wired.com/story/helsing-ai-military-defense-tech/.

Ministry of Strategic Industries of Ukraine (2024), "AI in Ukrainian-made Drones: Ministry of Strategic Industries and Helsing Sign Memorandum of Understanding", https://mspu.gov.ua/en/news/ai-in-ukrainian-made-drones-ministry-of-strategic-industries-and-helsing-sign-memorandum-of-understanding.

Nordic Wing, https://nordic-wing.com/press/.

Pannier, A. (2023), "Entre la guerre et la recherche : maîtriser les technologies critiques dans la recomposition", *Le Grand Continent*, https://legrandcontinent.eu/fr/2023/02/15/entre-la-guerre-et-la-recherche-maitriser-les-technologies-critiques-dans-la-recomposition/.

PR Newswire (2023), "Jacob Helberg Issues an Open Letter to the US Government, Co-Signed by Leading Defense Technology Companies", 15 September, https://www.prnewswire.com/news-releases/jacob-helberg-issues-an-open-letter-to-the-us-government-co-signed-by-leading-defense-technology-companies-301929140.html.

Preligens (2023), "Tip&Cue Episode #13 RUSSIA-UKRAINE: Key Detections over a Year of Conflict", https://preligens.com/resources/insights/tipcue-episode-13-russia-ukraine-key-detections-over-year-conflict.

Quantum Systems (2022), "Long-endurance Reconnaissance Drones from German Manufacturer Quantum-Systems in Operation in Ukraine", 1 August, https://quantum-systems.com/long-endurance-reconnaissance-drones-from-german-manufacturer-quantum-systems-in-operation-in-ukraine/.

Rhode, B. (2024), "Europe Without America", *Survival* 66(2), 7–18.

Soare, S. R., P. Singh and M. Nouwens (2023), *Software-defined Defence: Algorithms at War*, International Institute for Strategic Studies (IISS), https://www.iiss.org/research-paper/2023/02/software-defined-defence/.

The Economist (2023a), "Can America's Weapons-makers Adapt to 21st-century Warfare?", https://www.economist.com/business/2023/11/01/can-americas-weapons-makers-adapt-to-21st-century-warfare.

The Economist (2023b), "A Startup Called Anduril Has Unveiled a Reusable Missile", https://www.economist.com/science-and-technology-/2023/12/07/a-startup-called-anduril-has-unveiled-a-reusable-missile.

Traversals (2024), *Ukraine Dynamic Frontline Monitoring*, https://traversals.com/products/ukraine-dynamic-frontline-monitoring/.

Anita Dietrich, Florian Dorn, Clemens Fuest, Daniel Gros, Giorgio Presidente, Philipp-Leo Mengel and *Jean Tirole*

Europe's Middle-Technology Trap

KEY MESSAGES

- **The Lisbon strategy of the year 2000 failed: the share of R&D spending in Europe remains below the 3 percent of GDP target, far behind that of the US and China**
- **EU companies spend much less on R&D than their US peers and concentrate their innovation activities on mid-tech instead high-tech industries. Mid-tech sectors, however, tend to have lower growth rates and generate incremental innovations rather than large, disruptive ones**
- **Consequently, Europe currently lags in high-tech sectors (IT hardware, software, biotechnology, pharmaceuticals) and is losing ground to the US in terms of productivity, competitiveness, and economic growth**
- **EU funding for innovation is too small and needs reforms to focus more on disruptive leap innovations that foster business dynamics**

Research and development (R&D) are key drivers of innovation and, consequently, of future productivity and competitiveness of national economies. This is particularly true when these activities produce disruptive innovations that foster the emergence of new high-tech industries and the dissemination of key technologies. Innovations are crucial for addressing major societal challenges, such as climate change, the decarbonization of the economy, health issues, and demographic change. In Europe, however, innovations are occurring less frequently in emerging fields like artificial intelligence, being instead more driven by engineering expertise in established sectors such as the automotive industry. Europe is stuck in a Middle-Technology-Trap,[1] in which R&D investment is geared towards established sectors. Despite the inherent uncertainty regarding which sectors will drive future growth, there are indications that these established sectors may no longer be among the primary growth engines.

[1] The article is partly based on the policy report by Fuest et al. (2024); see also Dietrich et al. (2024).

EU SPENDS LITTLE ON RESEARCH AND DEVELOPMENT

A common input-oriented measure of innovation activities and the future competitiveness of a country or economic area is total R&D spending. The so-called 3 percent target of the Lisbon Strategy in 2000, according to which 3 percent of gross domestic product (GDP) was to be spent on research and development by 2010 to increase EU competitiveness, has not yet been achieved. In the EU, R&D expenditure by the private and public sectors was 2.2 percent of GDP in 2021, while in the US it was 3.5 percent, more than 50 percent higher relative to economic strength. In absolute terms, R&D expenditure in the US (EUR 730 billion in 2021) was more than twice the EU's (EUR 322 billion), with the gap widening over time (Figure 1). Italy and Spain, for example, invest comparatively little in R&D, with less than 1 percent of GDP at the end of the 1990s. By 2021, however, both countries managed to increase their R&D expenditure to almost 1.5 percent of GDP. France was in line with the EU average in 2021, at 2.2 percent of GDP. Germany, in turn, with total (private and public) R&D expenditure of around 3.1 percent of GDP in 2021, is in a comparatively good position compared to other EU countries. However, it still does not meet the target set by the German government in its current High-Tech Strategy 2025, which aims to increase total R&D expenditure by the private and public sectors to 3.5 percent of GDP by that year.

Clearly, European countries are losing ground to the US in terms of R&D spending and innovation ef-

Anita Dietrich

is a Scientific Manager at the ifo Center for Industrial Organization and New Technologies.

Florian Dorn

is Director of EconPol Europe, and Senior Secretary to the President of the ifo Institute. He is a Lecturer in Economics at the University of Munich.

Clemens Fuest

is the President of the ifo Institute, and Professor of Economics and Director of the Center for Economic Studies (CES) of the University of Munich.

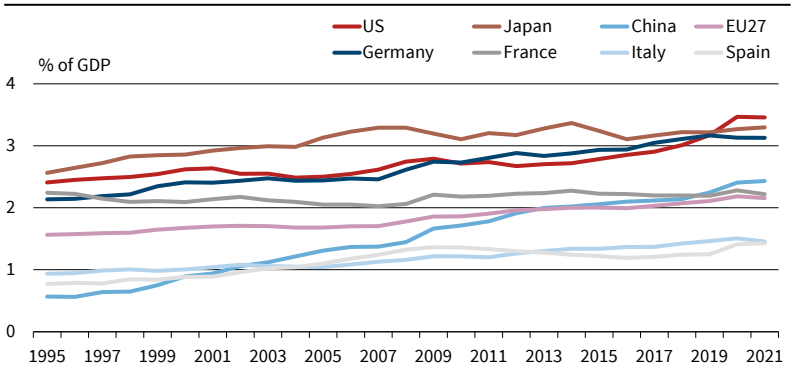
forts. Furthermore, China has continuously and visibly increased its R&D expenditure over the past 25 years, from less than 0.6 percent of GDP in 1995 to 2.4 percent in 2021, quickly outpacing the EU's innovation efforts. Japan's R&D investment has outstripped the EU's for decades, standing at 3.3 percent of GDP in 2021, and was only overtaken by the US in 2020 (Figure 1).

Differences become more relevant by looking at the composition of R&D spending. While the share of public spending on research and development relative to GDP is similar in the EU and the US, the differences mainly arise because European companies invest less than US ones, with the EU share of 1.2 percent of GDP only about half that in the US (2.3 percent of GDP). Meanwhile, US companies account for 67 percent of R&D expenditure in their country, against 57 percent for companies in the EU.

Figure 1

Gross Expenditure on Research and Development

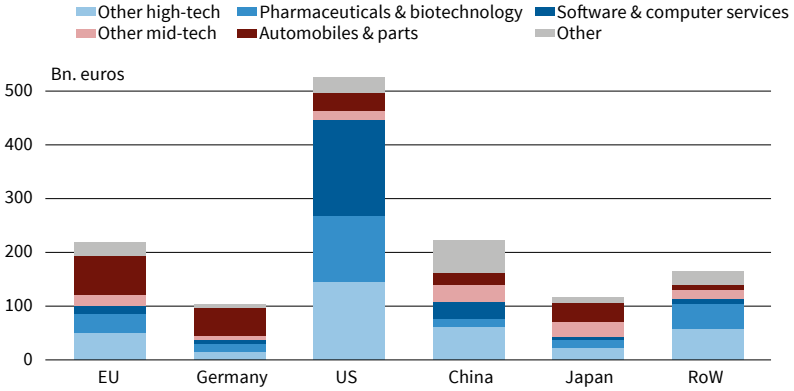
National private and public expenditure on R&D



Source: OECD. © ifo Institute

Figure 2

Private Sector R&D Expenditure (Berd) by Tech Level (Top 2,500 Companies)



Source: EU Industrial R&D Scoreboard 2023. © ifo Institute

EU COMPANIES FOCUS ON MIDDLE-TECHNOLOGY

Innovation activities in the EU and the US differ not only in terms of R&D expenditure, but also in terms of the technology fields on which they focus their investments. Private R&D expenditure in the EU is concentrated in so-called mid-tech industries, which include cars and industrial machinery, chemicals or telecommunications systems, as the sectoral composition of business R&D expenditure (BERD) shows (Figure 2), with the automotive sector spending the most on research and development among all sectors. In contrast, US companies focus 85 percent of their R&D expenditures on high-tech industries, particularly in the fields of software and computer services, as well as pharmaceuticals and biotechnology. In the EU, private-sector expenditure is evenly split, at 45 percent each, between in high-tech and mid-tech industries. The sectoral composition of business R&D expenditure by EU-headquartered firms is more similar to that of Japan and China than that of the US. Interestingly, German companies spent roughly as much on R&D as all the companies in the rest of the EU combined, with the share of mid-tech industries even higher, at 57 percent (high-tech share: 36 percent; others: 7 percent). That said, private R&D spending in Germany concentrates on the automotive industry, while companies from other EU countries invest comparatively more in the pharmaceutical industry and other high-tech sectors. This concentration on the automotive sector represents a major risk for the resilience of the German economy and could explain some of its recent structural problems.

