Analysis

The economic consequences of defence spending

February 2026

Bas Heerma van Voss, Daan de Leeuw, Fulvia Marotta,
Camille Mehlbaum, Andra Smadu, Irina Stanga, Stefan Wöhrmüller

DeNederlandscheBank

EUROSYSTEEM

The economic consequences of defence spending

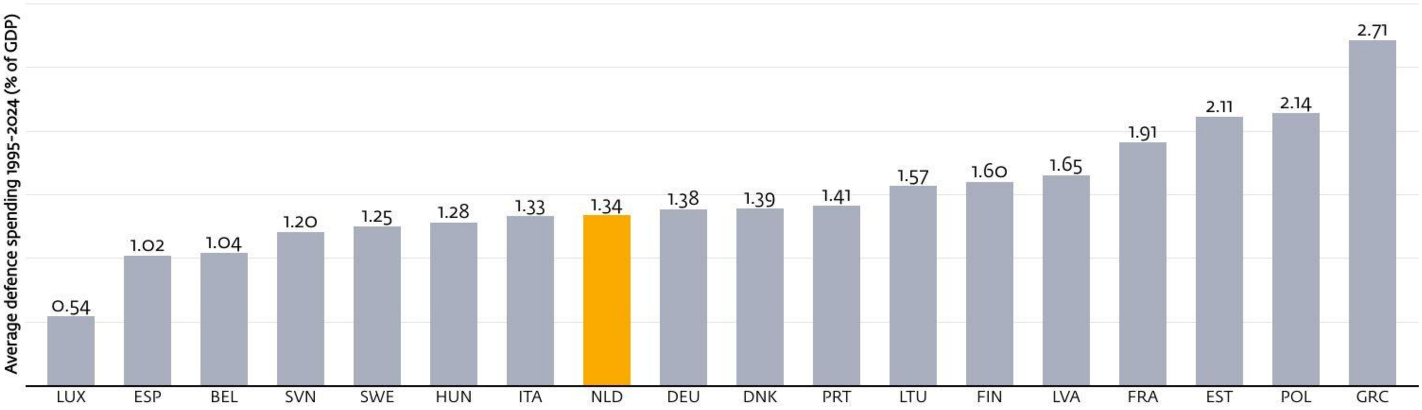
Authors: Bas Heerma van Voss, Daan de Leeuw, Fulvia Marotta, Camille Mehlbaum, Andra Smadu, Irina Stanga, Stefan Wöhrmüller.

In preparing this report, we gratefully used input from our colleagues at DNB, the Dutch Ministry of Defence and Ministry of Finance, CPB, CBS, Berenschot, Rabobank, SEO. In particular we want to thank Tjerk Kroes, Peter van Els, Sophie Steins Bisschop, Coen Teulings, Kostas Mavromatis, Dennis Bonam, Guus Brouwer, Haroon Mumtaz, Bart Nauta, Hugo Erken, Wouter Remmen, Frank van Es, Luddo Oh, Nick Hageraats, Martijn Badir, Tim Mulder, Michelle Haas, Tamas Erkelens, Arend Olthoff, Jarno Roenhorst, Matthijs Katz, Michiel Bijlsma, Gerben de Jong. All remaining errors are solely ours.

De Nederlandsche Bank n.v.
P.O. Box 98 1000 AB
Amsterdam
Internet: www.dnb.nl
Email: info@dnb.nl

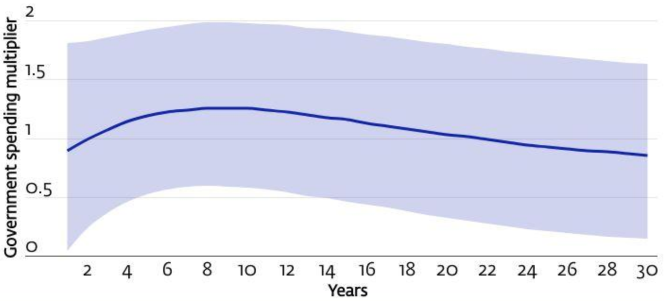
Higher European defence spending affects public finances, inflation and economic structure

NATO set the target of defence spending at 3.5% of GDP, a sharp increase from historical average of NL



Economic opportunities for Europe...

Historically, defence spending implies a higher average GDP across EU

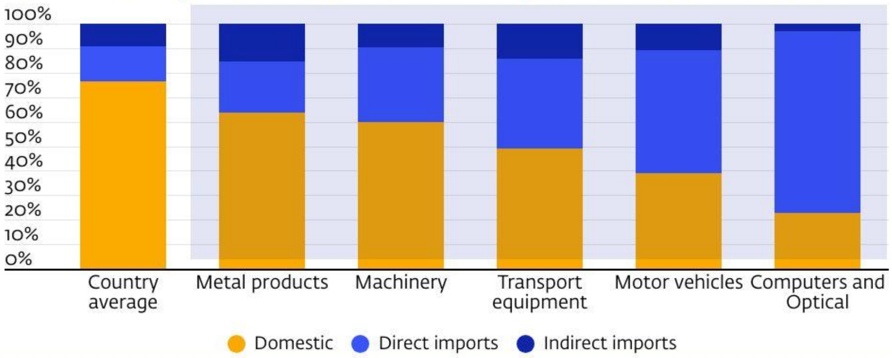


...but constraints for NL in the short run:

- Tight labour market leads to inflationary risks
- Roughly half of defence spending leaks abroad through imports
- Small defence industry leads to limited national spillovers

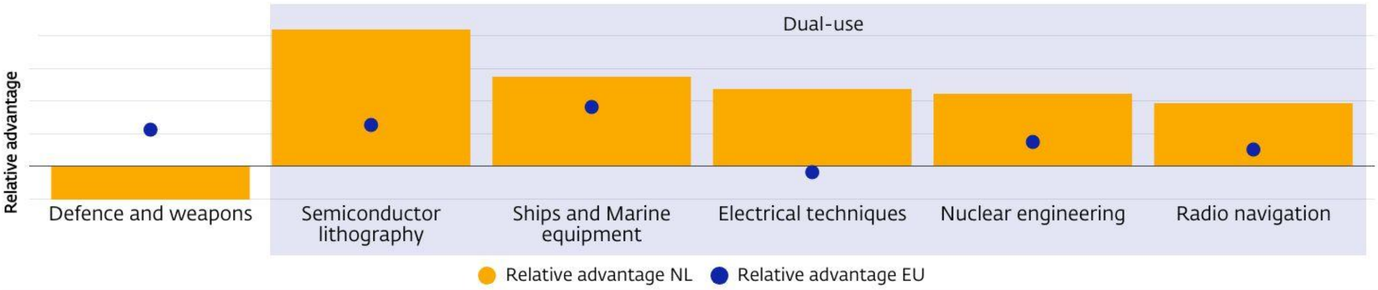
The economic spillovers depend on the origin of imports and importance of sectors

- The Dutch defence industrial basis consists of 5 main sectors
- About 50% of their foreign inputs come from EU partners
- Sectors central to Dutch economy drive stronger domestic effects



The Netherlands' main contributions lie in dual use technologies

NL is not well positioned to scale up core defense production. However, it has technological advantages in specific dual-use technologies, complementary to the EU specialisation.



Conclusion

- In the short term the economic effects of increased defence spending in NL remain limited.
- In the medium and long term there is greater economic potential, particularly through EU cooperation and specialisation.

DeNederlandscheBank
EUROSYSTEEM

Executive Summary

In this study we look at the expected economic effects of the increasing defence spending in the Netherlands, and how policy can influence economic outcomes. The Netherlands, along with other NATO member states, has committed itself to spending 3,5% of GDP on defence by 2035. This will affect Dutch public finances, prices, investments in research and development (R&D), and the national sectoral composition. DNB is interested in these effects because inflation, public finances, and sectoral economic developments in the Netherlands are affected. With this study we aim to shed light on these dynamics and contribute to the policy debate on economically efficient defence spending. Our study builds on previous work by other institutes that assesses economic effects of the increase in Dutch defence spending. We distinguish the economic effects over the short run from those over the medium and long run.

Higher defence spending will not automatically boost the Dutch economy in the short run; tight labour markets and high import dependence limit short-run gains. Using European historical evidence, we show that anticipated increases in defence spending typically generate moderate but persistent medium-run gains in output, investment, and productivity. However, we concur with CPB (2025) that these medium-run European effects are unlikely to translate one for one to the Dutch economy in the short run. Labour market conditions are tight, leading to higher inflationary effects of spending. Moreover, 61% of public defence investment flows directly abroad (both within EU and outside EU), and Dutch defence manufacturing itself is highly import dependent implying that domestic defence spending also leaks abroad indirectly. This is true both compared to other Dutch sectors and to other European defence industries. Combined with historically low defence-related R&D, these features limit the scope for domestic spillovers. Given the strategic urgency of meeting the new NATO target, there is only limited scope for policy to mitigate these short-run constraints.

In the long run, defence spending can create economic opportunities, but only with clear strategic choices, European coordination, and a credible long term investment plan. Over the medium and long run, the policy space widens. Some studies find a strong historical link between defence R&D and growth effects (e.g., Rabobank, 2025a). While such effects are perhaps not attainable in full within the expected scale of Dutch defence spending (CPB, 2025), it is worthwhile exploring how we can both meet our strategic defence spending goals efficiently while realizing positive economic spillovers. We provide data to support three strategic economic policy goals for Dutch defence spending: reducing dependencies on foreign (i.e. non-European) defence suppliers, primarily through European coordination and specialization (rather than national self-sufficiency); building on existing strengths; and maximizing domestic economic spillovers. We explore technologies and products in core defence and dual-use sectors[1] where the Netherlands has relative technological advantages, or where branching out would be relatively low-cost given the current production structure. We compare the Dutch position in these technologies, products, and sectors, with those of the EU. We find that the Netherlands lags its European peers in core defence innovation, and that its current production structure is not well suited for a rapid scale-up of core defence goods manufacturing. Instead, the Netherlands has technological and production strengths in specific dual-use areas, including specific types of semiconductor machinery and microscopes. European specializations are complementary to one another, with at least one country specializing in each relevant domain. The extent to which we can leverage these comparative advantages depends on effective multilateral coordination within Europe. Specialization in these domains implies high, up-front investments, for which buy-in from the private sector is necessary. A credible public long-term public investment plan - one that enables private investors to

[1] Dual-use sectors refer to industries, technologies, or products that have both military and civilian applications, such as cybersecurity, aerospace, artificial intelligence, advanced materials, and satellite technologies.

anticipate public spending – is therefore another essential condition for achieving our strategic defence goals efficiently.

In summary, the economic effects of higher defence spending appear limited in the short run, but the long-term payoff could be large if the Netherlands (and Europe) commits to a credible, coordinated plan. If Dutch comparative advantages are leveraged, such a plan will likely have a focus on dual-use production.

Economic impact assessed at three levels: macro, sectoral, and technological

We first look at historical macroeconomic effects of defence spending in Europe over the period 1960-2022. Secondly, we analyse the expected second-order effects - the indirect impacts transmitted through supplier sectors - to manufacturers of defence goods. This allows us to complement existing reports on the direct import dependence of Dutch defence spending (e.g., CBS 2025, Berenschot 2025) with insights into indirect import flows. We also assess how central defence-related sectors are in the Dutch production network. Thirdly, we analyse technological and product level data to identify strengths, weaknesses and opportunities of Dutch and European defence and dual-use manufacturers. This helps inform policies that aim to achieve our strategic goals in an economically efficient manner. We do so by placing the increase in defence spending in its European context, and by building on previous work that has assessed the expected economic effects of defence spending.

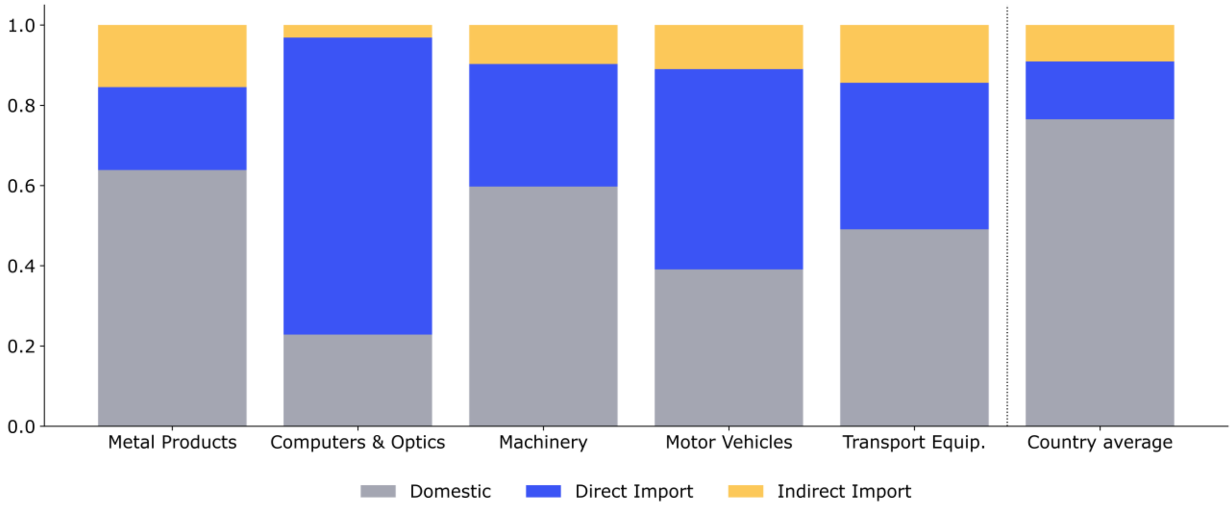
Little room for economic policy goals through defence spending in the short run

Short-run growth effects of defence spending are likely to be limited. This reflects a combination of tight labour market conditions, a small and import-dependent defence industrial base, and limited domestic supply-chain spillovers. Our analysis of the historic growth impact of European defence spending, whilst noting that estimates of such effects are highly dependent on modelling and sampling choices, finds that defence expenditure yields GDP gains in the medium run and is in line with earlier studies across different samples and periods. However, in the short run, the Netherlands has very little scope to pursue secondary economic objectives via higher defence outlays. Current domestic conditions such as an overheated labour market increase the likelihood of inflation rather than output growth. Under today's labour shortages, our model-based expectation is that the inflationary effects of defence personnel spending are roughly one-and-a-half times higher than under average labour market conditions. Coupled with the small Dutch defence-industrial base and its lack of technological edge in key military domains – stemming from decades of low defence R&D investment – these factors leave little room to use the defence budget as a short-run economic stimulus.

The import dependency of sectors composing the bulk of the defence manufacturing is high, both directly and indirectly. Even domestic defence procurement results in substantial spending abroad. This is because Dutch defence manufacturing relies heavily (between approximately 40%-80%, see Figure 1) on foreign inputs, causing much of the fiscal impulse from higher defence spending to leak abroad through supply chains. Key defence-related industries - metal products, machinery, computer and optical equipment, motor vehicles, and other transport equipment - all have high import intensities, both when compared to the national average for all sectors and relative to their European peers. This complements findings by other studies showing that defence procurement is spent abroad to a significant degree. While high import dependence greatly limits the local economic contribution and employment generated by defence spending, the origin of imports matters: leakage to non-EU suppliers represents a clear outflow of economic benefits, whereas imports from EU partners occur within integrated production networks and can still support collective security and efficiency.