Some may argue that the EU's focus on mid-tech is not a problem, since the sectoral composition of R&D spending in different economies could simply reflect an efficient international division of labor in which the EU focuses on its comparative advantages. At the same time, however, it should be noted that the sectors classified as high-tech have been growing faster than the mid-tech ones for many years (see below for a detailed discussion).

PATENT ACTIVITY: LOWER INNOVATION OUTPUT IN EUROPE

R&D expenditure is not the only measure of countries' investment efforts to foster innovation: another yardstick is patent activity, which is more likely to be seen as the output of these efforts. In this regard, the trend points to Europe falling behind the US and China in

Daniel Gros

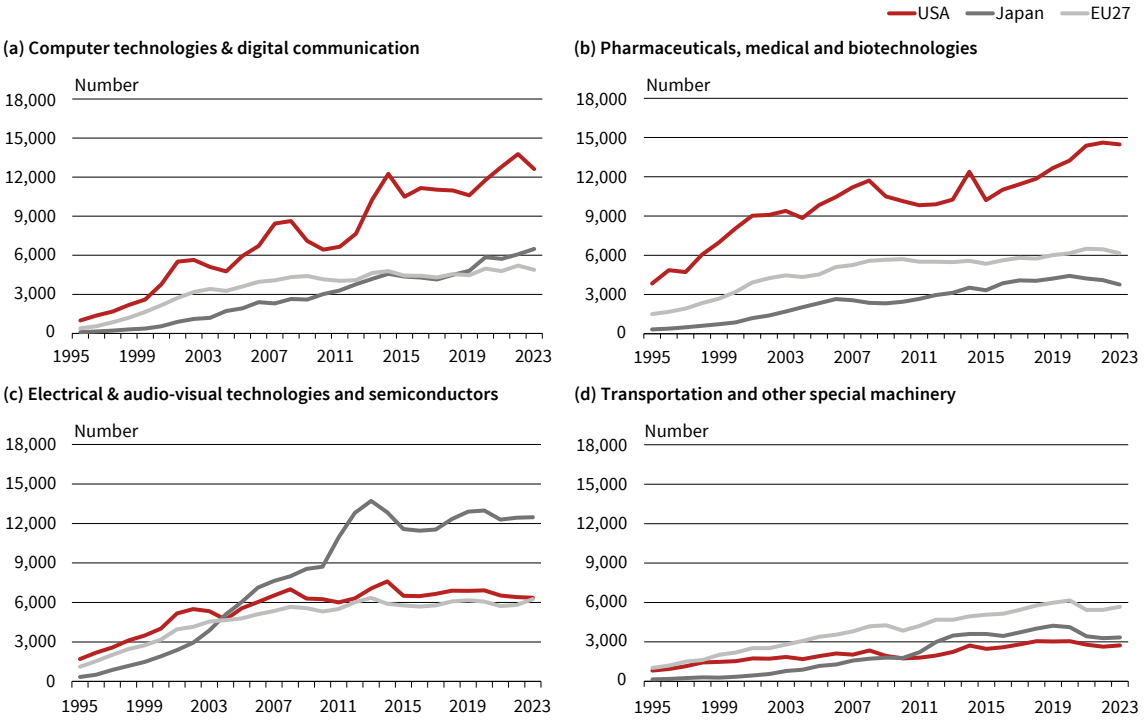
is Director of the Institute for European Policymaking at the Bocconi University, Milan.

Giorgio Presidente

is a Research Associate at the Institute for European Policymaking at the Bocconi University, Milan.

Figure 3

International Patent Applications by Technology Field



Note: Panel (a) summarizes PCT applications in the WIPO technology fields "Computer technology" and "Digital communication" (share of all PCT applications: 15.1 % in 2010, 19.6 % in 2023). Panel (b) summarizes PCT applications in the WIPO technology fields "Medical technology", "Pharmaceuticals" and "Biotechnology" (share: 16.3 % in 2010; 15.0 % in 2023). Panel (c) summarizes PCT applications in the WIPO technology fields "Electrical machinery, apparatus, energy", "Audio-visual technology", "Semiconductors", and "Optics" (share: 18.7 % in 2010, 17.7 % in 2023). Panel (d) summarizes PCT applications in the WIPO technology fields "Transport" and "Other special machines" (share: 7.7 % in 2010, 6.7 % in 2023).
Quelle: WIPO.

recent years, and that Europe's innovation efforts – again – are mainly focused on mid-tech industries.

In 2023, around 270,000 Patent Cooperation Treaty (PCT) applications[2] were filed with the World Intellectual Property Organization (WIPO) from all over the globe. China filed the most applications, with just under 70,000, followed by the US (55,700), Japan (48,900) and the EU27 (46,500), with all four accounting for over 80 percent of global patent applications. The number from China has risen rapidly since 2010 and continues to show very high growth rates. However, this could be partly due to government subsidies for patent applications (Prud'homme 2012). In some cases, moreover, quantity certainly outweighs quality (USPTO 2021). For this reason, the figures for China need to be taken with caution. Since it is not possible to disentangle the real from subsidy-induced Chinese patent activity, we concentrate the further analysis of patent data by technology field for the EU, US and Japan. Each region tends to specialize in a different technology field.

European countries are not at the forefront of patent applications[3] in high-tech sectors. In 2023, most PCT applications were published in the field of computer technology, followed by applications for new patents in the digital economy, mainly by applicants from the US (Figure 3a).[4] These two high-tech sectors, which are regarded as indicators of future growth and competitiveness, together accounted for around 20 percent of all PCT applications in 2023 (2010: 15 percent), with their PCTs growing the fastest compared to other fields since 2010, at rates of more than 10 percent . On average, the number of published PCT

Philipp-Leo Mengel

is a PhD Candidate at Bocconi University, Milan, and the University of Chicago.

Jean Tirole

is Honorary Chairman of the Foundation JJ Laffont-Toulouse School of Economics (TSE) and of the Institute for Advanced Study in Toulouse (IAST), and Scientific Director of TSE-Partnership. He was awarded the "Nobel Prize in Economics" in 2014.

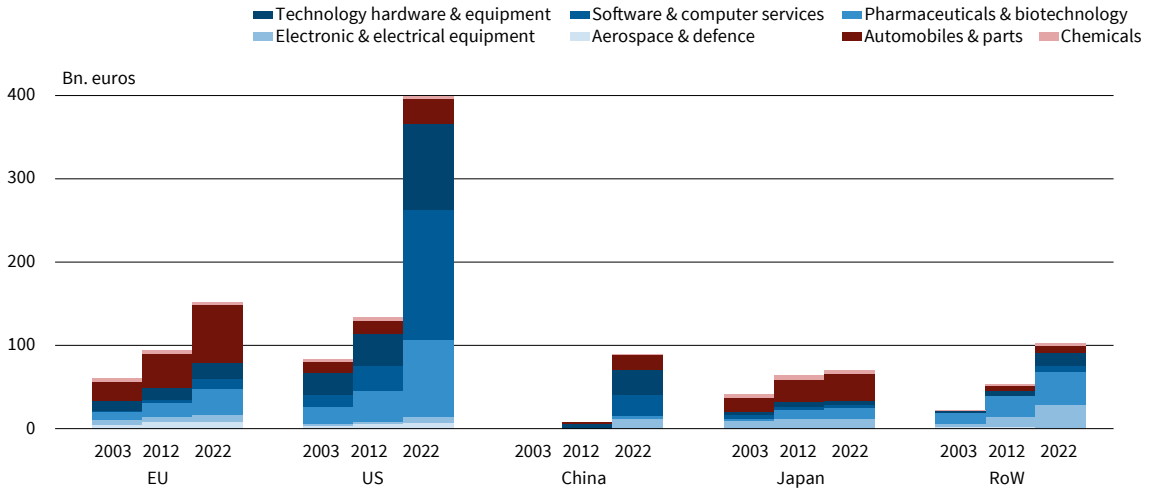
[2] If the patent is accepted in the so-called "international phase," applicants in so-called "national phases" can (but do not have to) simultaneously seek patent protection for their invention in a large number of countries, so that it de facto becomes an "international" patent. Further information can be found at https://www.wipo.int/portal/en/index.html. Statistical database of the WIPO; https://www3.wipo.int/ipstats/pmh-search/pct.

[3] WIPO assigns the PCT applications to 35 fields of technology based on the International Patent Classification (IPC). For confidentiality reasons, data on PCT applications by technology field is only available after publication (after 18 months of examination in the so-called "international phase").

[4] More than 30 percent of Chinese PCT applications in 2023 were in computer and digital technologies. Together with more than 20 percent in electrical, audio-visual and semiconductor technologies, more than half of the strong increase in Chinese innovation output can be attributed to these technology fields.

Figure 4

Private Sector R&D Expenditure (Top 500 Companies)



Source: EU Industrial R&D Scoreboard. © ifo Institute

applications has increased by around 5 percent per year since 2010. However, Europe has missed the boat in the past two decades when it comes to the growth drivers of the computer and digital economy. On the contrary, Europe has hardly seen any growth in patent applications. The situation is similar in the EU in terms of patent applications in the high-tech sectors of medical technology, pharmaceuticals and biotechnology. Although Europe has recorded slight growth here in recent years, the US has held the top position by a growing margin for decades (Figure 3b). Patents in the healthcare and pharmaceutical industries account for a solid 15 percent of PCT applications. Together with the other high-tech sectors of the computer and digital economy, this amounted to around 35 percent of all published PCT applications in 2023.

While the US has become more specialized in its patent applications in computers and digital communications over the past two decades, Japan has built up a clear lead over the US and the EU in PCT applications in the technology fields of electrical (7.9 percent) and audio-visual (3.6 percent) machines and devices, as well as optical (2.7 percent) and semiconductor (3.5 percent) technologies (Figure 3c). Together, these technology fields account for almost 18 percent of international patent applications and are therefore of great importance. In contrast, the increase in the number of international patent applications in the EU occurred in the field of transportation, which also includes the automotive industry, as well as in "other special machinery," clearly expanding its lead in the field (Figure 3d). Germany alone is already on a par with the US and Japan in the transport technology and special machinery fields. Still, the technology fields in which Europe leads in patent applications tend to be mid-tech, which accounted for only 6.7 percent of PCT patent applications in 2023 (2010: 7.7 percent).

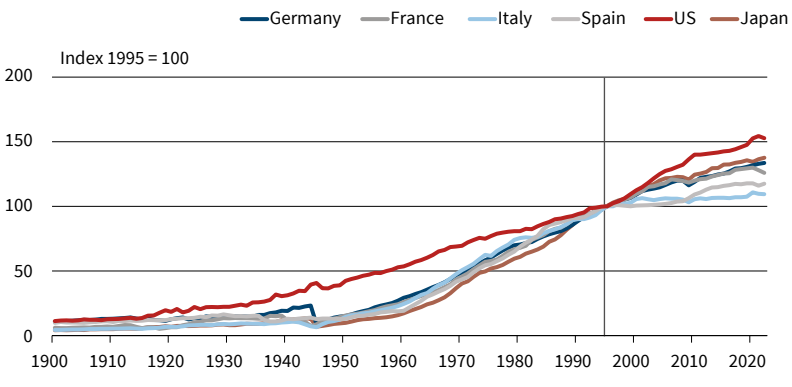
PATH DEPENDENCE IN EUROPE

While private R&D spending has almost doubled in the EU over the past two decades, it has quadrupled in the US. The sharp rise in private-sector R&D expenditure in the US is driven by high-tech sectors, particularly software (Figure 4), which accounted for a large fraction of the strong US growth in private R&D spending between 2012 and 2021. Similarly, China appears to be pursuing a strategy of concentrating its R&D efforts on high-tech sectors rather than mid-tech ones. China's private-sector expenditure reached the same level as Europe in the high-tech industries already in 2022. In Europe, by contrast, there has been almost no change in the sectoral distribution of private sector R&D expenditure over the past 20 years. In 2003, two of the three top US R&D spenders were in the automotive industry, but this changed over time. The software industry (ICT services and producers) became more and more important over the years; by 2022, all top-3 spenders are software companies

Figure 5

Long-term Development of Labor Productivity

Productivity per hour worked



Source: Long term-Productivity Database 2024. © ifo Institute

Table 1

Top-3 R&D Spenders by Region and Their Industries Compared over Time

	2003	2012	2022
US	Ford (auto) Pfizer (pharma) General Motors (auto)	Microsoft (software) Intel (hardware) Merck (pharma)	Amazon (software) Alphabet (software) Meta (software)
EU	Mercedes (auto) Siemens (electronics) VW (auto)	VW (auto) Mercedes (auto) Bosch (auto)	VW (auto) Mercedes (auto) Bosch (auto)
Japan	Toyota (auto) Panasonic (electronics) Sony (electronics)	Toyota (auto) Honda (auto) Panasonic (electronics)	Toyota (auto) Honda (auto) NTT (telecom)

Note: Amazon does not report R&D investment, but only a combined figure for "Technology and Content" investment in its accounts. Since no information is given on how to extract the R&D component, Amazon is not listed in the EU Industrial R&D Investment Scoreboard. However, using statements in Amazon's accounts it is estimated that Amazon's R&D is likely larger than Alphabet's. That is why Amazon should probably have been #1 in the R&D ranking.

Source: EU Industrial R&D Investment Scoreboard (2023); ifo Institute.

(Table 1). In fact, the top-5 in worldwide R&D investment are from the US and all belong to the software and ICT industry: Amazon, Alphabet, Meta, Microsoft, Apple.[5] The following comparisons also shows how dominant the US is in terms of private-sector R&D spending. In 2022, Meta (rank 3) alone spent more on research and development as the top-50 companies in France; in fact, based on company figures, it can be assumed that Amazon even spent more on R&D than the total (private and public) R&D expenditure of the second-largest European economy.

In the EU and Japan, the automotive industry dominated throughout the 20-year period. These patterns are consistent with the literature on path dependency of innovation and industrial specialization in developed economies (e. g., Acemoglu 2023). Around half of private-sector R&D in the EU flows into the mid-tech industry, particularly the automotive industry, and half into the high-tech industry. One could argue that the delimitation of industries is problematic in that there has been a strong build-up of IT within the European automotive industry, for example among German carmakers (see Falck et al. 2023).[6] However, German carmakers keep making headlines with their IT problems, especially in the context of the switch to electric vehicles.

Comparative Advantage of the EU Automotive Industry Is Dwindling

European companies are leaders in the automotive industry, while the US dominates in the software industry. However, the EU is much less dominant in the automotive industry than the US is in the software industry. In 2022, US companies accounted for around three quarters of all global R&D expenditure in the software sector, compared to the EU companies' 6 percent share. EU companies, on the other hand, accounted for 45 percent of the global R&D expenditure in the automotive industry, while Japan, the US, and other regions contributed just below 20 percent each. While the EU still enjoys a comparative advantage over other regions in car manufacturing, it runs the risk of losing its competitive edge as the world moves from the internal combustion engine towards electric vehicles, and ultimately being overtaken by the US and China.

Middle-Technology Trap

There are inherent risks in focusing R&D efforts on incremental improvements to mature technologies, such as in the automotive industry, since such industries offer limited potential for high, sustainable growth. Fostering innovation in high-tech sectors, in contrast, offers significantly higher growth potential. Revenues and profits in the high-tech sectors have grown much faster than in other sectors in all major economic regions – the EU, US, Japan, and China – over the past 20 years. Mid-tech industries had lower profit margins than high-tech ones in all the world regions.

Between 2020 and 2022, the profit margin was on average 5.5 percentage points lower in the EU than in the US. However, the transatlantic difference in profit margins was even larger for high-tech industries (6 percentage points) than for mid-tech ones (less than 2 percentage points). Still, the incentive to transition from mid- to high-tech sectors should not be measured by the transatlantic gap, but by the difference in profitability within each region. Europe's incentive to move up the tech ladder was much lower, with high-tech profit margins being only about 3 percentage points higher than mid-tech ones, whereas in the US the difference between high-tech and mid-tech industries was about 7 percentage points.

High-tech revenue in the US exceeded that of mid-tech sectors in 2015. In the EU, Japan, and China, in contrast, it was mid-tech companies that generated the largest share of revenue in the economy. The share of R&D expenditure in the revenue of high-tech industries has risen from 8 percent to 13 percent in the US over the past 20 years, while it has remained at around 9 percent in the EU over the same period. China shows a similar pattern to the US, while Japan is more similar to the development in the EU. In contrast, R&D expenditure as a share of revenue in mature technologies (mid-tech industries) has remained constant at around 3 percent in all regions of the world for 20 years (including some minor fluctuations). This suggests that R&D intensity in established mid-tech industries is not significantly influenced by region-specific factors and that the constancy is possibly due to the maturity of the technologies in these industries. Following the reasoning that the persistent concentration of EU companies on established mid-tech technologies is problematic, one may argue that Europe is caught in a "middle technology trap."

[5] Half of the world top-50 private companies in R&D investments are from the US, 12 are from the EU.
[6] The same applies to the development of skills and innovation with green technologies in industry (Falck and Kaura 2023).

EU LOSES COMPETITIVENESS

High levels of investment in fast-growing high-tech sectors in the US correlate with an increasing economic disparity between the US and the EU. This is starkly illustrated by the fact that none of the newly established, world-leading technology companies come from Europe. This disparity also becomes clear when looking at the development of labor productivity (Figure 5). By the mid-1990s, EU countries had been catching up with the US. Labor productivity in the major EU countries – Germany, France, Italy, and Spain – rose more strongly than in the US after the end of the Second World War and had reached the same level of productivity per hour worked before the turn of the millennium. However, this trend has since reversed, with the EU falling behind the US once again. In the US, labor productivity has increased more strongly since the turn of the millennium than before. Over the same period, growth in the four major Eurozone countries has slowed. Between 1995 and 2022, labor productivity rose by almost 53 percent in the US, but only by 34 percent and 26 percent in Germany and France, and by 17 percent and 9 percent in Spain and Italy. At 37 percent, labor productivity in Japan has also grown faster than in the four major Eurozone economies since the turn of the millennium, although here too growth has not kept pace with that in the US. In 2022, the productivity level of the four major Eurozone countries was therefore almost 20 percent lower than in the US. Germany achieved almost 94 percent of US labor productivity, France 89 percent, Italy and Spain only 74 percent and 72 percent respectively. However, at 67 percent of the US level, Japan was still behind the Europeans, although the gap to Europe has narrowed over the past two decades. Although labor productivity is influenced by many factors, innovations play a crucial role in productivity development and future economic growth.