The industries that make up the Dutch defence industrial base differ significantly in how strongly they are connected to the wider economy. Some sectors are relatively peripheral, with only weak upstream linkages. As a result, higher demand for their output yields only modest benefits locally. For instance, Dutch computer and optical equipment manufacturing, as well as military vehicle production, occupy peripheral and upstream positions in the national input-output network, which means they create limited spillovers to other Dutch sectors. In contrast, sectors such as fabricated metal products are far more central and downstream - ranking among the top quartile of all sectors in terms of network centrality. Growth in these areas would therefore propagate a defence spending boost upstream through domestic supply chains. This disparity implies that the economic impact of defence spending will partly depend on which sectors see growth, as not all defence-related production generates the same breadth of upstream activity within the Netherlands.

Figure 1. Relatively large import dependence of five defence-related manufacturing sectors



Notes: The figure shows the share of domestic and imported inputs (both direct and indirect) in the production of five defence-related manufacturing sectors. For comparison, the same shares for the overall Dutch economy are shown as 'Country average'. Source: Eurostat's Figaro dataset; own calculations.

In the short run, defence spending is largely constrained by strategic needs. Given the urgency of current strategic demands, secondary policy goals - such as economic effects - can only be pursued where they do not conflict with strategic priorities. For example, strategic considerations do not allow defence spending to be timed with the business cycle; procurement and personnel spending cannot be postponed until an economic downturn. Moreover, the persistently high import dependency of Dutch defence sectors limits the ability to select projects based on expected domestic spillovers. While the centrality of sectors offers some guidance, it is insufficient to meaningfully influence short-term economic outcomes, especially under existing production networks and potential resource constraints such as tight labour markets. The findings presented in Chapters 1 and 2 therefore reinforce the conclusion of the CPB (2025): the expanded defence budget cannot be used as an instrument for broader economic policy goals in the short run, except at the margins. Instead, economic gains can be maximized with a credible and multilaterally coordinated plan at the European level for the medium and long term.

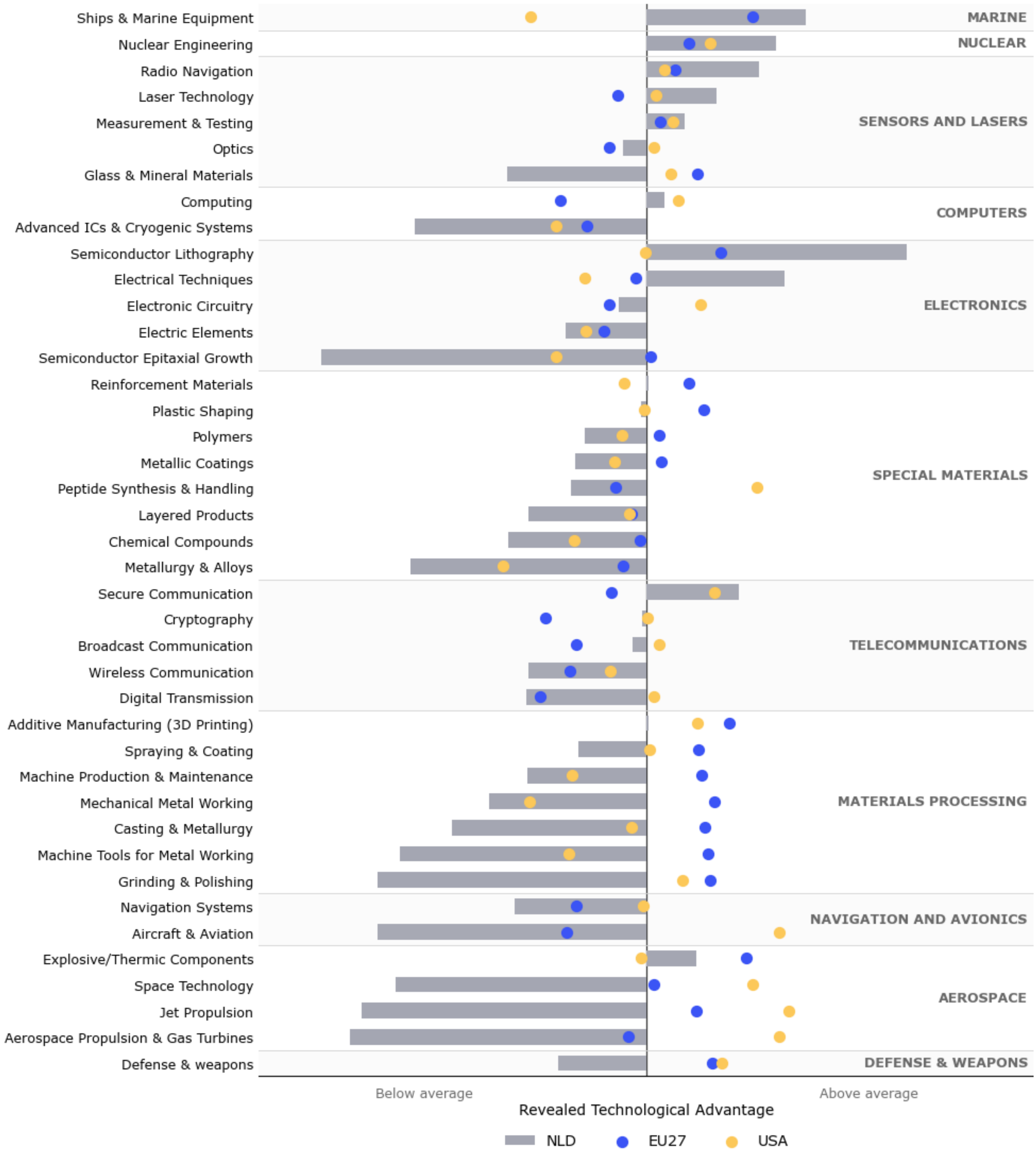
More scope for economic policy goals in the long run

Over a longer horizon, the economic effects are likely to depend strongly on the chosen composition and direction of defence spending. Decisions about the composition of defence spending between personnel, equipment and R&D matter for innovation and demand spillovers. For example, a deliberate emphasis on local procurement or on certain R&D-intensive projects could yield higher domestic multipliers than an import-heavy, uncoordinated expansion of defence expenditure. While previous studies have shown that the composition of expenditure matters, we highlight that *within* equipment spending and R&D the choice of specific products and technologies also plays a decisive role in shaping economic outcomes. By making such choices strategically, policymakers can shape defence expenditures in ways that also promote industrial development and technological progress over the medium and long run. We use patent and technology data to provide insights that can help underpin such strategic choices.

The Netherlands holds a strong production and technological position in specific dual-use areas. The Netherlands does not specialize in core defence products, and other European countries are better positioned to fill current strategic gaps in core defence goods. However, the Netherlands shows strong technological and production specialization in certain dual-use domains, such as semiconductor lithography and marine equipment (See Figure 2 below, where we use number of patents in specific technology domains to proxy for innovation). Conversely, it is far less specialized in other dual-use domains, including advanced materials, materials processing, avionics, and aerospace. However, in all core defence and dual-use domains, at least one European country holds a relative technological edge. This provides a basis for an effort-sharing agreement between European countries in reducing their dependence on foreign military technology.

Defence investments, both in R&D and in manufactured goods, can serve at least three policy goals: reducing dependencies, expanding strengths, and maximizing economic spillovers. Each of these goals is to some extent reflected in the Dutch Defence Strategy for Industry and Innovation (Rijksoverheid, 2025). Nevertheless, it is important to emphasize that strategic goals are the primary objective of defence spending, and economic objectives are among the secondary goals. One primary policy goal, central to the current debate is to reduce critical dependencies on non-European suppliers by developing domestic or European alternatives. This would improve security of supply and strategic resilience, albeit potentially at high cost or with a learning curve to scale up local production. Multilateral coordination with European partners would limit such costs, as it would allow member states to focus on expanding production in areas that fit well with their current production structure. Data on such 'production proximity' could offer guidance for which countries are best positioned to fill European production gaps. A second goal is to build upon current technological and manufacturing strengths. For the Netherlands, we find a strong position in the production and technological development of specific high-tech dual-use goods. A third approach is to maximize domestic spillovers by prioritizing projects that stimulate broad innovation and benefit the wider economy. This includes focusing on production that offers a high probability of 'locking in' new economic opportunities, for example projects that also strengthen high tech civilian applications in the field of avionics or maritime technology. Spillovers are also increased by procurement programs that target sectors central to the Dutch economy, such as metal products. In practice these objectives are not mutually exclusive and can be jointly optimized (see table 2 in section 3).

Figure 2. Revealed Technological Advantage per defence and dual-use domain



Notes: Revealed technological advantage is calculated over 2016-2020 based on patent activity using data from the OECD. To calculate the RTA for the EU, the patent activity for all member states is combined and compared to the rest of the world.

Whichever combination of policy goals is pursued, two overarching principles are crucial: long-term policy predictability and multilateral coordination. A stable, transparent spending trajectory through 2035 will give defence contractors and related industries the confidence to invest in capacity and innovation, knowing that demand will be sustained. New product lines and supply chains will only develop if demand is credibly locked in. This policy certainty can magnify the economic benefits by encouraging private-sector development around the anticipated defence projects. Moreover, enhanced production capacity may alleviate resource bottlenecks and diminish the likelihood that additional government expenditure will merely translate into inflationary pressures. Policy clarity does not mean fixing all expenditures in detail, as flexibility must also be maintained. However, a clear and sustained focus on specific domains for demand seems attainable. Second, close multilateral coordination, particularly with European partners, is essential to maximize efficiency and strategic impact. Coordination prevents needless duplication of efforts and industrial excess capacity and ensures that the overall rearmament addresses all critical capability needs without major gaps. Aligning national plans with European initiatives can leverage the complementary strengths of different countries' industries and avoid wasting resources. Analyses of technological strengths and industrial proximity to the required production can offer the basis for such agreements. However, these benefits will not materialize automatically: coordination is complex, requires sustained political commitment, and will take time to implement. While the short run economic effects are largely given and limited, short-term action is still needed: multilateral agreements and credible policy plans take time and can only yield economic and strategic returns over the medium run if they are agreed upon at an early stage.

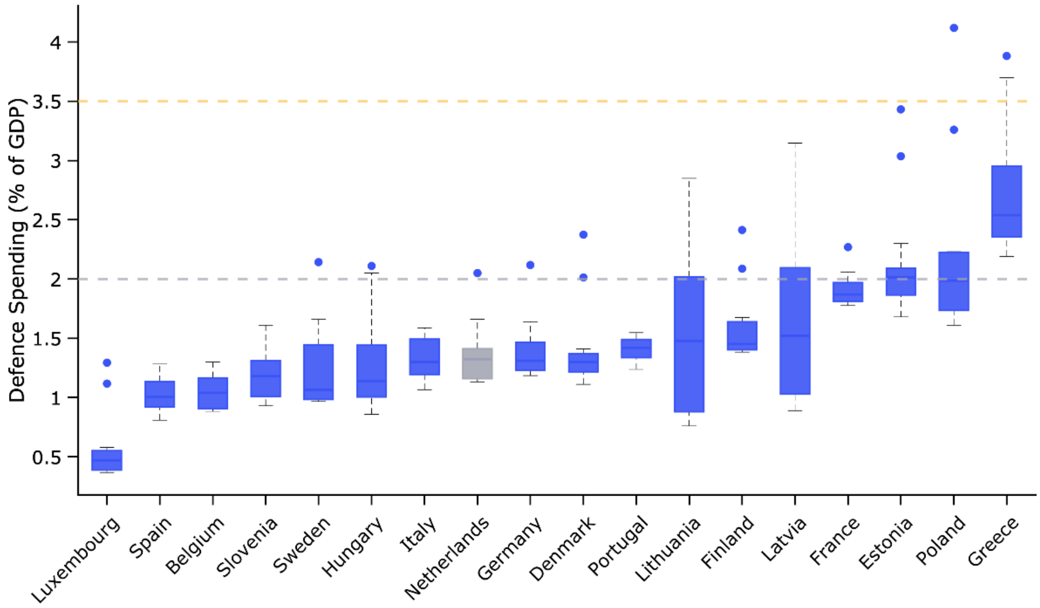
1 Macro-economic effects of defence spending

In this chapter we analyse how Dutch defence spending compares to European patterns and assess the economic effects of rising defence expenditure in Europe. We show that the Netherlands starts from a structurally low and import-intensive defence base. As a result, domestic economic gains are likely to be weaker than those implied by European panel evidence, where defence news shocks typically raise output, investment, and productivity with limited inflation or fiscal pressure. We also highlight that inflationary pressures are dependent on the tightness of labour markets. We distinguish these dynamics from the long-term potential of defence-related R&D, which, although currently modest in the Netherlands, offers strategic opportunities for technological spillovers and industrial development.

1.1 Trends in defence spending and composition

Over the past decades, Dutch defence spending has remained slightly below the European average. Figure 3 shows that, in terms of military expenditure as a share of GDP, the Netherlands has on average spent less than both the mean across European countries and the pre-2025 NATO guideline of 2 percent of GDP, indicated by the horizontal dashed line. While spending levels vary widely across countries, particularly in Eastern Europe where geopolitical pressures have historically driven higher military budgets, the Dutch trajectory sits in the lower-mid range of the distribution. Even with recent geopolitical developments prompting higher defence allocations, the Netherlands still spends a smaller share of GDP on defence than many of its European peers. The figure therefore illustrates that Dutch defence policy has operated from a comparatively low baseline, which is an important consideration when interpreting both current budgetary plans and assessing the potential macroeconomic effects of future increases.