EU INNOVATION POLICY – ROLE MODEL USA?

EU innovation policy has failed to reduce the US's technological lead. On the contrary, the gap has widened over the past two decades. A closer look at the structures of R&D funding policy in the EU and the US reveals that the European funding landscape for R&D activities is complex. The flagship program for R&D in the EU is Horizon Europe (HE, 9th Framework Program for Research and Technological Development), with a total budget of 95.5 billion euros over 7 years (2021–2027) – almost 14 billion euros per year. It consists of several funding programs in three program pillars (Pillar I: Scientific Excellence, Pillar II: Industrial Competitiveness, Pillar III: Innovative Europe) and many agencies, each pursuing specific goals while having different governance structures. One example is the European Innovation Council (EIC), which is located in Pillar III alongside the instruments of the European Innovation Ecosystems (EIE) and the European Institute of Innovation and Technology (EIT). The EIC strives for market-creating innovations that pave the way for radically new, ground-breaking products, services, processes and business models (so-called "breakthrough innovations").

Promoting Breakthrough Innovations – DARPA versus EIC

One of the main functions of strategic innovation policy – the promotion of breakthrough innovations that are far removed from market applications and therefore not privately funded – is given too little importance in the European context. This is particularly evident in a direct comparison with the Defense Advanced Research Projects Agency (DARPA) in the US which is widely regarded as a leading example in this field and served as a model for the EU's flagship program for the European Innovation Council (EIC).[7] The EIC oversees three main funding schemes: Pathfinder (EUR 0.35 bn), Transition (EUR 0.11 bn) and Accelerator (EUR 0.41 bn).[8] Only the first two of these programs finance the types of low-TRL (technological readiness levels) projects that are too early for private-sector investment or for market applications and typical of the DARPA model. So less than 5 percent (approximately EUR 470 million) of the EU's annual R&D budget is earmarked for a "DARPA-like" program (a good tenth of DARPA's budget) to support breakthrough innovations that have the potential to create new markets but are remote from commercial applications. A significant portion of this amount (around 70 percent) is reserved for EU SMEs and start-ups. Whether such a high proportion for SMEs is justified is questionable and seems more likely to improve access to the capital market for smaller companies (to compensate for the shallow European capital market for start-ups). That said, there is also evidence that it is precisely the smaller companies – especially in the software sector – that are more likely to produce disruptive innovations (Akgicit and Stantcheva 2020).

DARPA spends around 4 billion US dollars a year, of which only a fraction (around 100 million) flows into the US SME funding programs (SBIR and STTR). DARPA strives for disruptive innovations, not just incremental ones. Less than half of its budget is aimed at further developing existing products and services. Instead, greater emphasis is placed on basic and applied research that has no direct commercial purpose. Just under 60 percent of the funding goes to general (basic and applied) research, while the EIC devotes less than 40 percent to general research projects. Finally, compared to the EIC, DARPA focuses its funding more on research institutions rather than on private

[7] See Fuest et al. (2020) for a detailed comparison.
[8] The figure provides the breakdown of the average 2021–2022 R&D grants paid by the EU through its various research and innovation programs (Source: CORDIS).

companies. DARPA and EIC also differ greatly in their governance, personnel, and management structure. The application procedures and selection processes for EU projects appear extremely bureaucratic compared to those in the US, and are subject to a rigid and complex set of rules and mandated collaborations; and the disbursement of funding is slow. In addition, the EIC is mostly led by a few EU officials rather than a larger number of top scientists like in the US, where top scientists are given much more competencies as program managers. These serious governance issues may undermine EIC's mission of boosting breakthrough innovations.

POLICY IMPLICATIONS

Our key finding is that R&D investment in the EU is concentrated in sectors, including the automotive industry, that are classified as mid-tech, while in the US it is high-tech that dominates, including the digital economy, and the healthcare and pharma industries. This raises two questions: (1) Will the EU as a result fall behind economically in the medium term? (2) Can and should European policymakers choose a new path and, if so, how?

First, it is tempting to think that the patterns observed could reflect a sensible international division of labor and specialization in which EU companies concentrate on what they do best. However, given the manifold influences of state-imposed conditions for research and development and the considerable path dependences in this area, attributing the current situation solely to efficient market processes is unconvincing. It could also be argued that the classification of sectors as mid-tech or high-tech is questionable because it suggests that the high-tech sectors are necessarily more promising than the mid-tech ones. While it is hardly possible to predict today in which sectors the European economies will be able to achieve particularly high value added and profits in the future, it is clear that high-tech industries do show higher growth rates. Unsurprisingly, it is also in these industries that the volume of R&D expenditure is growing fastest. However, it is risky, to say the least, to stick to the idea of mere division of labor, since there is no doubt that the major EU economies are currently falling behind in terms of R&D investment.

Second, what are the economic policy implications of these findings? Simply calling for more government R&D funding to be channeled into high-tech industries is not enough. While the volume of government R&D spending shows little difference between the US and the EU, the corresponding spending structure is quite different, as is the size of private-sector expenditure. Even if there are some doubts about whether the European economy can develop any competitive advantages in the high-tech area, policymakers at both the European and national levels should examine the frameworks they have created to foster innovation. The main reforms we propose for the EU to stay relevant in the innovation front are:

1. The EIC should focus on its core mission of supporting breakthrough innovation (low-TLR activities) rather than funding venture capital for start-ups or supporting SMEs.
2. A large part of the budget of the European Institute of Innovation and Technology (EIT), which has a similarly large budget to the EIC but does not seem to be an effective policy approach, should be reallocated to the EIC.
3. The EIC's governance structure should be reformed to streamline decision-making, reduce the influence of the European Commission, and, crucially, give more say to highly qualified scientists and engineers on the EIC Board. That way, innovation policy should promote the best ideas in Europe, independent from political influences on the regional distribution of the funds or any requirements for cross-border collaborations.
4. Program managers who are experts in the fields of the projects under their purview should also be given more decision-making power.[9]
5. The effectiveness of national innovation funding institutions should be critically reviewed.

Furthermore, while better conditions for start-ups and the provision of venture capital are also necessary, these are primarily a task for policymakers at the national level. This involves the development of venture capital markets, changes in tax law, including loss offsetting, the reduction of red tape and better collaboration between basic research and industry.

Ultimately, EU member states will not be able to avoid prioritizing the promotion of R&D more strongly in their public budgets, regardless of the fact that the gap with the US exists above all in private innovation expenditure.

Finally, there is the perennial – and ever more urgent – call for a deepening of the single market and the removal of barriers to cross-border economic activity (in particular in services) at the European and national levels, since the lack of opportunities for scaling up leads many young companies to seek their fortunes in the US rather than in Europe. A better integration of the European single market for services harbors high growth potential (Dorn et al. 2024) – provided that the member states are willing to reduce barriers at the national level and to transfer corresponding competencies to the European federal level.

REFERENCES

Acemoglu, D. (2023), "Distorted Innovation: Does the Market Get the Direction of Technology Right?", *AEA Papers and Proceedings* 113, 1–28.

Akcigit, U. and S. Stantcheva (2020), "Taxation and Innovation: What Do We Know?", in A. Goolsbee and B. F. Jones, eds., *Innovation and Public Policy*, Chicago University Press, Chicago, 189–212.

[9] For a detailed discussion see Fuest et al. (2024). They formulate a policy proposal for a budget neutral but radical restructuring of the EU ecosystem for innovation.

Breitinger, J., B. Dierks and T. Rausch (2020), *World-class Patents in Future Technologies. The Innovative Power of East Asia, North America and Europe*, Bertelsmann Foundation, Gütersloh.

Dietrich, A., F. Dorn, C. Fuest, D. Gros, G. Presidente and P.-L. Mengel (2024), "EU-Innovationspolitik: Wie entkommt Europa der "Mid-tech-Falle"?", *ifo Schnelldienst* 77(4), 3–37.

Dorn, F., L. Flach and I. Gourevich (2024), "EU-Binnenmarkt stärken: Die ungenutzten Potenziale eines vertieften Dienstleistungshandels", *ifo Schnelldienst* 77(5), 24–29.

Grassano, N., H. Hernandez Guevara, P. Fako, E. Nindl, A. Georgakaki, E. Ince, L. Napolitano, F. Rentocchini and A. Tubke (2022), *The 2022 EU Industrial R&D Investment Scoreboard*, Publications Office of the European Union, Luxembourg.

Falck, O., N. Bunde and A. Wölfl (2023), *Competencies in the World of Work – Evaluation of Job Advertisements in Upper Bavaria*, ifo Institute, Munich.

Falck, O. and A. Kaura (2023), *Green Skills in German Manufacturing*, EconPol Policy Brief 55.

Fuest, C., N. Bunde, N. Czernich and O. Falck (2020), *European Public Goods: What Can Be Learned from the US ARPA System for the Promotion of Leapfrog Innovation in Europe?*, ifo Research Report 117, ifo Institute, Munich.

Fuest, C., D. Gros, P.-L. Mengel, G. Presidente and J. Tirole (2024), *EU-Innovation Policy: How to Escape the Middle Technology Trap?*, Policy Report of the IEP/TSE/EconPol-CESifo European Policy Analysis Group.

Nindl, E., H. Confraria, F. Rentocchini, L. Napolitano, A. Georgakaki, E. Ince, P. Fako, A. Tuebke, J. Gavigan, H. Hernandez Guevara, P. Pinero Mira, J. Rueda Cantuche, S. Banacloche Sanchez, G. De Prato and E. Calza (2023), *The 2023 EU Industrial R&D Investment Scoreboard*, Publications Office of the European Union, Luxembourg.

Prud'homme, D. (2012), *Dulling the Cutting Edge: How Patent-related Policies and Practices Hamper Innovation in China*, European Union Chamber of Commerce in China, Beijing.

United States Patents and Trademark Office (USPTO, 2021), *Trademarks and Patents in China: The impact of Non-market Factors on Filing Trends and IP Systems*, Alexandria VA.

David B. Audretsch

Entrepreneurship in the United States and Germany: Attaining the Promise of Innovation

KEY MESSAGES

- **If innovation is necessary to tackle the huge economic, political, and social challenges facing society, then entrepreneurship is needed to drive innovation**
- **Both Germany and the US are not only among the most innovative, but also among the most entrepreneurially active countries in the world**
- **Entrepreneurship in Germany and the US has both its strengths and its challenges**
- **The entrepreneurial challenge in Germany is to strengthen and maintain the traditional strengths of incremental innovative entrepreneurship, while building on the impressive transformative entrepreneurship that is taking root in large cities**
- **In contrast, the entrepreneurial challenge for the US is to continue to drive its radical and disruptive innovative entrepreneurship, while expanding the spread of entrepreneurship to less densely populated and more rural regions**

THE INNOVATION MANDATE

Nearly a quarter through this century, Western democracies are confronted with challenges that would have seemed unimaginable only a few short years earlier. The mandate for sustainability imposes dauting demands for enhancing the environment, distribution of wealth, and social inclusion across the entire spectrum of society. The European Union, along with member countries, adhere to "The Sustainable Development Goals (SDGs)" articulated by the United Nations 2030 Agenda for Sustainable Development "to eradicate poverty, find sustainable and inclusive development solutions, ensure everyone's human rights, and generally make sure that no one is left behind" (European Commission undated).

The viability of democracy itself is fundamentally challenged. It is not just the global wave of wars and hostilities that threaten democracy. Democracy is also threatened within, by totalitarian and authoritarian forces amassing power and influence. As Freedom House, the premier global institution monitoring the viability of democracy, warns, "acceptance of democracy as the world's dominant form of government – and of an international system built on democratic ideals – is under greater threat than at any point in the last 25 years" (Freedom House 2015). Within the arc of a generation, the conclusion that the "Fall of the Berlin Wall" had ushered in the undeniable triumph of democracy over totalitarianism, which was widely heralded as *The End of History* (Fukuyama 1992), has disintegrated.

All this comes at a time when economic growth has stalled throughout Europe and many of the OECD countries, rendering it that much more difficult to take on new challenges. In Germany, stagnant economic growth led The Economist (2023) to wonder, "Is Germany Once Again the Sick Man of Europe?" As Stelzenmüller points out, these four challenges are not isolated: "Germany had outsourced its security to the United States, its energy needs to Russia, and its export-led growth to China" (The Economist 2022).

Economic stagnation combined with unanticipated challenges and demands is tantamount to having to do more with less. Economic doctrine teaches us that there are two paths to respond to this dilemma. The first is the path paved by Thomas Malthus – acceptance of the finality of ever-increasing demands on limited resources and capacity. The second is what proved Malthus to be wrong – innovation.

IDEAS DRIVE INNOVATION

Innovation requires new ideas, or economic knowledge (Arrow 1962). Without new ideas, there can be no innovation (Romer 1986 and 1990). Research and development (R&D) is a key source generating new knowledge and ideas. While Germany remains among the R&D leaders in the EU, R&D expenditures as a share of gross domestic product (GDP) has been similar in Germany and the United States. The US spent USD 789 billion on R&D in 2021, or 3.34 percent of GDP. Germany spent EUR 121 billion, or 3.13 percent of GDP, on R&D in 2021. However, as Stelzenmüller alluded to, there are vast differences in how that R&D is allocated between Germany and Europe, on the one hand, and

David B. Audretsch

holds the Ameritech Chair in Economic Development at Indiana University and is Director of the Institute for Development Strategies. He also holds a professorship at the Alpen-Adria-Universität Klagenfurt.

the US, on the other hand. National defense accounts for a substantial share of R&D in the US but not in Germany. In the United States, 53 percent of R&D is funded by the government, of which 47 percent is allocated to the Department of Defense (NCSES 2023).

Both Germany and the United States rank among the global leaders in patented inventions. In 2022, Germany had 24,684 new patent applications (Statista 2023). There were 646,855 new patent applications in the United States in 2022 (Lexology 2023).

Industrial policy in the United States enhances not just the total amount of R&D but also its allocation toward targeted industries. Most notably, the 2022 *CHIPS and Science Act* authorized USD 50 billion for revitalizing the semiconductor industry to bolster American and national security, of which USD 11 billion was dedicated to semiconductor R&D through four specific programs – the CHIPS National Semiconductor Technology Center (NSTC) Program; the CHIPS National Advanced Packaging Manufacturing Program (NAPMP); the CHIPS Metrology Program; and the CHIPS Manufacturing USA Program (US Senate Committee on Science, Commerce, and Transportation 2022).

ENTREPRENEURSHIP

New knowledge and ideas emanating from R&D are not enough to generate innovative activity. Innovation also requires something else – the implementation or commercialization of those ideas into society. The widely known Swedish Paradox and European Paradox around the turn of the century described a paucity of innovation even with substantial R&D expenditures (Audretsch 2007). Even though Sweden undertook among the highest investments in R&D in the world, as a share of GDP, innovative activity in the country remained disappointing. Europe similarly expressed concern about the glaring gap between investments in knowledge and new ideas on the one hand, and actual innovative activity on the other hand (Audretsch 2007).

As Johan Wolfgang von Goethe observed, "Knowing is not enough; we must apply. Willing is not enough; we must do." However, not all ideas are good ones, in that they will result in innovation. Companies, financial organizations, and other non-profit organizations, such as universities and research institutions, all make decisions about which new ideas to pursue for innovation and to commercialize, and which have less potential. This decision-making process forms what has been characterized as the knowledge filter, which is the result of efforts to separate out the viable ideas from those with no promise of commercialized innovation (Audretsch et al. 2007).

Some of the ideas discarded by the knowledge filter in companies and other organizations are sufficiently promising to attract entrepreneurs to attempt to commercialize them by starting new companies. Entrepreneurship is crucial to innovation because it provides a conduit for the spillover of knowledge from the organization or company in which the new ideas are created to the new startup, where they are ultimately commercialized and implemented through innovative activity (Audretsch 1995).

Because disruptive and more radical innovations are associated with greater risk and uncertainty, they are the ones more typically discarded by the very companies and other organizations creating them through their R&D in the first place. The willingness of entrepreneurial startups to incur greater risk accounts for the paradox that those same entrepreneurial companies do not just account for a disproportionate share of innovative activity, but also have a far greater propensity for disruptive radical innovative activity than do the companies that actually created the ideas through their own R&D (Audretsch 1995).

Without entrepreneurship, less of the costly R&D will be commercialized through innovative activity. Entrepreneurship provides an important way to penetrate the knowledge filter and enhance the innovative yield emanating from investments in R&D and other new knowledge (Audretsch et al. 2008).

Measures of entrepreneurship suggest more robust entrepreneurial activity in the United States compared to Germany. The Global Entrepreneurship Monitor (GEM) estimates early-stage entrepreneurial activity in Germany of 9.1 percent in 2022. By contrast, in the US, early-stage entrepreneurial activity is nearly double (GEM 2024).

An even more striking difference involves financing entrepreneurship, and in particular ventures with high growth potential. There is considerably more venture capital to finance high-growth entrepreneurship in the US than in Germany. In 2021 there was USD 269 billion, or USD 915 per capita, of venture capital funding of high-growth entrepreneurship in the United States. By contrast, there was only USD 17 billion, or USD 202 per capita, of venture capital funding of high-growth entrepreneurship in Germany (Glassner 2021).

The greater availability of venture capital has contributed to a greater prevalence of unicorn startups in the United States than in Germany. As of 2020, there were 228 unicorn companies in the US, but only 13 unicorn companies in Germany. Still, it is important to note that Germany had the greatest prevalence of unicorns in Europe (Armstrong 2020).

A plethora of other sources of finance, both public and private, provide funding for entrepreneurial firms. In the US, for example, the Small Business Innovation Research (SBIR) and Small Business Technology Transfer (SBTT) provide federal funding for the innovative activities of small business. The explicit purpose of the SBIR is to provide small and new companies with sufficient financing to traverse the well-known valley of death, which characterizes the early stage of an innovative project that is still too uncertain and risky to procure private finance.

The SBIR provides a mandate for the federal agencies with an annual budget greater than USD 100 mil-

lion to allocate a minimum of 3.2 percent of their external R&D expenditures to small business. The largest governmental agencies, such as the Department of Defense, National Institutes of Health, and Environmental Protection Agency, are therefore required by law to include small and new business in their R&D awards, which amounts to more than USD 3.2 billion annually (SBA 2020).

Over 5,000 grants for small business innovation are awarded each year. Phase I grants are between USD 50,000 and USD 250,000 for development of an innovative concept, with a duration between six months and one year. Phase II grants are to develop a prototype with an amount up to USD 1.5 million over a two-year period. Phase III grants are to support the actual commercialization of the innovative concept with funding from non-SBIR sources (SBA 2020). Robust studies have found the SBIR to have a positive impact on the innovative activity of recipient firms, as well as inducing university scientists and other staff to becoming entrepreneurs (Guerrero et al. 2024).