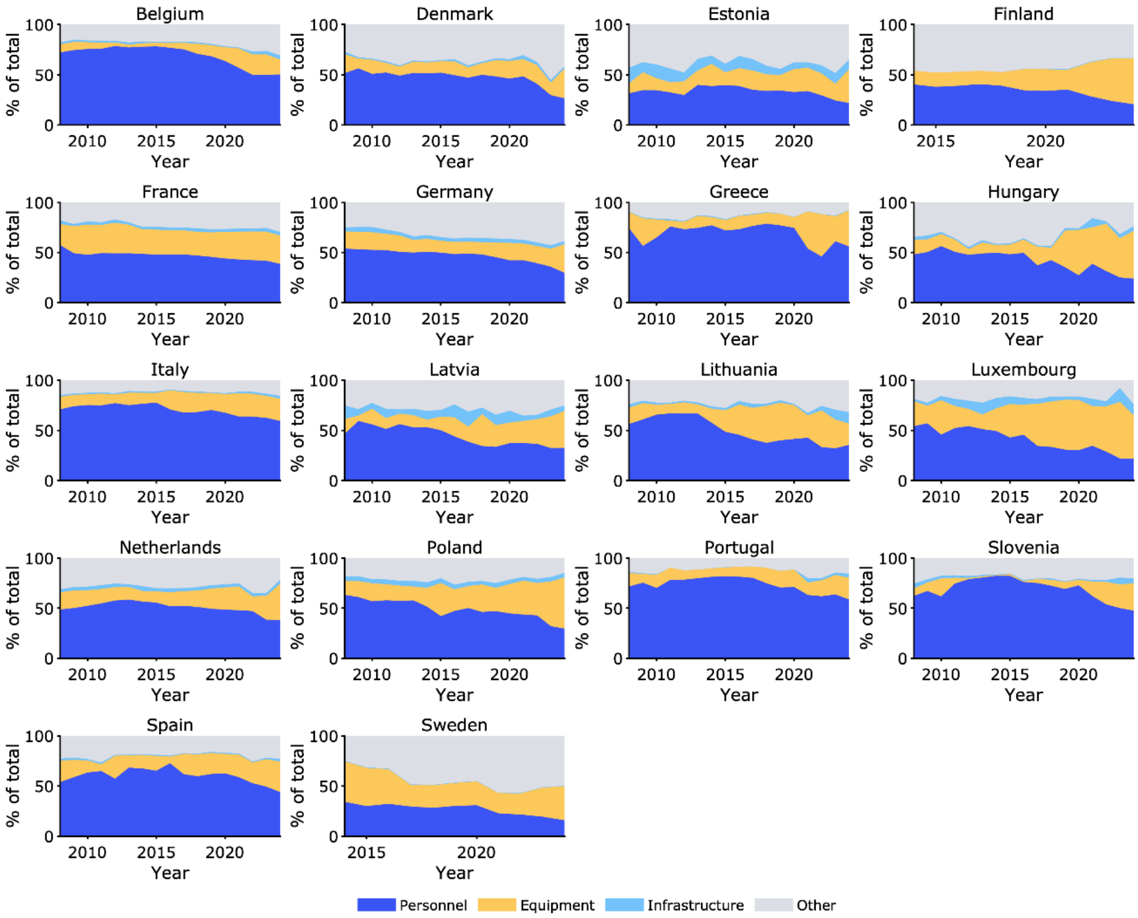
Figure 3. Defence Spending in Europe, 2010-2024



Notes: Boxplots show the distribution of military expenditure as a share of GDP for EU and NATO European countries over 2010–2024. The Netherlands is highlighted in orange. European average is 1.49% of GDP. The dashed grey line marks the 2% of GDP NATO guideline, and the dashed yellow line is the new 3.5% target. Data expressed as percent of GDP. Outliers are displayed as blue dots and the box represents the interquartile range, spanning the 25th to the 75th percentile. Sources: NATO.

The composition of Dutch defence spending is broadly similar to that of the average European country. Figure 4 compares the allocation of defence budgets across European countries over the past decade, distinguishing between personnel costs, equipment procurement, infrastructure spending, and other categories.[2] The Dutch composition, and trends in the composition, follow that of the average EU member state: personnel remains the largest component of the defence budget, equipment expenditures have increased in recent years, and infrastructure represents a relatively small but stable share. In contrast to countries like France or Germany, whose large defence-industrial bases reflect decades of consistently high equipment investment, the Netherlands has followed a more moderate approach, resulting in relatively stable procurement levels without sharp reallocations toward equipment.

Figure 4. Composition of Defence Expenditure Across European Countries



Notes: Stacked area charts display the composition of defence spending for selected European economies over 2010–2024, decomposed into personnel, equipment, infrastructure, and other expenditures (percent of total). The Netherlands appears on the third row, first column. Colours denote spending categories as indicated in the legend. Sources: NATO.

[2] 'Other' includes operations and maintenance, training, logistics, administration, medical services, R&D not classified as equipment, and pensions paid by defence ministries (Source: NATO).

1.2 Macroeconomic effects of anticipated defence spending in Europe

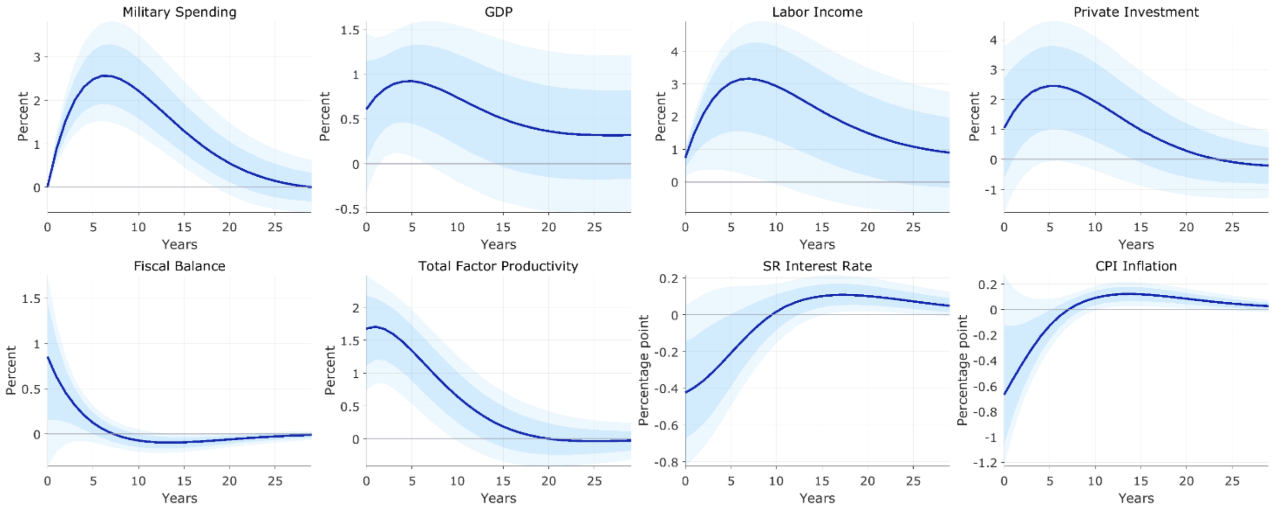
In a European historical panel (1960-2024), announced defence spending is associated with moderate growth effects over the medium run. We note that precise effects are dependent both on modelling and sampling choices (Ben Zeev et al., 2025). Thus, it is important to view outcomes in the context of the present state of the economy. In Europe, anticipated increases in defence spending over the period 1960-2024 have generated a gradual but persistent expansion in economic activity. This has happened through a combination of demand- and supply side-channels, while fiscal and inflationary effects remain contained. Figure 5 reports the dynamic responses of key macroeconomic variables to a defence spending news shock identified in a panel VAR for European economies over 1960–2024.[3] By construction, the defence news shock does not raise military expenditure on impact; instead, defence spending increases only gradually and peaks several years after the announcement, consistent with long planning and procurement horizons. Using the estimated spending path in Figure 5, the defence news shock increases cumulative additional defence outlays by roughly 0.4% of one year's GDP over the first ten years, assuming a baseline defence spending level of 2% of GDP. Despite the delayed implementation, real GDP rises immediately and continues to build over the medium run. This early expansion reflects forward looking demand effects: firms anticipate- tighter future labour markets and increase hiring today, while investment also rises as businesses adjust capacity in response to higher expected demand. Labour income increases persistently, consistent with stronger labour demand and higher wage pressures.

Over the medium run, the adjustment is not purely demand driven. Total factor productivity increases and remains positive for several years. This result, in line with Ben Zeev et al. (2025) and Beirne et al. (2025), should not be interpreted as rapid technological progress, but rather as improved efficiency as firms make fuller use of existing capacity and reorganize production in response to higher expected demand, consistent with models in which fiscal expansions generate endogenous productivity gains through learning-by-doing (d'Alessandro et al, 2019). These supply-side adjustments help sustain the expansion and moderate nominal pressures. Consistent with this timing, inflation may initially fall relative to baseline, as anticipatory investment and efficiency gains raise effective supply before spending materializes, while inflationary pressures catch up once defence expenditure ramps up and capacity constraints begin to bind. On the fiscal side, the fiscal balance-to-GDP ratio improves following the shock. This reflects the timing asymmetry inherent in anticipated spending: revenues increase early as output expands, while actual defence outlays materialize only gradually. The resulting temporary strengthening of the fiscal position should not be interpreted as evidence of self-financing spending, but rather as a short-run consequence of the announcement structure of the shock. In the medium run, when defence spending finally ramps up, the fiscal balance becomes slightly negative.

---

[3] The defence spending news shock is identified using a medium-run maximum forecast error variance (MFEV) approach following Ben Zeev and Pappa, (2014), Ben Zeev et al., (2025), Beirne et al., (2025). More details on this method can be found in the Appendix.

Figure 5. Macroeconomic Effects of Defence Spending for a panel of EU countries



Notes: Impulse responses from an unbalanced panel Bayesian VAR estimated on 17 European economies over 1960–2024. The figure reports the response of military spending, real GDP, labour income, private investment, fiscal balance, TFP, short-term interest rate and CPI inflation to a defence news shock. This specification includes country fixed effects. Shaded areas denote 84 and 95 percent credible intervals.

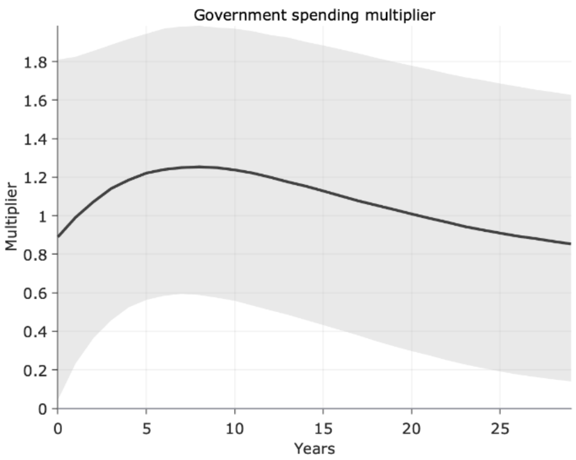
The estimated multiplier indicates that anticipated defence spending yields sustained medium-run output gains relative to its long-term fiscal cost. Figure 6 reports the defence spending multiplier (an average measure, for Europe) implied by the estimated impulse responses, computed using a present-value, program-based definition designed for anticipated spending shocks. Rather than relating output gains to contemporaneous or short-horizon changes in defence expenditures, the multiplier measures cumulative GDP gains relative to the full present-value cost of the defence spending program induced by the shock. This approach, proposed by Ben Zeev et al. (2025), explicitly accounts for the gradual implementation of military spending and avoids the instability of conventional cumulative multipliers when spending materializes with long delays. Formally, the multiplier relates cumulative output responses over horizon h to the discounted sum of future defence expenditures over a long horizon (30 years), scaled to an average annual effect. As discussed in detail in the appendix, this definition provides a conservative and policy-relevant measure of fiscal effectiveness under anticipation. Interpreted in this way, the figure indicates that anticipated defence spending generates moderate, but sustained output gains, with the multiplier rising in the medium run to values above one before gradually declining at longer horizons as the effects of the spending program dissipate.

These findings are in line with consensus in the literature but must be interpreted with care. The magnitude and profile of the estimated multiplier are broadly in line with recent studies emphasizing the role of supply-side channels in shaping the macroeconomic effects of government spending, particularly in the context of defence outlays (e.g. Antolín-Díaz and Surico (2025), Ben Zeev and Pappa (2014), Ben Zeev et al. (2025), Beirne et al. (2025)).[4] At the same time, the figure should be interpreted with caution. First, the multiplier is a local object, identified from historical marginal variations in defence spending around a relatively low average defence share of GDP, and cannot be interpreted as a one-to-one prediction of the effects of large-scale rearmament programs. Second, because defence spending represents a small fraction of GDP, euro-for-euro multipliers are

[4] See Ben Zeev et al. (2025) for careful sensitivity checks with respect to choice of variables, time frame and countries included in the VAR.

sensitive to scaling and may amplify statistical uncertainty. Third, the estimated multiplier reflects an average response across heterogeneous historical episodes and institutional environments and therefore should not be viewed as a structural constant. For these reasons, the multiplier should be understood as a summary indicator of medium run macroeconomic effectiveness under anticipated defence expansions, rather than as a precise forecast of the output returns to any specific defence spending package. Evidence from international studies suggests a broad range of multipliers and highlights the importance of context for interpretation. CPB (2023) provides a comprehensive summary of these insights from fiscal multiplier research. A more detailed discussion on the multiplier estimation can be found in the Appendix.

Figure 6. Defence spending multiplier



Notes: Government spending multiplier following a defence news shock. The multiplier is computed over a 30-year horizon using a present-value, program-based definition following Ben Zeev et al. (2025). Shaded areas denote 84 percent credible intervals. See Appendix 5.1.4 for a discussion on the multiplier calculation.

While the European-level estimates provide a useful benchmark, their interpretation in the context of Dutch defence spending must be informed by the structural features of the Dutch economy. First, defence spending represents a very small share of Dutch GDP and displays limited time-series variation, which mechanically amplifies scaling uncertainty[5] when translating elasticities into euro-for-euro multipliers. Second, the Netherlands is a highly open economy with a relatively small domestic defence-industrial base. This implies that a larger fraction of defence expenditure may leak abroad through imports, reducing the domestic output response. Chapter 2 will complement the earlier findings by Berenschot (2025) and CBS (2025), showing that this holds not only for direct defence procurement, but also indirectly, through the import dependence of the Dutch defence manufacturing base. For these reasons and given data constraints related to the short time series and limited variation in national defence spending, this report does not attempt to estimate a country-specific defence spending multiplier for the Netherlands. Instead, the European panel results should be interpreted as an upper-bound benchmark for the potential macroeconomic effects of defence spending under conditions of greater scale and stronger domestic production linkages. This interpretation is fully in line with CPB (2025), which argues that

[5] Scaling uncertainty refers to the amplified statistical imprecision that arises when elasticities estimated on broader samples are converted into country-specific level effects in contexts where the relevant spending share is small or exhibits little variation.

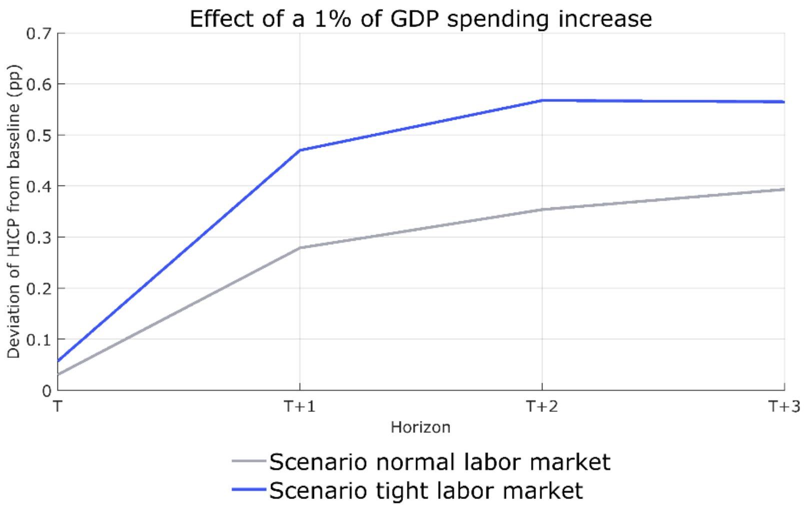
Dutch defence spending multipliers are likely small in the short term due to labour-market tightness, import leakage and limited domestic production capacity.