Entrepreneurship is inherently a local phenomenon influenced by conditions in the external national context (Audretsch and Feldman 1996). Entrepreneurial activity varies considerably across geographic regions in the United States, as it does in Germany. For example, entrepreneurial activity has been identified as being the highest in Austin (Texas), Boulder (Colorado), Miami (Florida), Los Angeles (California), and San Francisco (California) in the US (Audretsch 2015). In Germany, entrepreneurial activity is the greatest in Berlin, followed by Munich, Hamburg, and Cologne (Statista 2020). Recent rankings place Berlin as one of the top three cities for entrepreneurship in Europe (Ohr 2023).

The spatial variation of entrepreneurial activity has been attributed to locational disparities in attitude and culture with respect to risk taking and entrepreneurship, availability of early-stage finance, the local industry structure, infrastructure, and robustness of the local entrepreneurial ecosystem (Prenzel et al. 2024). The local entrepreneurial ecosystem reflects the capacity for the region to provide entrepreneurs and their firms with what they need to succeed, ranging from finance to technological capabilities, networking, marketing, and human resources (Stam and van de Ven 2021).

CHALLENGES

There are distinct differences in the strengths and challenges for entrepreneurship between the US and Germany. The US is more conducive to entrepreneurship based on transformational and disruptive innovation. Entrepreneurship in newly emerging industries resulting in high-growth companies that disrupt extant technologies is more prevalent in the US. This is evidenced by the high share of unicorn companies and large technology companies that were only recently founded.

By contrast, Germany is more conducive to entrepreneurship based on incremental innovation within existing technologies and industries. The manifestation of this incremental innovation is evidenced through the prevalence of Hidden Champion Mittelstand companies located in Germany (Simon 1996 and 2009). Hidden Champions are defined as relatively unknown small companies with sales less than USD 5 billion that rank among the top three in terms of global market share or else are the leading company on their continent.

Hidden Champion companies are by far the most prevalent in Germany, where 1,573 Hidden Champions have been identified as of 2021, followed by the US with 350 Hidden Champions. Hidden Champions are also highly prevalent in Austria and Switzerland but considerably less prevalent in Japan, France, Italy, the United Kingdom, and the Netherlands (Simon 2022).

The exceptional prevalence of Hidden Champions reflects a related entrepreneurial strength exhibited by the Mittelstand in Germany. The Mittelstand refers to companies exhibiting common, distinguishing characteristics. Mittelstand companies tend to be small, family-owned, have close links to the local community, be in manufacturing, have a focus on high quality product niches, have a global export orientation, eschew equity finance for relational bank finance, engage in incremental innovation, and have a nurturing and long-term relationships with employees. With their core strategy of incremental innovation and highly skilled employees, Mittelstand companies are conducive to manufacturing.

The relative success and competitiveness of manufacturing in Germany is attributable to the entrepreneurial activity inherent in the Mittelstand (Audretsch and Lehmann 2016). The high share of skilled labor in the German economy, resulting from the dual system of education combined with apprenticeship training and technical institutes, along with research institutes such as the Fraunhofer Institutes, dedicated to applied research and technology transfer, are conducive to incremental innovation not just in entrepreneurial manufacturing firms, but especially in Mittelstand companies. The share of GDP accounted for by German manufacturing was 18.44 percent in 2022. By contrast, the manufacturing share of GDP was only 60 percent as much, at 11 percent in the United States (US Bureau of Labor Statistics 2023). Similarly, manufacturing accounted for 26.87 percent of employment in Germany but only 10.3 percent of employment in the US in 2022. The relative strength of manufacturing in Germany is further evidenced compared to its lower employment share of 19 percent in France, 14 percent in the Netherlands, 17 percent in Sweden, and 21 percent in Finland (World Bank 2024).

The emphasis on incremental innovative entrepreneurship in Germany has been more conducive to greater inclusiveness, in terms of both geography

and educational attainment (Audretsch and Lehmann 2016). The Mittelstand has been found to enhance the standard of living and general prosperity in less populated and even relatively rural regions in Germany (Pahnke et al. 2023). By contrast, the emphasis on more radical and disruptive entrepreneurship in the United States has been concentrated both spatially, within urban areas, as well as among the more highly educated. The result has been a greater growth in income and wealth disparities in the US compared to Germany, as well as a growing divide between urban areas and rural regions, both of which threaten social and political sustainability.

The recent wave of Chinese acquisitions of Mittelstand companies has triggered concern about the longer-term viability of the Mittelstand and its Hidden Champions (Harper 2021). At least until now, a precondition of belonging to the Mittelstand has been ownership – not just in terms of family ownership but also by German nationality (Barve 2019).

POLICY CONCLUSIONS

If innovation is needed to address the formidable economic, political, and social challenges confronting society, entrepreneurship is needed to drive that innovative activity. Both Germany and the United States rank among not just the most innovative countries in the world but also the most entrepreneurial. While it is always important to focus on what can be improved, it is also important to remember that the glass of entrepreneurship and innovation is more than half full. The opposite view, such as that articulated by Joschka Fischer, who admonished, "if Bill Gates were German, there would be no Microsoft" (Bracey 2008), is neither constructive nor accurate.

What is accurate is that entrepreneurship in Germany and the US both have their strengths and challenges. The entrepreneurial challenge in Germany is to bolster and sustain its traditional strengths of incremental innovative entrepreneurship, while building on the impressive more transformative entrepreneurship taking root in the most entrepreneurial cities, such as Berlin, Munich, and Hamburg, enabling the country both to preserve its traditional strength in manufacturing but also increase its competitiveness in newly emerging industries such as artificial intelligence.

By contrast, the entrepreneurial challenge confronting the United States is to continue to advance its radical and disruptive innovative entrepreneurship, while at the same time diversifying the inclusiveness to diffuse entrepreneurship to less densely populated and more rural regions. The lessons from each country are that enhancing innovation to address the daunting challenges confronting the world is indeed possible. However, entrepreneurship across its full and broad spectrum of manifestations will need to be activated to fulfill the promise of innovation.

REFERENCES

Armstrong, M. (2020), "Startups: The Countries with the Most Unicorns", *Statista*, 6 July, https://www.statista.com/ chart/6696/ the-us-is-home-to-the-most-unicorns/.

Arrow, K. (1962), "Economic Welfare and the Allocation of Resources for Invention", in R. R. Nelson, ed., *The Rate and Direction of Inventive Activity*, Princeton University Press, Princeton, 609–628.

Audretsch, D. B. (1995), *Innovation and Industry Evolution*, The MIT Press, Cambridge MA.

Audretsch, D. B. (2015), *Everything in Its Place: Entrepreneurship and the Strategic Management of Cities*, Regions and Countries, Oxford University Press, New York.

Audretsch, D. B. (2007), *The Entrepreneurial Society*, Oxford University Press, New York.

Audretsch, D. B. and M. P. Feldman (1996), "R&D Spillovers and the Geography of Innovation and Production", *American Economic Review* 86, 630–640.

Audretsch, D. B., M. Keilbach and E. E. Lehmann (2006), *Entrepreneurship and Economic Growth*, Oxford University Press, New York.

Barve, M. (2019), "Enter the Dragon: China Acquiring German SMEs", *BBN Times*, 5 June, https://www.bbntimes.com/ companies/ enter-the-dragon-china-acquiring-german-smes.

Bracey, G. W. (2008), "The Entrepreneurial Thing – We're Only No. 2", *Education Week*, 16 September, https://www.edweek.org/technology/ opinion-the-entrepreneurial-thing-were-only-no-2/2008/09.

European Commission (undated), *Sustainable Development Goals*, https://international-partnerships.ec.europa.eu/policies/ sustainable-development-goals_en.

Freedom House (2015), *Freedom in the World 2015*, Washington DC, https://freedomhouse.org/sites/default/files/01152015_FIW_2015_final.pdf.

Fukuyama, F. (1992), *The End of History and the Last Man*, The Free Press, New York.

GEM–Global Entrepreneurship Monitor (2024), *Global Entrepreneurship Monitor 2023/2024 Global Report: 25 Years and Growing*, GEM, London, https://www.gemconsortium.org/report/global-entrepreneurship-monitor-gem-20232024-global-report-25-years-and-growing.

Glassner, J. (2021), "These Countries Have the Most Startup Investment for Their Size", *Crunchbase News*, 2 November, https://news.crunchbase.com/startups/countries-most-startup-investment/.

Guerrero, M., A. N. Link and M. van Hasselt (2024), "The Transfer of Federally Funded Technology: A Study of Small, Entrepreneurial, and Ambidextrous Firms", *Small Business Economics* 62, 1009–1023.

Harper, J. (2021), "China Eyes Germany's 'Hidden Champions' Model", *Deutsche Welle*, 30 August, https://www.dw.com/en/ china-eyes-germanys-famous-hidden-champions-model/a-58986878.

Lexology (2023), "2022 U.S. Patent Filings Statistics", https://www.lexology.com/library/detail.aspx?g=1170d66d-63b8-4901-b819-e88c67916a2f.

NCSES – National Center for Science and Engineering Statistics (2023), "Federal Budget Authority for R&D and R&D Plant for National Defense and Civilian Functions Totaled $191 Billion in FY 2023 Proposed Budget", 26 January, https://ncses.nsf.gov/pubs/nsf23323.

Ohr, T. (2023), "TOP 30: Europe's Biggest Startup Hubs in 2023", *EU-Startups*, https://www.eu-startups.com/2023/07/ top-30-europes-biggest-startup-hubs-in-2023/.

Pahnke, A., F. Welter and D. B. Audretsch (2023), "In the Eye of the Beholder? Differentiating between SMEs and Mittelstand", *Small Business Economics* 60, 729–743.

Prenzel, P., N. Bosma, V. Schutjens and E. Stam (2024), "Cultural Diversity and Innovative Entrepreneurship", *Small Business Economics*, https://doi.org/10.1007/s11187-024-00888-1.