The inflationary impact of defence spending depends strongly on the composition of expenditures, with personnel outlays and different categories of equipment procurement showing distinct price dynamics. For spending on equipment, the inflation effects are likely to depend on the type of goods purchased. A distinction between highly complex weapon systems (e.g. specific types of aircraft or long-range missiles) and less complex military goods (e.g. basic ammunition or clothing) must be made, but is ambiguous: while economic arguments suggest that highly complex systems should be more prone to rapid price increases due to limited production capacity and barriers to entry, recent evidence also shows that certain less complex goods have experienced even sharper inflation. While we are not aware of a centralized database for inflation in defence goods, there is anecdotal evidence to this point from recent purchases of tanks (BulgarianMilitary.com, 2025), aircraft (Breaking Defence, 2025) and missile systems (CBS News, 2023). For complex platform categories, decades of performance upgrades and regulatory compliance have raised baseline unit costs independent of short-term demand (Arena et al., 2008). In contrast, the Rabobank (2025b) finds that prices for some types of munitions have gone up more than for complex naval and avionic systems following the Russian invasion of Ukraine, a pattern likely driven by procurement strategies and limited industrial capacity rather than their specific use in the Ukraine conflict. Surveying the field, Burilkov et al. (2025) warn that "price increases for military equipment might absorb large parts of budget increases" for defence spending in Europe.

In addition to spending composition, the state of the economy, particularly labour-market tightness, plays a central role in shaping the inflationary effects of defence expenditure. For countries such as the Netherlands, where labour markets have been tight in recent years, this state dependence suggests a heightened risk of stronger inflationary pressures. Figure 7 illustrates this point, by giving a model-based comparison of the response of consumer price inflation to a spending increase on government employment equivalent to 1 percent of GDP under normal labour market conditions and under conditions of an overheated labour market. Inflation rises in both scenarios, but the response is around one-and-a-half times as strong and more persistent when labour markets are tight. This reflects binding capacity constraints and stronger wage pressures (Antonova et al, 2025). By contrast, when labour market slack is available, the inflationary response is more muted and adjusts more gradually.[6] While Figure 7 does not isolate defence spending per se, it illustrates a general mechanism through which fiscal expansions can have markedly different price effects when interacting with labour market tightness, which is particularly relevant for defence spending given its labour-intensive components.

[6] See DNB (2025) for an explanation of the difference in modelling assumptions that underpin these different outcomes.

Figure 7. Inflationary effects of government spending on labour in a normal and overheated labour market



Notes: The figure shows the deviation of consumer price inflation (HICP) from baseline following a government spending increase on employment of 1 percent of GDP, comparing normal and overheated labour market conditions. Overheated labour market conditions are simulated using a steeper Phillips curve. Inflationary effects are stronger and more persistent when labour markets are tight. Sources: authors' calculations.

1.3 Defence R&D and technological spillovers

Defence-related R&D matters mainly for the long-term economic effects of defence spending, rather than for the short- or medium-run dynamics discussed earlier in this chapter. While CPB (2025) focuses primarily on macroeconomic effects under current Dutch conditions, our empirical analysis examines medium-run adjustment mechanisms associated with anticipated defence spending at the European level. Recent work by Rabobank (2025a,c) emphasizes potential long-run productivity spillovers from defence-related R&D. These strands of literature reflect differences in time horizon, object of analysis, and methodology. Long-run R&D studies focus on productivity gains unfolding over decades and often rely on cointegration or growth-accounting approaches, whereas the macroeconomic framework used in this chapter is not designed to capture such very long-horizon spillovers. As a result, defence R&D effects discussed below should be interpreted as structural, long-term considerations, rather than as extensions of the short- or medium-run macroeconomic multipliers analysed earlier.

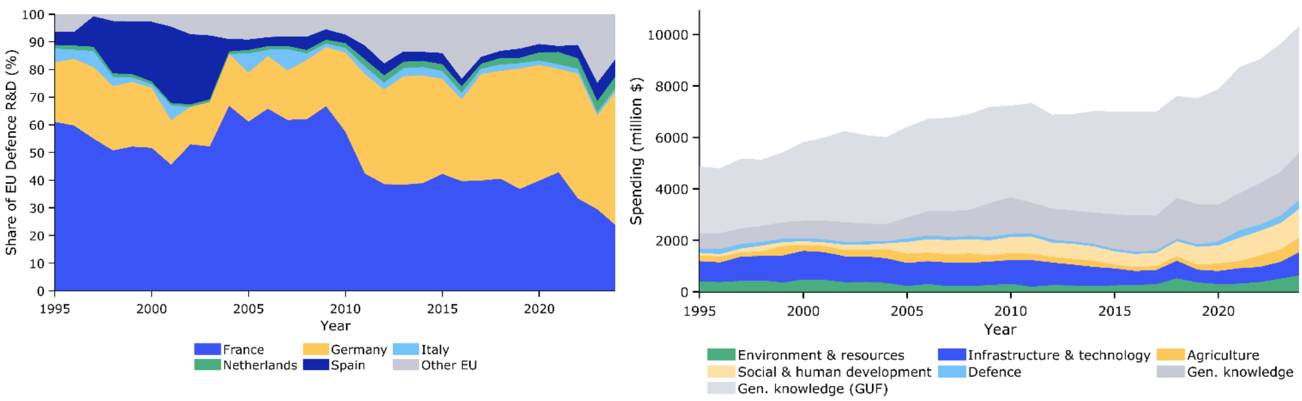
The literature suggests that defence-oriented R&D has a greater potential to support long-run productivity than other components of military spending. Unlike personnel or procurement, R&D investments create knowledge that can spill over into civilian industries and stimulate broader innovation (Moretti et al., 2021). Evidence from the United States, most prominently the experience of DARPA, shows that mission-driven defence R&D has been instrumental in the development of general-purpose technologies such as computing, advanced materials, and digital communications. European studies reach similar conclusions, though with smaller effects, as the more fragmented defence-industrial landscape limits benefits of scale (Ibid; Rabobank 2025a; CPB 2025). For countries with modest defence-R&D capacity, including the Netherlands, the macroeconomic impact of such investments is naturally more limited. Nonetheless, the literature consistently identifies defence R&D as the component most likely to generate long-term economic benefits, provided that investments are sustained and embedded within broader national innovation systems.

Defence R&D is highly concentrated in a few EU member states. The first panel in Figure 8 shows that public defence R&D across the European Union is dominated by a handful of large member states, primarily France, Germany, Spain and Italy, which together account for the vast majority of EU defence-related research activity. Smaller economies, including the Netherlands, contribute only a modest share to the European total, reflecting differences in industrial capacity and the scale of national defence programs. The second figure focuses on the Netherlands and shows that, within the national R&D portfolio, defence represents only a very small fraction of total research expenditure, dwarfed by civilian categories such as health, energy, and industrial technologies. The two figures indicate that defence R&D remains a comparatively minor and highly specialized activity in the Netherlands, limiting the scope for large domestic innovation spillovers from defence-oriented research.

Figure 8. Public defence R&D Expenditure

(a) Distribution of public defence R&D within European countries

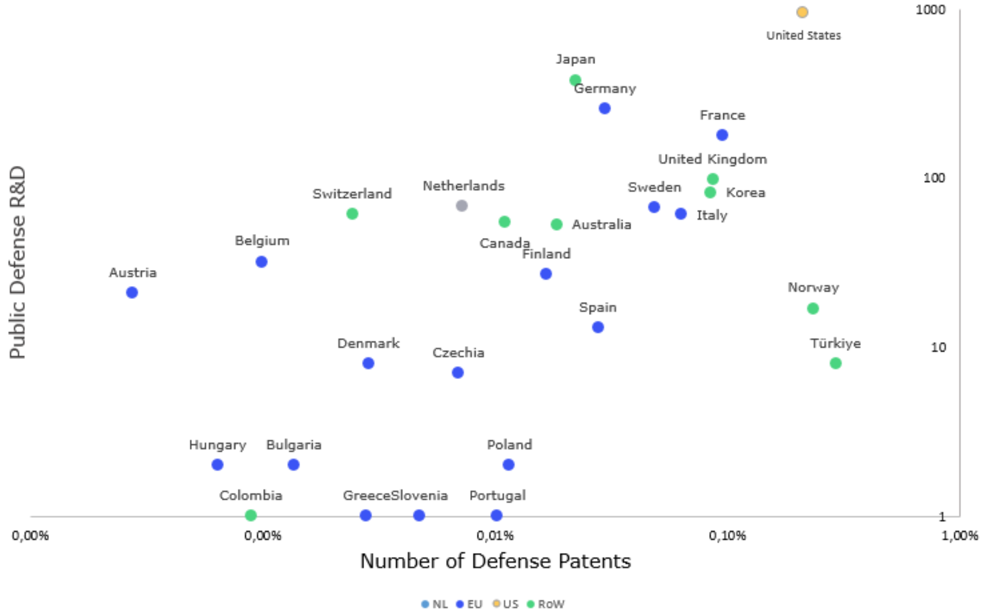
(b) Composition of public R&D expenditure within the Netherlands



Notes: Panel (a) shows the distribution of total EU public defence R&D expenditure accounted for by major member states over 1995–2024. Countries shown separately include France, Germany, Italy, the Netherlands, and Spain; remaining EU members are grouped under "Other EU." Values represent each country's annual percentage share of total EU defence R&D spending. Panel (b) presents the composition of national R&D expenditure within the Netherlands over the same period, disaggregated into major thematic categories, including defence. GUF stands for General University Fund, a specific type of government grant allocated to universities, especially for research and development (R&D). Sources: OECD data.

Higher public defence R&D expenditure has historically led to a higher innovation output as measured through defence patenting activity. See Figure 9 below. We note that, while patenting is a standard proxy for innovation output, it is also an imperfect measure. This may be particularly true for defence patenting, as the incentives to maintain secrecy for strategic reasons can lead to both lower overall patenting and longer patenting lags. In addition, such differing strategic considerations may lead to additional variation between countries, above and beyond general variations in legal copyright frameworks and patenting practices. Nevertheless, Figure 9 shows a highly significant correlation (P<0.001) between defence R&D as a share of GDP and the number of patents filed in a cross-country sample over 2000-2020. Countries such as the US, Japan, Germany and France, which have the highest defence R&D expenditure, generally also have the highest amount of defence patents. The Netherlands ranks in the middle bracket, with moderate defence R&D expenditure and moderate patenting activity. The logarithmic scales of the figure below underscore the message of Figure 8a above: defence R&D, both in its input and its output, is dominated by a small subset of countries. We will further explore patenting data and technological advantages in Chapter 3 of this study.

Figure 9: Public R&D-spending related to defence as a share of GDP and number of defence patent filed, 2000-2020



Notes: Average public defence-related R&D-spending 2000-2020 in million US dollars, PPP converted and constant prices 2020 over 2024 GDP in US dollars, PPP converted current prices; absolute number of core defence patents in 2000-2020. Both logarithmic axes. Selected number of countries for which data on public defence related R&D spending was available.

For the Netherlands, taken together, these findings imply a clear distinction between short-term constraints and long-term policy choices. In the near term, the structure of the domestic defence market and the limited size of the national defence-industrial base constrain the scope for large economic spillovers from higher defence spending, regardless of its composition. Against this backdrop, increases in defence expenditure are unlikely to translate into sizable, short-run gains in domestic output or productivity. Looking ahead, however, policy objectives extend beyond short-term macroeconomic effects. To maximize longer-run technological spillovers, strengthen participation in European defence value chains, and advance strategic autonomy at the EU level, defence-related R&D should be prioritized as a key margin of adjustment. While joint procurement can improve efficiency and interoperability, and personnel spending supports readiness, neither offers the same potential to drive innovation or reshape industrial capabilities. By contrast, R&D investment enables gradual capability renewal, fosters upstream collaboration across borders, and aligns defence policy with broader objectives for innovation and European integration.

The following chapters build on this perspective by examining the position of the Dutch defence industry within Europe and identifying areas of strategic, comparative, and technological advantage. In these areas, targeted R&D and industrial policy could yield the greatest long-term returns. Defence R&D should be viewed not as an instrument for immediate economic stimulus, but as a forward-looking strategic investment whose economic payoff depends on persistence, coordination, and integration within European research and industrial frameworks.

2 Sectors: trade and centrality

In this chapter we look at the import dependence and centrality of the Dutch defence manufacturing industrial base. We look at characteristics of five manufacturing sectors that can play a central role in growing defence manufacturing in the Netherlands. We find that these sectors are all highly import dependent and of varying centrality to the Dutch domestic economy. The import data reinforce the notion that Dutch defence procurement is likely to largely leak abroad in the short run, as postulated by other studies based on figures on direct foreign procurement. Import leakage is not uniform: while procurement from EU partners still limits domestic multipliers, it tends to be economically and strategically more advantageous than leakage to non-EU suppliers, as it supports European industrial integration, strengthens collective security, and enhances coordination within the EU. However, the varying centrality of sectors can offer some guidance for policymakers seeking to maximize domestic spillovers, especially in the context of an expanding defence manufacturing base over the medium run.

2.1 Import dependence and centrality influence economic effects

Import dependence, both direct and through supply chains, crucially shapes how much of the defence spending resonates in the domestic economy. If government spending relies heavily on imported inputs, a substantial share of the fiscal stimulus leaks abroad rather than boosting home output. In practice this means the effect of defence spending on growth is smaller: resources flow to foreign producers of equipment or components instead of local firms and workers. Domestic government spending can be subject to secondary import dependence as well: the domestic defence industry may itself be substantially dependent on foreign suppliers. As a targeted sector's import dependence increases, so does the extent to which the government's demand impulse will increase foreign rather than domestic demand.

The related concept of 'downstream centrality' within the domestic production network also matters to the propagation of a governmental defence demand increase through supply chains. Sectors that drive demand for other industries as they expand will propagate a government spending impulse more broadly through the economy. In this study, we call this 'downstream centrality'. This concept is the same as Katz's (1953) authority centrality, the calculation of which is explained in the appendix. Targeting a downstream central sector can generate significant spillover effects: higher demand for these sectors translates into increased demand for inputs from its suppliers, which in turn stimulates those upstream industries, and so on through the supply chain. The result is a larger overall boost to GDP. By contrast, spending on a sector with low downstream centrality tends to remain self-contained, with minimal knock-on benefits to other industries. The strength of a sector's multiplier effect depends largely on how many sectors it feeds into and how intensively its goods or services are used by others. This combination (low import leakage and high domestic linkages) maximizes the bang-for-buck of fiscal stimulus, ensuring that public spending translates into widespread domestic economic activity rather than dissipating abroad.[7]

The Netherlands' defence budget exhibits exceptionally high import dependence, especially in capital outlays for advanced equipment. According to CBS, about 61% of defence investment was spent directly on imported goods during 2015-2024 (CBS, 2025). Even routine operational spending, which CBS classifies as 'intermediate consumption', has a sizeable import component of 29%. This heavy reliance on foreign suppliers means the bulk of new defence outlays leaks abroad, limiting domestic economic gains. In the case of more

[7] An important caveat in this mechanism is that the input-output analysis implicitly assumes constant prices and no feasibility constraints. Hence, potentially inflationary effects through resource scarcity are not considered.

complex weapon systems, this dependency is even higher and highly concentrated on the US (ABN Amro, 2025). This underscores a dependence on external supply chains that dampens the fiscal multiplier of defence spending. Personnel expenditure ends up almost exclusively with Dutch households, but in a tight labour market the net economic gains of such spending are limited as well (see Chapter 1).

Over the longer run, the centrality and import dependence of the defence-sector increase in importance for the associated economic effects. The medium and long-run economic impact of defence spending depends less on today’s high levels of foreign procurement implied by the current production structure and more on the evolving structure of the European defence industrial base. While current Dutch defence procurement is indeed import-intensive, this pattern is not fixed: EU initiatives such as ReArm Europe and the emerging European Defence Industrial Strategy explicitly aim to shift production and procurement back inside Europe, reducing reliance on extra-EU suppliers. As European countries scale up joint production, deepen cross-border supply chains and expand R&D investment, the downstream centrality and domestic embeddedness of defence-related sectors will determine how government demand resonates domestically.

2.1 Sectors in Dutch defence industry have relatively high import dependence

Governmental defence spending is concentrated in a handful of sectors. As the defence manufacturing sector is not specified as such by datasets covering international production networks, a mapping to sectors that collectively make up the defence sector is required. For the Netherlands, we identify these sectors based on data and guidance of CBS on which sectors make up the bulk of the defence expenditures of the Dutch government. Defence-related equipment purchases are concentrated in the metal products, computers and optics, machinery, motor vehicles, and transport equipment sectors. See Table 1 for an overview of their value added and some examples of defence products included. Survey-based data from Berenschot (2025) confirms the importance of the sectors identified on basis of the CBS data. While industrial defence production is concentrated in these sectors, it is important to stress that they cover more non-defence than defence production, and our results should be interpreted with that caution in mind. From the survey-based data, we also find that wholesale, engineering and IT also supply both directly and indirectly through supply chains to the government for defence-related purposes. However, these are mainly general-purpose sectors for which defence expenditure is not a major source of revenue, even when domestic defence outlays are scaled up significantly. Nevertheless, for completeness we have also analysed the centrality and import dependence of these general-purpose sectors and included the resulting graphs in the appendix. Finally, the relevance of the five selected sectors beyond the Dutch defence composition is confirmed by US data from the Bureau of Economic Analysis (BEA), which offers detailed insights into the sectors receiving defence-related government expenditure, and shows the same sectors to be the most relevant for defence procurement. To analyse the role of the five identified sectors in the broader domestic and global production network, we obtained sectoral data for the global production network from Eurostat's Figaro tables, which cover 61 sectors in total. A more detailed description of this dataset can be found in the appendix.

Table 1: defence manufacturing sectors: value added and product examples

Defence manufacturing sector	Value added share	Defence products included
Metal products	1.10%	Metal castings/forgings for naval & weapon systems; structural steel parts; armour solutions; precision metal components
Computers and optics	0.27%	Radar systems, night-vision optics, avionics, secure communication devices, missile guidance electronics, sensors for drones
Machinery	2.21%	CNC machine tools, metal forming/pressing machines, robotic handling systems, mobile repair/power units
Motor vehicles	0.30%	Armoured personnel carriers, tactical trucks, military jeeps, specialized chassis for defence vehicles, spare parts for armoured systems
Transport equipment	0.20%	Naval ships, patrol boats, submarines components, fighter jet parts, helicopter assemblies, aerospace propulsion systems

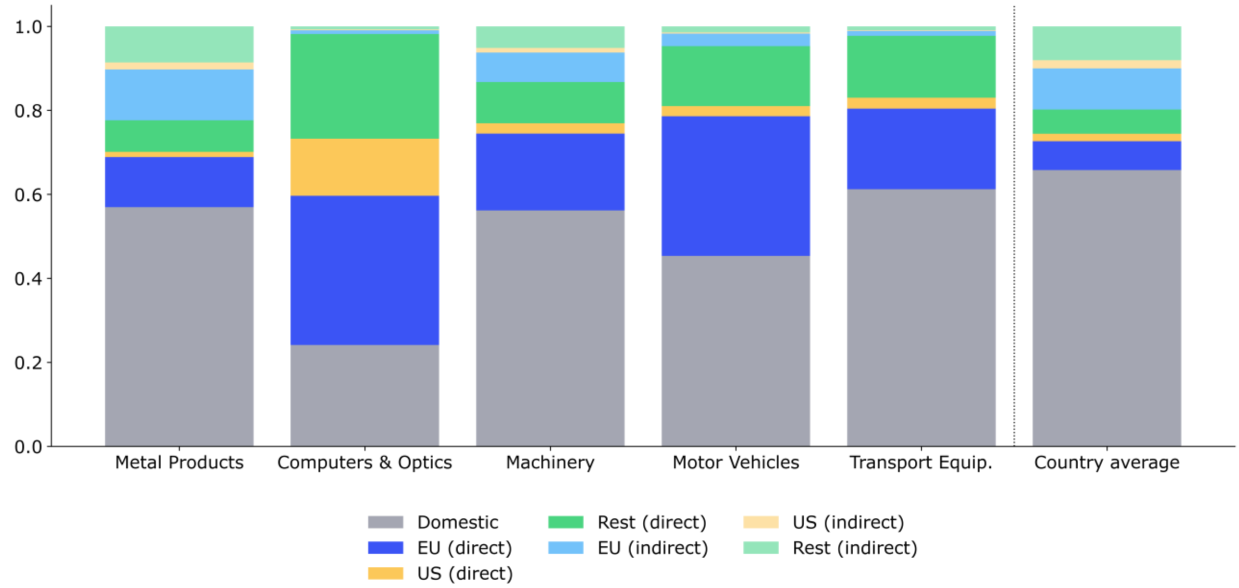
The sectors that form the industrial base of the Netherlands' defence industry exhibit a relatively high dependence on imports. See Figure 10 for both their direct and indirect (imports via other sectors) import shares by origin. In other words, these sectors source a significant share of their inputs from foreign suppliers. This is particularly true for the domestic computer and optical products sector. Likewise, the Dutch motor vehicles and transport sectors rely heavily on foreign inputs, amongst others from German and Belgian motor vehicles sectors (see appendix, Figure A6) causing demand in these categories to spill over into imports. These patterns reinforce findings from CBS (2025) and Berenschot (2025) that additional defence procurement primarily benefits foreign producers. The metal products sector is an exception, as it creates significant upstream demand, particularly for the sizable Dutch basic metals sector (more on that in Chapter 2.3 below). However, even the metal products sector is significantly more import dependent than the Dutch average sector, which has a direct import dependency of 14% and an indirect import dependency of 9% (see the 'Country average' bar in Figure 10). The high import dependence of the Dutch industrial base for defence production implies that, even if procurement shifts to more locally produced goods, without a change to the production structure much of this demand will leak abroad indirectly.

The choice between domestic and foreign suppliers implies a trade-off between different policy goals. Procuring abroad can deliver lower prices and higher-quality equipment, given access to a broader set of producers and greater competitive pressure. Foreign procurement is also less inflationary: when supply is sourced internationally rather than domestically, the effective supply elasticity increases, preventing domestic bottlenecks and price pressures from amplifying fiscal expansion. However, these advantages come with a cost. The fiscal multiplier associated with defence spending is typically smaller when purchases leak abroad, since fewer of the induced economic effects materialize within the domestic economy. This reinforces the finding in Chapter 1 that the effects of spending on growth are likely to be small in the short run. Differences between sectors mean that this can be mitigated to some extent, with spending in the computers and optics sector (the most exposed to non-EU imported inputs) or the motor vehicle sector leading to higher demand leakage than spending in the machinery or metal products sectors, but cannot be expected to have a high impact on the overall multiplier.

Hence, foreign procurement can be efficient in the short run, especially if strategic goals must be met, but long-term increases in defence investment justify building additional domestic production capacity.

A separate but related distinction concerns procurement from EU versus non-EU suppliers. Figure 10 also splits import dependencies by the EU, the US, and the rest of the World. We see that approximately half of the foreign dependencies, except for the metal products sector, stem from the EU. This dependence on national rather than EU suppliers has its own trade-offs. Defence capability can be viewed as a European public good. Increases in production capacity elsewhere in the EU strengthen collective security and raise overall efficiency. In other words, while import dependence dampens short run domestic multipliers, leakage to EU partners is less economically and strategically problematic than leakage to non-EU suppliers. Draghi (2024, p. 165) points out that procurement from the EU even in the short term is realistic, as European equivalents to many US defence products already exist or could be made available rapidly. He argues that continued preference for US procurement mainly reflects non-economic factors rather than genuine capacity constraints or quality limitations. Finally, evidence from Ilzetzki (2024) shows that productivity gains are particularly strong in plants facing tight capacity constraints. This "learning by necessity" would therefore act as an endogenous adjustment mechanism under increased demand. Taken together, these insights suggest that a balanced procurement strategy, one that supports domestic industry where it has potential for scalable capacity, while relying on EU partners where complementarities exist, can maximize both economic and strategic returns.

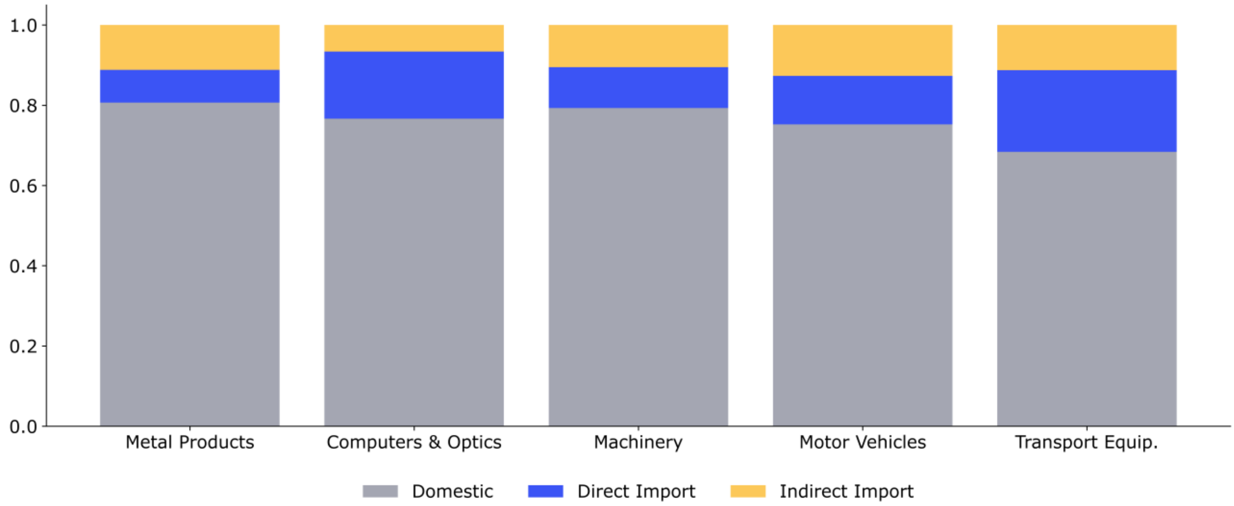
Figure 10. Relatively large import dependence of five defence-related manufacturing sectors



Notes: The figure shows the share of domestic and imported inputs (both direct and indirect) by origin (distinguishing between EU, US, and the rest of the world) in the production of five defence-related manufacturing sectors. For comparison, the same shares for the overall Dutch economy are shown as 'Country average'. Source: Eurostat's Figaro dataset; own calculations.

When we extend our analysis to the European level, we find a more self-contained industrial base than in the Netherlands (see Figure 11). Europe's key manufacturing sectors source roughly 70–80% of their intermediate inputs from within the EU, indicating far deeper local integration than is the case in the Dutch economy. Put simply, the Netherlands' high degree of openness implies that a substantial share of defence expenditure leaks abroad, whereas Europe's more internally integrated industrial base would retain a larger portion of the investment. This reflects the size and diversity of the European defence industrial base. While a direct comparison between a small open economy like the Netherlands and the entire EU may seem unbalanced, however, a similar picture emerges when examining only Germany: German manufacturing sectors are, on average, less import dependent than their Dutch counterparts (see Appendix, Figure A3).

Figure 11. Import dependence of European defence-related sectors

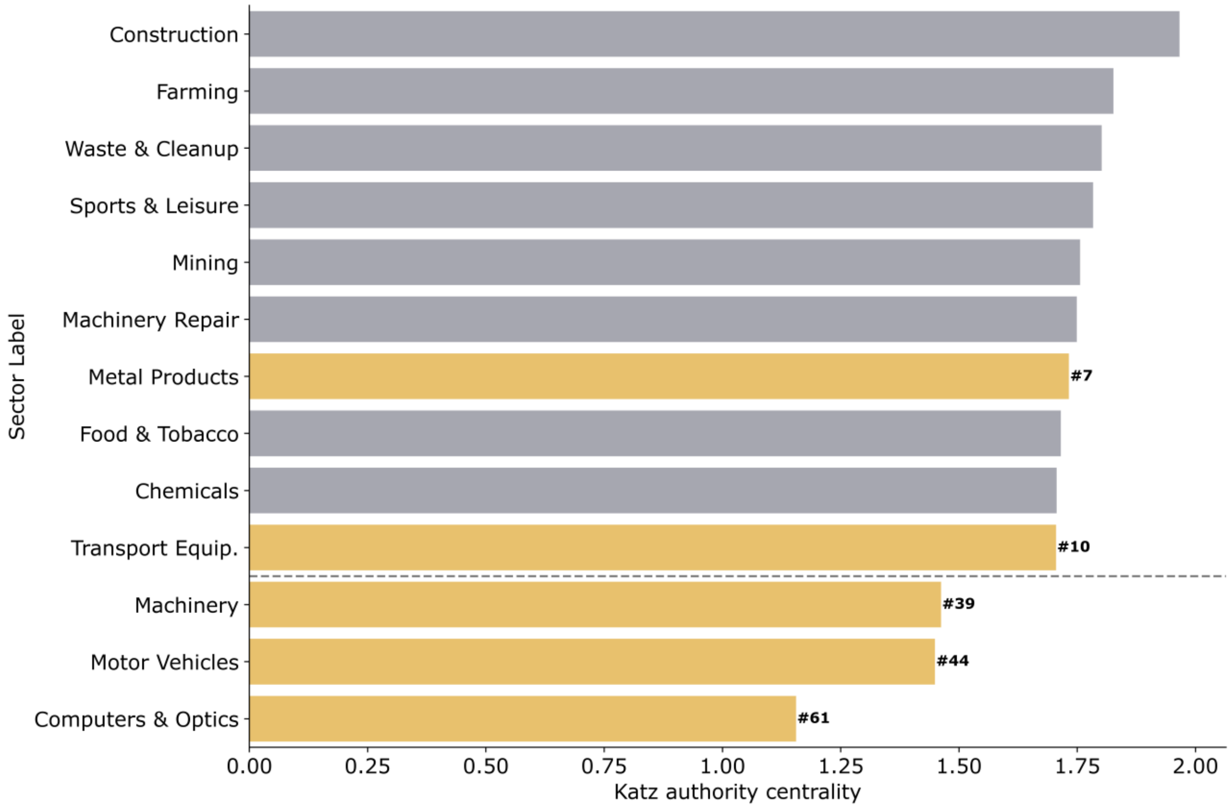


Notes: The figure shows the share of domestic and imported inputs (both direct and indirect) in the production of five defence-related manufacturing sectors at the European level. Source: Eurostat's Figaro dataset; own calculations.