Romer, P. (1986), "Increasing Returns and Long-Run Growth", *Journal of Political Economy* 94, 1002–1037.

Romer, P. (1990), "Endogenous Technological Change", *Journal of Political Economy* 98, S71–S102.

SBA – US Small Business Administration (2020), "Leveraging America's Seed Fund. Small Business Innovation Research (SBIR). Small Business Technology Transfer (STTR)", https://www.sbir.gov/sites/default/files/SBA_SBIR_Overview_March2020.pdf.

Simon, H. (1996), *The Hidden Champions of Germany*, Harvard Business School Press, Brighton MA.

Simon, H. (2009), *Hidden Champions of the Twenty-First Century: The Success Strategies of Unknown World*, Springer, Heidelberg.

Simon, H. (2022), "Hidden Champions and the Development of Regions", *IAR Journal of Business Management* 3, 1–5.

Stam, E. and A. van de Ven (2021), "Entrepreneurial Ecosystem Elements", *Small Business Economics* 56, 809–832.

Statista (2022), "Leading Cities for Startups in Germany in 2022, by Total Score", https://www.statista.com/statistics/1275436/top-cities-for-startups-in-germany/.

Statista (2023), "Number of Patent Applications Filed at the European Patent Office from Germany from 2013 to 2022", https://www.statista.com/statistics/411651/european-patent-applications-from-germany/.

The Economist (2022), "The War in Ukraine Is Going to Change Geopolitics Profoundly", 5 March.

The Economist (2023), "Is Germany Once Again the Sick Man of Europe?", 17 August.

US Bureau of Labor Statistics (2023), "A Look at Manufacturing Jobs on National Manufacturing Day", 6 October, https://www.bls.gov/opub/ted/2023/a-look-at-manufacturing-jobs-on-national-manufacturing-day.htm.

US Senate Committee on Science, Commerce, and Transportation (2022), *The Chips Act of 2022*, https://www.commerce.senate.gov/services/files/592E23A5-B56F-48AE-B4C1-493822686BCB.

World Bank (2024), "Employment in Industry (% Total of Employment)", https://data.worldbank.org/indicator/SL.IND.EMPL.ZS?locations=EU.

Jean-Victor Alipour and *Valentin Lindlacher*

How Well-Intentioned Measures Have Unintended Consequences for Election Turnout

MOTIVATION

Voting is the backbone of every democracy. In large elections, however, an individual ballot has hardly any influence on the election result, as the probability of a decisive vote converges to zero. Classical voting theory points out the conflict between voting as the basis of the system's legitimacy and the insignificance of single votes as a critical challenge of democracy: If citizens are mainly concerned with the election result, even minor hurdles in the voting process could significantly affect participation.

Our study provides new empirical findings that demonstrate that seemingly small changes to voting costs have measurable consequences for voting behavior. In Munich, the electoral office controls precinct sizes and recruits barrier-free polling places to facilitate voting at the polls. A supposedly harmless by-product of these policies is that some eligible citizens are assigned to vote at a *different* polling location than before. The key question is: Do these policies achieve the desired goal of simplifying electoral participation? Or does changing the polling place create additional voting costs that potentially reverse the intended effect of the policies?

SETTING & DATA

In Munich, polling place reassignments are common and are linked to the aim of simplifying the voting process: For example, the city council mandated in 2014 that the number of barrier-free polling places be doubled between 2014 and 2017. To prevent congestion, precincts were also reconfigured more frequently from 2017 onward to ensure that an average size of 1,500 voters per precinct was maintained. Together, this meant that in the eight elections between 2013 and 2020, 58 percent of all residential addresses were assigned to a new polling place at least once (Figure 1). Figure 2 shows the distribution of walking distances between home addresses and polling places (Panel A). On average, eligible voters have to walk 800 meters to vote at the polling place. Panel B shows that the walking distance increases by a mere five meters on average. 90 percent of reassignments change the walking distance by less than one kilometer.

KEY MESSAGES

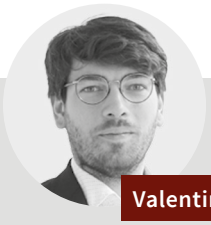
- **Reassigning citizens to vote at a different polling place causes a persistent shift from in-person to mail-in voting and a transitory drop in total turnout**
- **The turnout loss is driven by inattentive voters, who miss the deadline for requesting a mail-in ballot**
- **The effects are more driven by the reassignment itself and less by the changes in distance to the polling location**
- **Explicit notification about polling place reassignments could prevent losses in turnout**

To assess the effect of polling place reassignments econometrically, we combine information on turnout, election results, residential addresses of eligible voters, polling place locations, and precinct characteristics, which we obtain from the Munich Electoral Office and the Munich Statistical Office. We geo-reference the approximately 150,000 residential addresses of eligible voters in Munich and identify the assigned polling place in each election as well as the respective distance to this polling place.

One limitation is that the finest resolution available for turnout data is at the precinct level. Thus, we aggregate reassignments and distance from the polling location from the address level to precinct delineations. To obtain a constant unit of observation, we impose time-invariant precinct borders corresponding to the 2018 configuration for aggregation.

Jean-Victor Alipour

is Economist at the ifo Center of Industrial Organization and New Technologies. His research interests are economics of digital transformation and political economy.

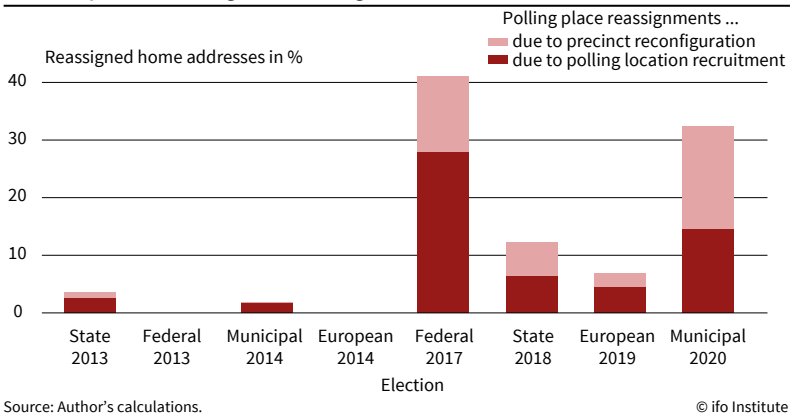


Valentin Lindlacher

is Junior Professor in Economics at the Technical University of Dresden. His research fields are regional economics, development economics, and political economy.

Figure 1

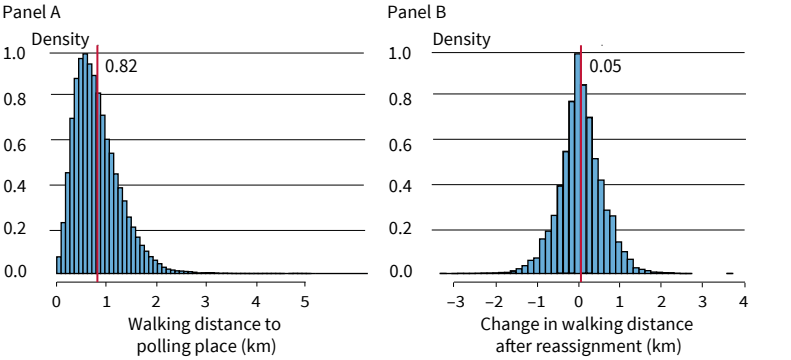
Frequency of New Polling Place Reassignments since 2013



Source: Author's calculations. © ifo Institute

Figure 2

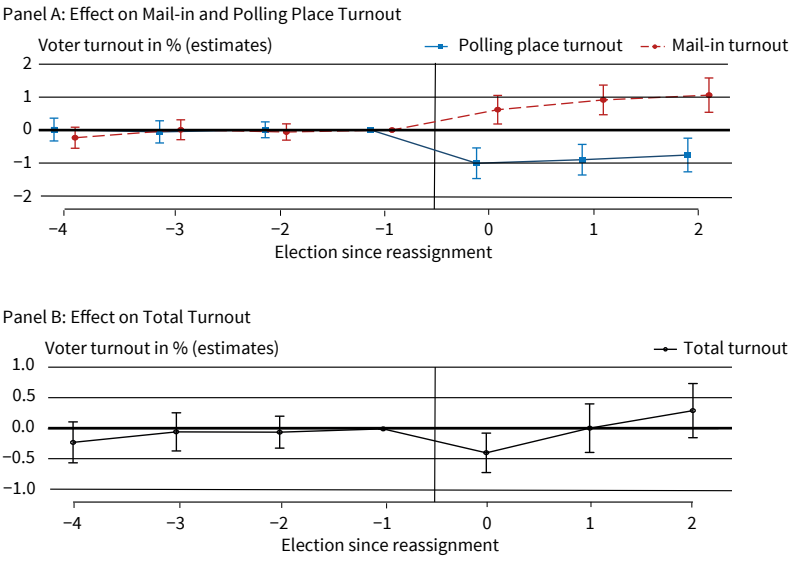
Distribution of Walking Distances and Change in Distance to the Polling Place



Note: The figures present density plots of the walking distance between residential addresses of eligible voters and their assigned polling places (Panel A, N = 1,206,232) and the *change* in distance conditional on assignment to a different polling place relative to the previous election (Panel B, N = 147,874). The sample covers the eight elections held between 2013 and 2020. Vertical lines highlight the mean of the distribution.
Source: Author's calculations. © ifo Institute

Figure 3

Effects of Polling Place Reassignments on Turnout



Note: Panel A shows the estimation results of the difference-in-differences estimator for the average effect of a polling place reassignment on in-person and mail-in turnout. Panel B shows the effects on total turnout. Period 0 corresponds to the election immediately after the polling place reassignment. Data is based on 618 Munich precincts observed over eight elections (2013–2020). Confidence intervals are plotted at the 95 % level and calculated based on standard errors clustered at the precinct level.
Source: Author's calculations. © ifo Institute

Our final panel comprises 618 precincts, which we observe over eight elections (2023–2020). During this period, about half of all precincts are affected by polling place reassignment.