2.2 Suppliers to defence manufacturing mostly not central

The defence industrial base sectors are of differing downstream centrality to the Dutch economy. Input-output analysis indicates that three defence-relevant manufacturing sectors are not well integrated into the Netherlands' production network. See Figure 12. Computer and optics equipment manufacturing, for instance, is among the most peripheral sectors. It ranks near the bottom in domestic downstream centrality, reflecting few upstream linkages to other Dutch sectors. Likewise, motor vehicle production and general machinery manufacturing occupy relatively low positions. Just as with the high import dependence in Chapter 2.2, an overall relatively low centrality reinforces the finding in Chapter 1 that the short-term growth effects are likely to be limited. By contrast, fabricated metal products and other transport equipment appear in reasonably central positions (within the top ten) of the Dutch industrial network. This means that increased demand for defence goods in the Netherlands has a stronger ripple effect if these sectors are targeted.

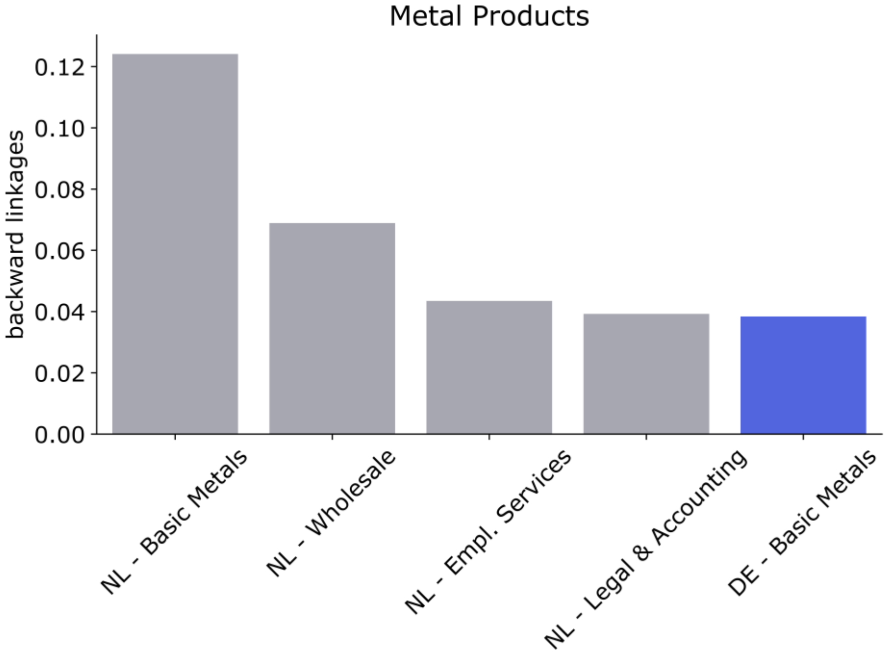
Figure 12. Downstream centrality of Dutch defence-related sectors



Notes: The X-axis shows the Downstream/Katz authority centrality score, which reflects how strongly each sector is connected to and influenced by other sectors in the network, including both direct and indirect links. Higher values indicate greater downstream influence within the Dutch economic network. Intuitively, it measures how influential a sector is in terms of its network connections. The top 10 sectors by downstream centrality appear above the dotted line; the remaining defence-related sectors appear below. Defence-related sectors are shown in yellow with its rank next to it. Source: Eurostat's Figaro dataset with 61 sectors in total; own calculations.

Metal products is a sector that does offer relatively strong domestic linkages with rather limited import dependence. This sector includes metal components and subsystems often used in larger defence platforms. Supplier data show that Dutch metal-products manufacturers source significantly from other domestic sectors, including basic metals, wholesale trade and logistics, and business services. See Figure 13. These upstream linkages mean that expansion in metal-products output can cascade to some degree through the Dutch economy. However, the depth of these linkages is still weaker than in Germany's case, where metalworking firms sit within a dense network of local heavy industries (see Appendix, Figure A3). Overall, for all five sectors except computers and optics, about 80% of all upstream linkages, extend from either domestic or EU production (see Appendix, Figure A8).

Figure 13. Top five upstream suppliers to the Dutch metal products sector along the entire supply chain



Notes: Backward linkages measure the extent to which the Metal Products sector depends on inputs from other sectors along the entire supply chain, including both direct and indirect contributions. The bars show the five sectors with the largest upstream influence on Metal Products. The abbreviation 'NL' stands for The Netherlands, and 'DE' for Germany. 'Wholesale' stands for Wholesale trade (G46) and 'Empl. Services' for Employment Services (N78). Source: Eurostat's Figaro dataset; own calculations.

3 Technologies and products: specialization and opportunities

Investment, in particular in R&D, can generate economic returns over the medium and long run, but the direction of that investment is crucial. Using product and patent data, we show that the Netherlands lags its European peers in innovation and production proximity to core defence goods but has a comparative technological and production advantage in specific dual-use domains, such as semiconductor lithography and specialized microscopes. By directing investments toward these comparative advantages, the Netherlands can contribute to reducing European level dependencies, strengthen its existing economic capacities, and unlock future opportunities. Further specialization requires multilateral coordination within Europe; without it, countries risk competing with one another, leaving both strategic and economic goals unfulfilled at a European level. In addition, a coherent and credible long-term plan is essential to mobilize the necessary private investments.

3.1 Strategic choices starting from a small defence manufacturing base

The composition and direction of defence spending shape long-term strategic capabilities and economic outcomes. As shown in Chapter 1, EU defence spending has declined for decades, remaining well below the NATO benchmark. This persistent underinvestment has eroded the defence production base across Europe and particularly in the Netherlands. Of the world's 100 largest defence firms, only 14 are European, and none are Dutch (SIPRI, 2024). Chapter 2 further highlights that while the EU is broadly dependent on defence imports, the Netherlands is even more reliant. Within shrinking defence budgets over the past decades, the share of defence R&D, which has the highest economic spillovers, has historically been low in the Netherlands compared to other EU countries (see Figure 8b in Chapter 1), resulting in limited defence-related innovation (see figure 9 in Chapter 1). Consequently, the Netherlands is poorly positioned in core defence production, with both constrained production capacity and knowledge gaps.

As defence budgets expand, policymakers face decisions about which strategic objectives to emphasize. We identify three relevant policy objectives, which are not mutually exclusive and can be balanced, but can also imply different investment focuses. Each of these goals is to some extent reflected in the Dutch Defence Strategy for Industry and Innovation (Rijksoverheid, 2025). Nevertheless, it is important to emphasize that strategic goals are the primary objective of defence spending, and economic objectives among the secondary goals.

1. <u>Reducing foreign dependencies</u>: developing Dutch or European alternatives for strategically critical equipment currently imported.
2. <u>Leveraging current strengths</u>: channelling investment toward areas where Dutch industry already holds technological advantages or established production capabilities.
3. <u>Maximizing spillovers:</u> channelling investment towards areas that create wider economic benefits, for example, production that offers opportunities for expansion to new types of production.

Attainment of any of these goals requires a degree of technological and product specialization. Such specialization can only take place in the context of a European collective effort at improving our security. Therefore, the strategic choices for which we provide input in this section can only be made in the context of multilateral coordination in Europe. In addition, specialization in technologically advanced production implies up-front investment costs. Part of this investment will likely need to come from private sources. Private investment is contingent upon returns that are to some extent predictable. A credible, long-term commitment to areas in which the Netherlands will specialize, is therefore another necessary condition for economic efficiency and specialization. We will return to these points at the end of this chapter. First, we use trade and patent activity indicators to assess strengths and weaknesses of the Dutch defence and dual-use production.

3.2 Reducing strategic defence dependencies: Dutch focus on dual-use

Reducing defence-related strategic dependencies enhances EU security and resilience against external pressure or supply disruptions. Reducing dependencies increases autonomy and crisis readiness but comes at a cost: deliberately building out new domestic production limits economies of scale and requires time. Efforts should therefore focus on critical technologies and products with few diversification options at the EU level, acknowledging that national autarky is neither practical nor economically efficient (Mehlbaum and Heerma van Voss, 2025). Although dependencies can arise in many domains—such as services (e.g., US IT solutions) or supply chains (e.g., Chinese rare raw materials)—this analysis focuses on dependencies in final products and demonstrates that international trade data can help identify these vulnerabilities and guide policy responses. For this analysis, we use product data from the Harvard Economic Complexity Atlas. This dataset contains a proximity indicator which, based on historical correlations in co-export data, measures how closely a product aligns with existing capabilities, indicating how easily existing production can shift to this product. For a more straightforward interpretation we use the inverse of distance, adjacency. See the appendix for a more complete description of data and methods.

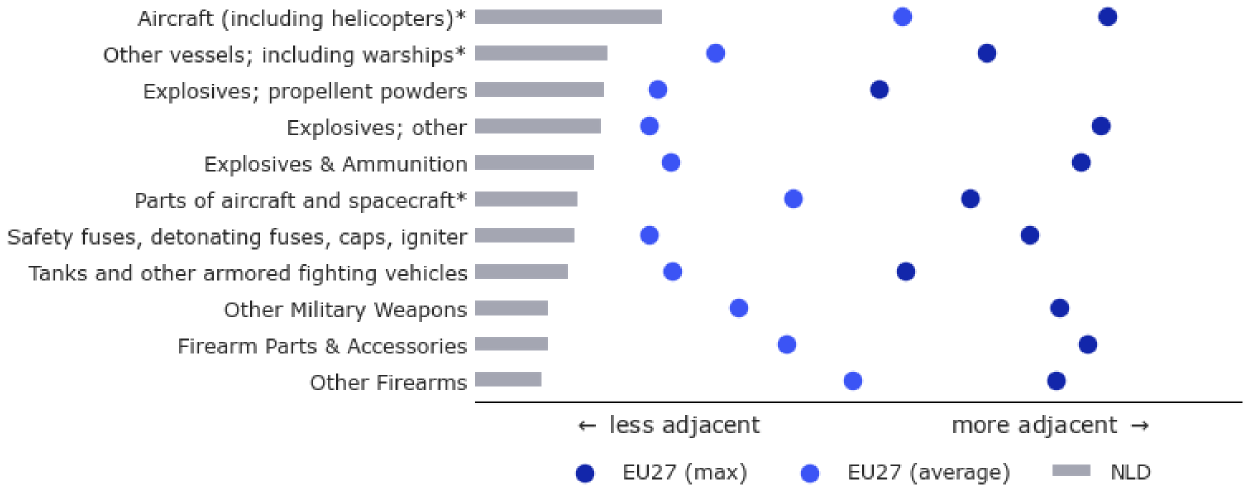
Other EU countries are generally better positioned to initiate or expand production of core defence goods. Figure 14 compares the Netherlands' adjacency to producing core defence goods - such as bullets, tanks and weapon systems - with the EU average and the highest adjacency among member states. The latter are marked with dark blue dots and mostly represent Germany, Italy, and Spain, whose production structures are most adjacent to these core defence goods. This comparison shows Dutch production structures are not well aligned with defence requirements, scoring below the EU average adjacency score in each product category. Moreover, the Netherlands is also not among the leaders in core defence patenting (see figure 15) and has historically spent less than average on defence R&D (see figure 8). Thus, our lagging production position is not compensated for by core defence technological advantages. Consequently, scaling up core defence production in the Netherlands would require higher investments and take longer than in countries with a technological edge and closer production alignment. This finding matches with the relatively small size of the Dutch defence sector found in Chapter 1, as well as the high import dependence of the defence industrial base as shown in Chapter 2.

Instead, the Netherlands holds a technological advantage in specific dual-use areas. Patent data provide a standard metric for comparing technological sophistication and innovation activity between countries (e.g., OECD, 2009; Nagaoka, 2010). Using OECD patent data, we identify defence-related patents following the classification developed by Caviggioli et al. (2018). Moreover, we identify 10 dual-use sectors based on the EU export control list and link each of them to the corresponding patent codes.[8] Countries such as the US and Japan dominate overall innovation, driven by their economic scale, sectoral composition, and strong research orientation. This is also the case for most defence (both core and dual-use) patenting.[9] To account for these structural differences, we use the Relative Technological Advantage (RTA) indicator. The RTA provides a normalized measure of technological specialization by comparing the share of a given technology in a country's patent portfolio with that technology's share in global patenting, thereby adjusting for cross-country differences in overall patenting. The Netherlands shows technological strengths in specific domains within marine, nuclear, electronic, computer, and sensor and laser technologies. Conversely, it is far less specialized in other dual-use domains, including advanced materials, materials processing, avionics, and aerospace. See Figure 15. These

[8] Appendix 5.3 provides more details on the mapping between sectors and IPC patent codes
[9] See Figure A9 in the appendix for an overview of the share of patenting by defence category and location

technological advantages position the Netherlands to contribute meaningfully to the European effort to reduce dependencies, both by developing new lines of dual-use goods and by participating in European weapon system supply chains. A focus on dual-use goods aligns well with current Dutch advantages but is only viable in the context of a broader European defence production plan in which other countries specialize in defence products.

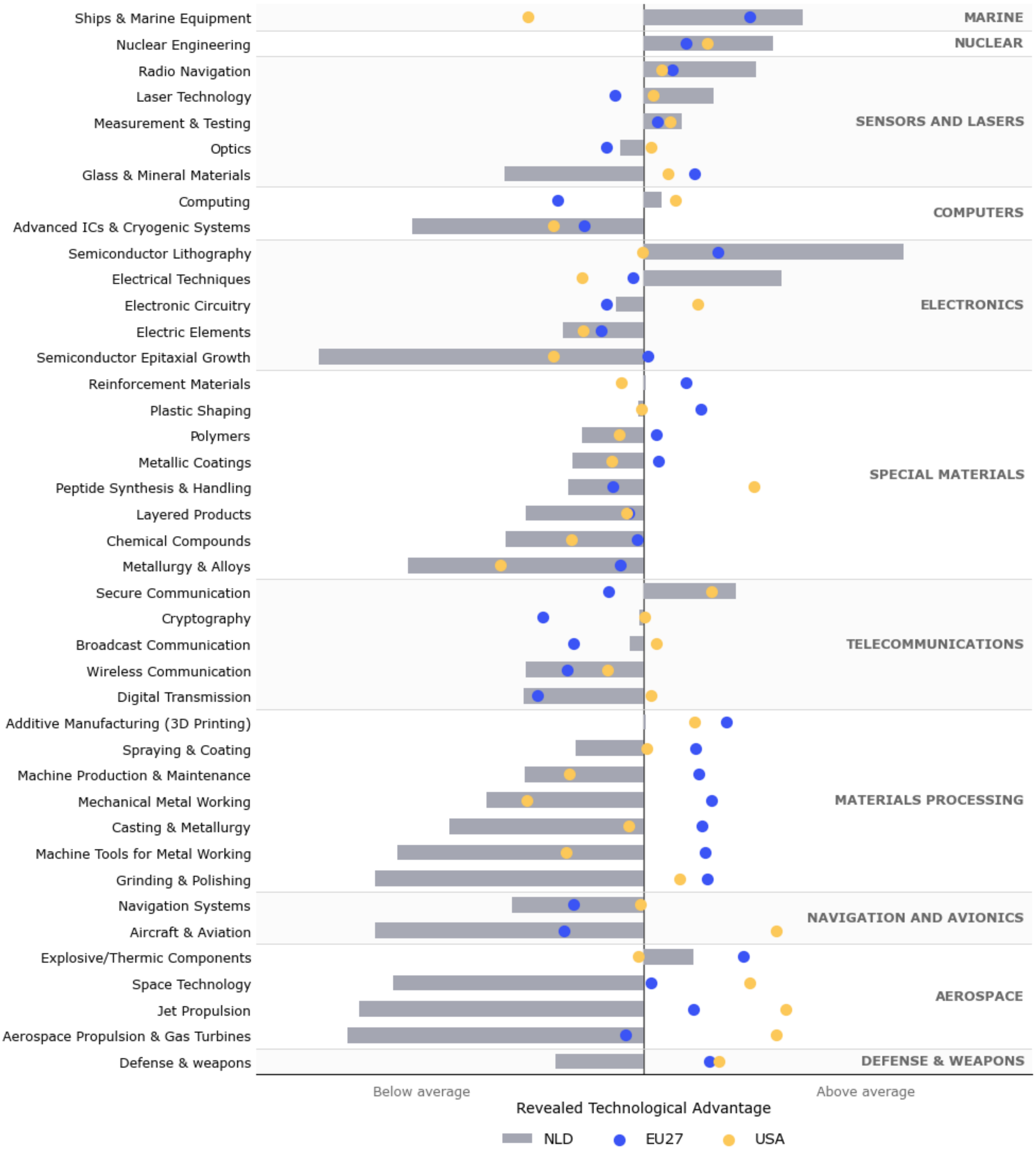
Figure 14. Adjacency to core defence products



Note: Adjacency of product groups (4-digit HS2012) related to defence based on export profiles of countries for 2023. Indicators are taken from the Harvard Complexity Atlas. For the average EU score, the average of member countries is taken weighted by their export shares. * Includes also products with civil applications.

From a strategic autonomy perspective, it is encouraging that there are complementarities in technological specialization within the EU. The EU as a whole scores positively in core defence innovation and in several areas where the Netherlands is less specialized, such as materials processing, aerospace, and specific technologies like reinforcement materials and polymers. More broadly, at least one member state specializes (has a positive RTA) in each core defence or dual-use product. This complementarity reflects the diversity of EU member state production structures and reduces reliance on external actors. Moreover, it facilitates an agreement between European partners with an aim to reduce collective dependencies. Comparing the EU and the US, we find that the US specializes in aerospace and avionics, as well as certain niche technologies like peptide synthesis linked to biotechnology. Conversely, the EU is on average more specialized in marine technologies and materials processing compared to the US.

Figure 15. Revealed Technological Advantage per defence and dual-use domain



Note: Revealed technological advantage is calculated over 2016-2020 based on patent activity using data from the OECD. To calculate the RTA for the EU, the patent activity for all member states is combined and compared to the rest of the world.

3.3 Leveraging existing strengths: doubling down on specialized manufacturing

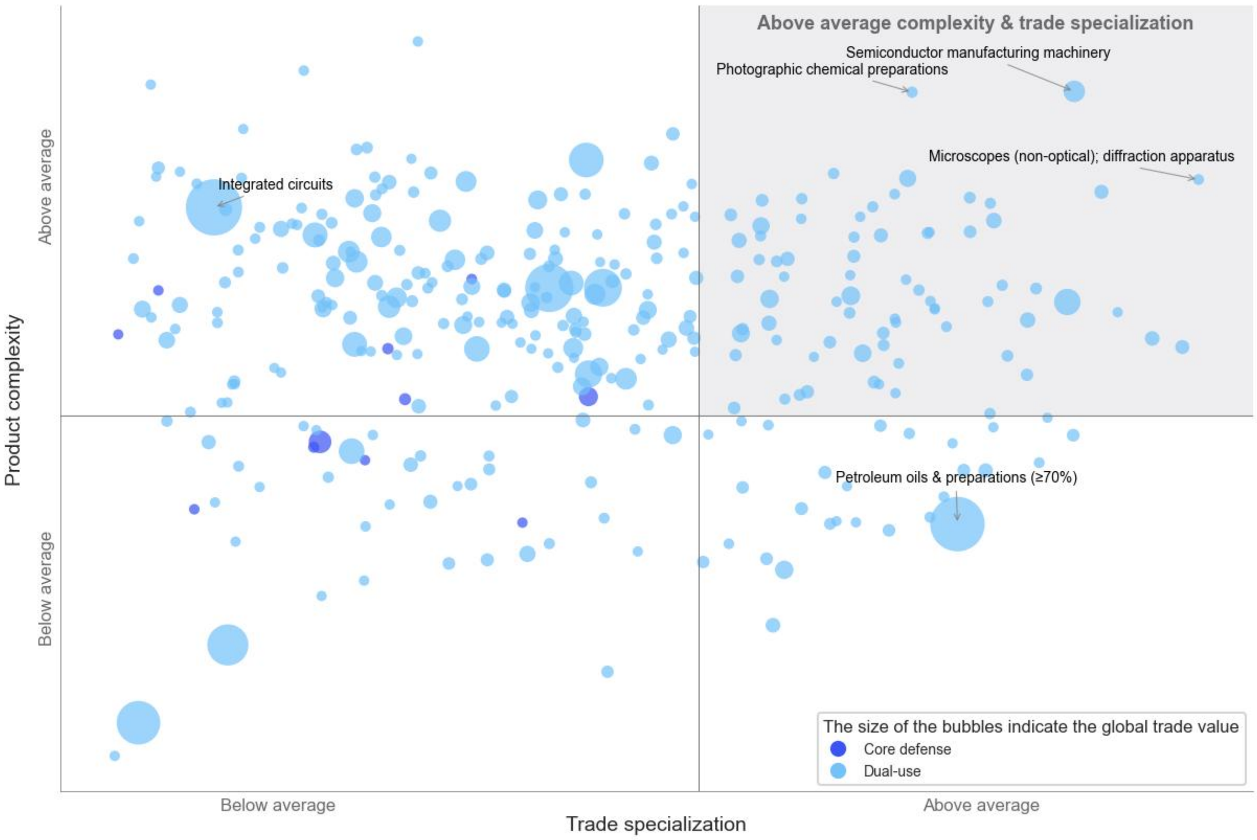
Building on established capabilities and expertise helps safeguard the production strengths the Netherlands already possesses. Scaling up activity in areas where a country has technological leadership or sophisticated production capacity also reduces cost of entry and shortens development timelines compared to investing in less established areas. Moreover, relying on proven capabilities reduces risks, as existing firms and supply chains already have relevant experience, infrastructure and skilled labour. As such, policymakers may choose to leverage technological strengths and existing production capabilities by directing investments towards areas where the Dutch economy already has a comparative advantage. Beyond the technological advantages outlined in Section 3.2, this section looks at current comparative advantages using trade and complexity data.

Indicators derived from international trade data can help identify comparative advantages in the current production of defence and dual-use goods. We use an approach that combines two dimensions: trade specialization and the complexity of producing a given product. The complexity indicator, taken from the EU 2023 dataset from the Harvard Complexity Atlas[10], captures the diversity and sophistication of the productive know-how required to manufacture a product. Higher complexity scores typically signal greater barriers to entry, higher value added, and stronger links to long-run economic growth (e.g., Hidalgo & Hausmann, 2009; Balland et al., 2022). To complement this, we use the Symmetric Revealed Comparative Advantage (SRCA) metric to measure trade specialization. SRCA adjusts the traditional RCA measure to a symmetric scale ranging from –1 to +1, making comparisons across products and countries more intuitive. Like RCA, it evaluates whether a country is an effective exporter of a specific product by comparing its export share to that product's share in global trade. Positive SRCA values indicate comparative advantages, negative values signal disadvantages. By combining complexity scores with SRCA, we provide a framework for identifying areas of strength in defence and dual-use production.

Current Dutch production capabilities signal specialized manufacturing strengths in select dual-use categories. Figure 16 shows product groups related to defence and dual-use categories and ranks them by trade specialization and production complexity. In this analysis, a product group is classified as a strength if it meets two criteria: (1) it scores above average in terms of production sophistication (complexity), and (2) the Netherlands holds a comparative trade advantage (SRCA > 0). In the figure, these strengths appear in the shaded area in the top-right corner. Using this approach, Dutch production strengths are most concentrated in dual-use categories such as electronics, sensors and lasers, navigation, and telecommunications. Products with these potential dual-use applications appear more frequently among current strengths compared to their share in the overall Dutch export basket. There is some overlap with the areas in which the Netherlands shows technological advantages identified in Section 3.2, for example in the domains of electronics, and sensors and lasers. This allows for the exploration of synergies between these goals.

[10] See for more information on the calculation of these concepts appendix 5.3.3.

Figure 16. Current strengths in Dutch production capabilities



Note: Product groups (4-digit HS 2012) related to defence plotted based on product complexity and SRCA for the Netherlands for 2023. Data is taken from the Harvard Complexity Atlas.

3.4 Maximizing economic opportunities: building out specialized manufacturing

Economic spillovers can be maximized by focusing on activities which are close to the Dutch production capabilities and increase diversification potential. Although initiating or scaling up activities in areas where a country lacks a current comparative advantage may require higher upfront costs, such efforts can generate long term benefits. Spillover opportunities often arise in product areas that complement existing capabilities and have the potential to unlock new opportunities. Indicators derived from international trade data can help identify areas with strong potential for economic spillovers. Our approach combines three dimensions from trade data:

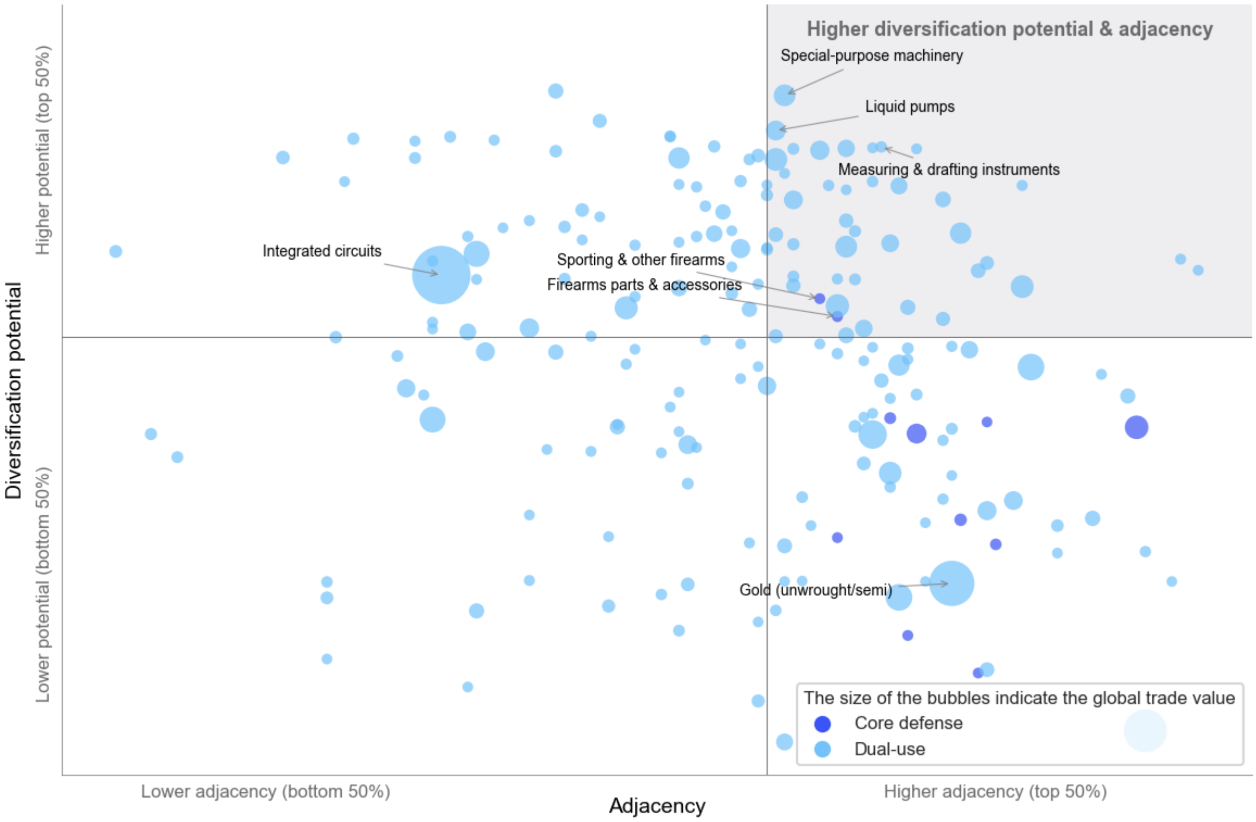
- Adjacency, which measures how closely a product aligns with current capabilities and therefore how easily production can shift. The economic logic here is that production factors (both knowledge and physical capital) necessary for a specific good, can make it easier to branch out into other goods requiring the same or similar production factors. For example, if there is a chemical industrial cluster, this makes branching out into other chemical products more feasible.
- Diversification potential, which estimates how adopting a new product could enhance the technological sophistication of a country's export basket by linking to other complex goods. Building on the adjacency concept described above, the economic logic here is that starting up the production of new goods can

facilitate a transition to other goods as well. Staying with the example above, building a first chemical plant can make it less costly to build out production into other chemical products in the future. Diversification potential does not only reflect the adjacency to new products, but also the complexity of these products. The economic logic here is that the higher the complexity is of products of which production is facilitated, the higher the competitive benefits are that a country reaps, as complex products offer higher barriers to entry and are therefore on average subject to less competition.

- Comparative trade advantage, where we focus on products with SRCA < 0, signalling untapped opportunities where a country lacks specialization. The economic logic is here that products only represent a new opportunity, if they are not already part of the production structure of a country.

Adjacency and diversification potential are taken from the EU 2023 dataset from the Harvard Complexity Atlas and SRCA is calculated based on export data from the same source. For more details about the calculation of these measures and their definitions see Appendix 5.3.3.

Figure 17. Potential opportunities for additional defence spending



Note: Product groups (4-digit HS 2012) plotted based on diversification potential, adjacency and SRCA for the Netherlands for 2023. Data is taken from the Harvard Complexity Atlas. Graph only shows product groups with an SRCA < 0.

For the Netherlands, trade data signals several dual-use categories with high spillover potentials. Figure 17 compares defence-related and dual-use product groups and compares them based on adjacency and diversification potential. A product group is classified as an opportunity for economic spillovers if it meets three criteria: (1) it ranks in the top half for diversification potential, (2) it ranks in the top half in terms of adjacency, and (3) the Netherlands does not hold a comparative trade advantage (SRCA < 0). In the figure, which only shows products with an SRCA<0, these opportunities are found in the shaded area in the top-right corner. Applying this approach, the most promising opportunities are concentrated in dual-use categories such as maritime, aerospace and special materials. These appear more frequently in the group of identified economic opportunities compared to their overall share in the total Dutch export basket. Focusing on the product groups with the greatest diversification opportunities (top 25% diversification potential) reveals a pronounced overrepresentation of dual-use categories associated with maritime and telecommunications applications. Product groups related to navigation, nuclear technology, and electronics are also notably overrepresented, though to a lesser extent.