METHOD

The aim of the empirical analysis is to determine the *causal* effect of polling place reassignments on changes in electoral turnout. More specifically, the outcomes are turnout at the polling place, turnout by mail, and total turnout. The empirical approach is based on the *difference-of-differences (DD)* estimator. This method compares *changes* in turnout in the treatment group (precincts with a polling place reassignment) with changes in the control group (precincts without a polling place reassignment). If the change in turnout after reassignment is identical in both groups, the DD estimator is zero (since the difference in change is zero). This case would suggest that, on average, polling place reassignments have *no effect* on turnout. A DD estimator different from zero, on the other hand, indicates a "treatment effect".

Econometrically, we control for other potential factors that could influence voting behavior, among others, the election year and the type of election (e. g., federal versus state election), as well as precinct characteristics. For a causal interpretation of the DD estimator, two assumptions must be fulfilled: first, the time at which a precinct is assigned a new polling place must not be systematically correlated with other *changes* in the precinct that influence turnout. Second, turnout would have evolved in the same way in the treatment and the control group without reassignments. These assumptions cannot be tested directly. However, we present indirect evidence that supports the validity of these assumptions. For example, we show that, on average, a reassignment does not coincide with observable changes in precincts, such as the local size of the (voting) population, the local age structure, local rents, or the proportion of households with children. We also show that trends in turnout in elections prior to reassignments evolve in parallel.

RESULTS

The Average Effect of a Polling Place Reassignment

Figure 3 shows the results of the DD estimator graphically. Shown are estimation coefficients and confidence intervals of the trend *differences* in turnout between the treatment and the control group before and after a polling place reassignment. Blue coefficients refer to in-person turnout, while red coefficients refer to mail-in turnout (Panel A). The black coefficients in Panel B refer to total turnout. Since reassignments occur in different elections, the time axis is normal-

ized. Period 0 is the first election immediately after a reassignment; Periods 1 and 2 are the subsequent elections. Periods −4 to −1 refer to the elections before the "treatment".

The plot shows no trend differences in the elections preceding the reassignment (the coefficients are close to zero and statistically insignificant). Immediately after reassignment, in-person turnout *falls* significantly, while mail-in turnout increases significantly (Panel A). The shift from in-person voting to mail-in voting is *persistent*, suggesting a lasting shock to in-person voting costs. Hence, on average, changing polling places makes mail-in voting more attractive than in-person voting in the long term. This leads some of the affected eligible voters to switch to mail-in voting. However, the coefficients in Panel B show that the initial shift to mail-in voting is not large enough to offset votes lost at the polls, generating a decline in total turnout of 0.4 percentage points (or around 0.6 percent, measured by the average total turnout). Given the policy's good intentions and the minor changes in proximity to the polling place, a declining total turnout is notable. At the same time, our results highlight the importance of the availability of mail-in voting in Germany: the loss of votes at the polling place by just under 1 percentage point is completely compensated for in periods 1 and 2 by a higher mail-in turnout. Without this low-threshold alternative to in-person voting, the loss of voting participation would probably have been greater.

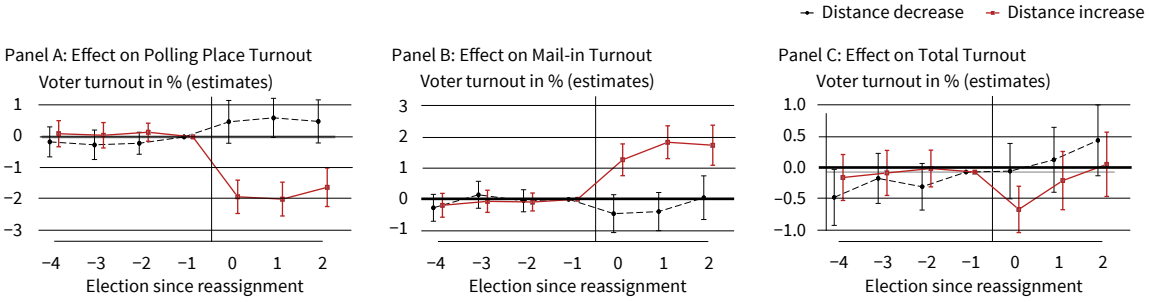
It is notable that while polling place reassignments cause a persistent shift from in-person to mail-in voting, the drop in total turnout is only transitory and total turnout recovers in subsequent elections. By contrast, the decline in total turnout completely recovers in the subsequent election. We test two alternative hypotheses that could explain this recovery. Hypothesis 1: voters familiarize themselves with their new polling place and return to vote there after one election. Hypothesis 2: the reduction and recovery in turnout are driven by *inattentive* voters, who miss the deadline for requesting mail-in ballots. Since affected eligible voters are *not explicitly* notified of changes to their polling place (but must refer to their election notification), some eligible voters might not realize the change until it is too late to vote by mail. Inattentive voters who would have switched to mail-in voting can now turn to mail-in voting only in the *subsequent* election. Consequently, some abstain in the election immediately after the polling place change and only vote by mail in the subsequent election. In fact, the evidence supports the inattention hypothesis, while hypothesis 1 is not supported. This is because the recovery in total turnout is fully explained by an increase in mail-in voting between period 0 and period 1, while there is no measurable recovery in in-person turnout.

The Role of the Change in Walking Distance to the Polling Place

To better understand the underlying the mechanisms, we next analyze to what extent the change in walking distance or the change of the polling place *itself* are decisive for the change in voting behavior. To this end, we estimate the effects separately for cases in which the polling place is moved *further away* or *closer* to the eligible voters because of a reassignment. The results are shown in Figure 4. The red coefficients show turnout changes in precincts in which the distance to the polling place has increased, on average, relative to precincts without a polling place reassignment. Similarly, black coefficients show the change in turnout in precincts in which the reassignment has reduced the distance to the polling place, on average. Turnout effects are strikingly asymmetric: reassignments that increase distance cause a sharp and persistent decline in in-person turnout (around 2 percentage points). By contrast, when reassignments reduce the distance to the polling place, in-person turnout tends to rise slightly, albeit not to a statistically significant extent. The results show that both the change of polling place itself and the change in walking distance play a role. Coupled with an increase in distance, a polling place change makes in-person voting slightly less attractive compared to mail-in voting and abstention. However,

Figure 4

Changes in Turnout Depending on the Change in Distance to the Polling Place



Note: Shown are estimation results of the difference-in-differences estimator for the average effect of a polling place reassignment separately for polling place reassignments that decrease (in black) or increase (in red) the distance to the polling place. Panel A shows the effects on in-person turnout, Panel B for mail-in turnout, Panel C for total turnout. Data is based on 618 Munich precincts observed over 8 elections (2013–2020). Confidence intervals are plotted at the 95 % level and calculated based on standard errors clustered at the precinct level.
Source: Author's calculations.

a polling place reassignment can also make in-person voting more attractive, but only if the distance decreases *sufficiently*. On average, a polling place must move about 20 percent (or about 130 meters) *closer* to eligible voters to compensate for the disutility of the reassignment itself and to offset the turnout drop at the polling place. We calculate that more than 60 percent of the overall effect can be explained by the reassignment itself and less by the change in distance. This is a relevant finding, from both a scientific and a practical point of view. While correlational studies have often identified the distance to the polling place as a possible explanation for regional differences in turnout, our results show that the mere change of location – keeping distance constant – is more relevant for voting behavior.

Impact on Election Results and Voting Behavior of Different Groups

Effect differences by voter group. In the study, we also explore whether different voter groups react differently to polling place reassignments. A key finding of this analysis is that precincts with a higher share of elderly eligible voters show a greater decline in in-person turnout and a weaker shift to mail-in voting when reassigned. Given that recruiting barrier-free venues to improve access for voters is a main driver of polling place changes, this result is important. It suggests that the burden of reassignments outweighs the potential benefits of better access to the buildings.

Effects on election results. Do certain parties benefit from this practice? Our results show: no. The temporary decline in turnout is evenly distributed across the six parties we examined. We also find no evidence that the reassignment of polling places significantly changes vote shares. The null effects on the electoral outcomes are reassuring from an administrator's perspective. The obvious reasons for this are that polling place boundaries in Munich are not concentrated within a particular voter group and that supporters of different parties are not as geographically segregated as in the US, for example.

POLICY IMPLICATIONS

Our study shows that even small and seemingly harmless changes to voting costs have a strong impact on voting behavior and participation. If not considered, even well-intentioned policies can have unintended consequences. This is illustrated by the case of polling place reassignments in Munich. A new polling place leads to a shift from in-person to mail-in turnout and a transitory decline in total turnout. Informing affected voters explicitly and separately from the usual election notification about such changes could prevent losses in turnout. In the US, this is already required by law in many states. Access to mail-in voting could cushion most vote losses at the polling place. However, only 15 percent of EU member states offer mail-in voting to all eligible voters. Especially in these countries, it is important to closely monitor and minimize changes to polling places or to create alternatives.

RECENTLY PUBLISHED

POLICY DEBATE OF THE HOUR IN THE NEXT ECONPOL FORUM:

EconPol FORUM 5/2024 will be published in September 2024

"US Presidential Election 2024: What's Next for Gobal Politics and the World Economy? "