3.5 Elements of an economically efficient plan to attain defence spending goals: dual-use focus, policy certainty, and European coordination

The Netherlands can contribute to European security goals by focusing on dual-use rather than core defence goods. Across all three policy aims – reducing foreign dependencies, building on existing strengths, and maximize economic spillovers – the Netherlands appears poorly placed to efficiently scale up core defence goods. Instead, it is well positioned to expand the production of dual-use goods. At the product and technology level, each policy aim highlights different priorities (Table 2). For example, a focus on specific technologies and/or products in the domain of electronics or sensors and lasers, such as lithography machines and specific types of microscopes, offer potential to leverage existing strengths. Similarly, a focus on technologies and/or products related to marine categories could be beneficial to decrease foreign dependencies while simultaneously unlocking economic opportunities. There is an opportunity to pursue synergies across different policy goals by concentrating on clusters of products and technologies that advance strategic objectives while also generating long-run economic spillovers. Nevertheless, there is substantial variation at the technology and product level within each group, highlighting the importance of a granular look at the data for policy purposes.

Technological and production strengths and opportunities can provide input to the process of finetuning the Dutch defence investment focus. The Defence Strategy for Industry and Innovation (Rijksoverheid, 2025) provides a list of technologies it prioritizes: marine, intelligent systems, sensors, smart materials, space, and quantum. It is important to stress that the categories used in the Defence Strategy do not map perfectly to the demarcations used in our data. This means that, while at face value there is both overlap and divergence between the identified technologies for prioritization and the strengths and opportunities identified in Table 2, a more in-depth look at the categorization is needed before we can draw conclusions on the extent to which they match.

Table 2. Is the Netherlands well positioned to achieve defence policy goals? Per core and dual-use domain

	REDUCING FOREIGN DEPENDENCIES	PRODUCTION STRENGTH	ECONOMIC OPPORTUNITY
CORE DEFENCE	No	No	No
DUAL-USE DOMAINS			
- ***MARINE***	Yes	No	Yes
- ***NUCLEAR***	Yes	No	No
- ***SENSORS AND LASERS***	Yes	Yes	No
- ***COMPUTERS***	Yes	No	No
- ***ELECTRONICS***	Yes	Yes	No
- ***SPECIAL MATERIALS***	No	No	No
- ***TELECOMMUNICATIONS***	Yes (in selected subdomain)	Yes	No
- ***MATERIALS PROCESSING***	No	No	Yes
- ***NAVIGATION AND AVIONICS***	No	Yes	No
- ***AEROSPACE***	No	No	Yes

Achieving any of the policy objectives depends on a credible, coordinated long-term investment plan for defence. A stable and transparent spending trajectory extending through 2035 is essential to give defence contractors and related industries the confidence to invest in capacity expansion and innovation, knowing that demand will remain reliable. Without such certainty, new product lines and supply chains, whether aimed at leveraging existing technological strengths, reducing foreign dependencies, or maximizing domestic spillovers, are unlikely to materialize. Predictable budgets not only support strategic planning but also amplify economic benefits by encouraging private-sector investment and fostering ecosystems around anticipated defence projects. Ultimately, policy stability, both domestically and at the EU level, is essential to convert rising defence budgets into lasting industrial growth and innovation.

Robust multilateral coordination, particularly with European partners, is essential for maximizing efficiency and strategic impact. Given the diversity of goods needed for the collective security of Europe, a Dutch focus on dual-use goods need not necessary be a weakness. The conflict following Russia's invasion of Ukraine has demonstrated how dual-use goods such as drones and satellite communications can be just as crucial as core defence goods. However, the feasibility of such a focus is feasible depends entirely on the degree to which security provision can be coordinated at the EU level. Aligning defence planning within the EU (or, alternatively, NATO) provides predictability, reduces unnecessary duplication, and prevents industrial overcapacity, while ensuring that collective rearmament addresses all critical capability gaps. Harmonizing national strategies with European initiatives, such as joint procurement programs and the emerging European Defence Industrial Strategy, allows countries to leverage complementary industrial strengths and avoid wasting scarce resources. The analysis of technological capabilities and industrial adjacency presented in sections 3.2 and 3.3 offers a basis for shaping such agreements. Timely action is crucial: multilateral frameworks and credible policy commitments require time to negotiate and implement, and their economic and strategic benefits will only materialize in the medium term if work begins now.

References

ABN AMRO. 2025. “Macro Watch: Can Defence Spending Revitalise the Eurozone Economy?” *ABN AMRO Research*. Amsterdam.

Antolin-Diaz, Juan, and Paolo Surico. 2025. “The Long-Run Effects of Government Spending.” *American Economic Review* 115 (7): 2376–2413.

Antonova, Anastasiia, Ralph Luetticke, and Gernot J. Muller. “The Military Multiplier*”*. No. 11882. CESifo Working Paper, 2025.

Arena, Mark V., Obaid Younossi, Kevin Brancato, Irv Blickstein, and Clifford A. Grammich. 2008. *Why Has the Cost of Fixed-Wing Aircraft Risen? A Macroscopic Examination of the Trends in U.S. Military Aircraft Costs over the Past Several Decades.* RAND Corporation, MG 696 NAVY/AF.

Balland, Pierre-Alexandre, Tom Broekel, Dario Diodato, Eliza Giullani, Ricardo Hausmann, Neave O’Clery, and David Rigby. 2022. “The New Paradigm of Economic Complexity.” *Research Policy* 51 (3).

Barsky, Robert B., and Eric R. Sims. 2011. “News Shocks and Business Cycles.” *Journal of Monetary Economics* 58 (3): 273–289.

Beirne, John, Haroon Mumtaz, Donghyun Park, Gazi Salah Uddin, and Angeliki Theophilopoulou. 2025. “Who Benefits from Increases in Military Spending? An Empirical Analysis.” *arXiv preprint* arXiv:2511.08218.

Berenschot. 2024. *Nederlandse defensie en veiligheid gerelateerde technologische industriële basis.* Utrecht: Berenschot.

Berenschot. 2025. *Vizier defensie-industrie gericht op Europa, rugdekking overheid noodzakelijk.* Utrecht: Berenschot.

Breaking Defence. 2025. “F-35 Lot 18 Price Increase Coming Due to Inflation, Rising Raw-Material Costs: Pentagon.”

Blagoeva, Daniela, Cristina Pavel, Daniel Wittmer, Jaco Huisman, and Federico Pasimeni. 2019. Materials Dependencies for Dual-Use Technologies Relevant to Europe’s Defence Sector. *JRC Report*, EUR 29850 EN.

Bokan, Nikola, Philippe Jacquinot, Marek Lalik, Georg Müller, Roman Priftis, and Rodolfo Rigato. 2025. “Macroeconomic Impacts of Higher Defence Spending: A Model-Based Assessment.” *ECB Economic Bulletin*, Issue 6/2025.

BulgarianMilitary.com. 2025. “Leopard 2A8 Tank Price Hits €30M, Equivalent to a Used F-16.”

Burilkov, Alex, Katelyn Bushnell, Juan Mejino-López, Thomas Morgan, and Guntram B. Wolff. 2025. “Fit for War by 2030? European Rearmament Efforts vis-à-vis Russia.” Brussels: Bruegel.

Checherita-Westphal, Cristina, Christian Huber, Marta Rodríguez-Vives, and Georg Müller. 2025. “Fiscal Aspects of European Defence Spending: Implications for Euro-Area Macro-Fiscal Projections.” *ECB Economic Bulletin*, Box, Issue 5/2025.

Caviggioli, Federico, Daniele Scellato, and Alessandro Vivarelli. 2018. Assessing the Innovation Capability of EU Companies in Developing Dual-Use Technologies. *JRC Technical Report*. Luxembourg: Publications Office of the EU.

Caviggioli, Federico, Andrea De Marco, and Giacomo Scellato. 2023. “Dual-Use Inventions: Identification and Characterization Using Patent Data.” *Economics of Innovation and New Technology* 32 (7): 697–722.

CBS News. 2023. “Weapons Contractors Price-Gouging Pentagon, 60 Minutes Transcript.”

CBS. 2025. *Verbijzondering defensie-uitgaven naar binnenland en buitenland, 2015–2024.* Den Haag: Centraal Bureau voor de Statistiek.

CPB. 2023. *Nieuwe inzichten over multipliers van overheidsbestedingen.* Den Haag: Centraal Planbureau.

CPB. 2025. *Macroeconomische effecten van hogere defensie-uitgaven.* Den Haag: Centraal Planbureau.

DNB. 2025. *The impact of government policies on inflation*. Amsterdam: De Nederlandsche Bank.

d'Alessandro, Antonello, Giulio Fella, and Leonardo Melosi. "Fiscal stimulus with learning-by-doing." *International Economic Review* 60.3 (2019): 1413-1432

Draghi, M. (2024). “The future of European competitiveness: A competitiveness strategy for Europe.” *Policy Report*. European Commission.

Clapp, S. (2024) European Defence Industrial Strategy. *European Parliamentary Research Service* - Briefing

Curran, Brendan, Ralf Martin, Sabrina Muller, Viet Nguyen-Tien, Juliana Oliveira-Cunha, Esin Serin, Arjun Shah, Anna Valero, and Dennis Verhoeven. 2022. *Growing Clean: Harnessing the UK’s Strengths for Low-Carbon Growth.* Economy 2030 Inquiry. Resolution Foundation. Accessed January 6, 2026. https://economy2030.resolutionfoundation.org/wp-content/uploads/2022/05/Growing_clean_report.pdf.

Fankhauser, Sam, Alex Bowen, Raphael Calel, Antoine Dechezleprêtre, David Grover, James Rydge, and Misato Sato. "Who will win the green race? In search of environmental competitiveness and innovation." *Global environmental change* 23, no. 5 (2013): 902-913.

Garnadt, Niklas, and Filippo Taddei. 2025. “How Much Will Rising Defence Spending Boost Europe’s Economy?” *Goldman Sachs Research*, February 27, 2025.

Greenpeace. 2023. Arming Europe: Military Expenditures and Their Economic Impact in Germany, Italy and Spain. *Brussels: Greenpeace European Unit*.

Hidalgo, César A., and Ricardo Hausmann. 2009. “The Building Blocks of Economic Complexity.” *Proceedings of the National Academy of Sciences* 106 (26): 10570–10575.

Ilzetzki, E. 2024. “Learning by Necessity: Government Demand, Capacity Constraints, and Productivity Growth.” *American Economic Review*, 114(8), 2436-2471.

Katz, Leo. 1953. “A New Status Index Derived from Sociometric Analysis.” *Psychometrika* 18 (1): 39–43.

Mehlbaum, Camille, and Bas Heerma van Voss. 2025. “Kijk voor strategische afhankelijkheden naar goederen, niet sectoren.” *ESB.nu.*

Mejino-Lopez and Wolff. 2024. “What Role Do Imports Play in European Defence?” *Bruegel Policy Analysis*

Moretti, Enrico, Claudia Steinwender, and John Van Reenen. 2025. “The Intellectual Spoils of War? Defence R&D, Productivity, and International Spillovers.” *Review of Economics and Statistics* 107 (1): 14–27.

Nagaoka, Sadao, Kazuyuki Motohashi, and Akira Goto. 2010. “Patent Statistics as an Innovation Indicator.” In *Handbook of the Economics of Innovation,* vol. 2, 1083–1127. North-Holland.

OECD. 2009. *OECD Patent Statistics Manual.* Paris: OECD Publishing. https://doi.org/10.1787/9789264056442-en.

OECD. February 2025. *Triadic Patent Families Database.*

OECD. May 2025. *REGPAT Database.*

Rabobank. 2025a. *The Economic Returns on Defence R&D.* Utrecht: Rabobank Economic Research.

Rabobank. 2025b. *Hogere defensie-uitgaven: meer materieel, of hogere prijzen?* Utrecht: Rabobank Economic Research.

Rabobank. 2025c. *Europe in the New NATO Era: Economic Consequences of 3.5% and 5% Defence Spending Scenario's.* Utrecht: Rabobank Economic Research.

Rijksoverheid. 2025. *Defensie Strategie voor Industrie en Innovatie*. Den Haag. Minister van Defensie, Staatssecretaris van Defensie, Minister van Economische Zaken.

SIPRI. 2024. *SIPRI Top 100 Arms-Producing and Military Services Companies in the World, 2024.* Stockholm International Peace Research Institute.

The Growth Lab at Harvard University. 2025. *International Trade Data (HS12).* Harvard Dataverse. https://doi.org/10.7910/DVN/YAVJDF.

Uhlig, Harald. 2005. "What Are the Effects of Monetary Policy on Output? Results from an Agnostic Identification Procedure." *Journal of Monetary Economics* 52 (2): 381–419.

Zeev, Nadav Ben, and Evi Pappa. 2015. "Multipliers of Unexpected Increases in Defence Spending: An Empirical Investigation." *Journal of Economic Dynamics and Control* 57: 205–226.

Zeev, Nadav Ben, Evi Pappa, and E. Scola Gagliardi. 2025. *The Offensive Power of Defence News in Europe.* CEPR Discussion Paper.

4 Appendix: methods

4.1 Literature Review

4.1.1 Effects of defence-spending shocks on GDP growth, prices, and productivity

Across various studies, short-run fiscal multipliers for defence spending generally fall around or below one, while long-run impacts depend heavily on how spending is composed. ECB research for the euro area finds output multipliers just below unity and subdued inflationary effects.

Effects on output growth Higher defence spending raises aggregate demand and could support GDP growth in the short-term. However, the size and persistence of any growth impulse depend on composition (investment/procurement versus current consumption), the domestic content of spending, spare capacity in product and labour markets, and the financing mix (Checherita Westphal et al., 2025). Bokan et al. (2025) find that defence investment could add roughly 0.1 percentage points to annual GDP growth in 2026–2027, with little inflation pressure. The growth effect is larger when spending takes the form of domestic procurement or investment rather than purely government consumption, because higher domestic content raises demand for local production and has bigger fiscal multipliers. Similarly, Garnadt and Taddei (2025) assume a gradual rise in annual EU defence spending of about €80 billion by 2027 and conclude this will boost GDP modestly while leaving inflationary pressure limited in baseline scenarios. Their report emphasizes modest positive GDP effects are plausible, contingent on the pace of spending, domestic supplier capacity, and the extent to which procurement is channeled into investment and R&D.

Effects on inflation Inflationary effects are generally modest in baseline runs because much of the additional demand is assumed to be met by expanding domestic production or using spare capacity. Higher inflation appears only in scenarios where defence demand rapidly tightens labour markets or is financed in ways that boost aggregate demand without a corresponding supply response (Bokan et al., 2025; Checherita Westphal et al., 2025).

Effects on productivity growth Longer run productivity and potential output gains depend critically on the composition of defence spending. The literature indicates that defence procurement which includes investment, R&D, or technology intensive projects can support capital accumulation and innovation spillovers that raise potential output over time, whereas pure current spending delivers little persistent productivity gain (Bokan et al. 2025). The magnitude and persistence of productivity gains vary across models and assumptions about spillovers, domestic supply chains, and the linkage between defence R&D and civilian technology diffusion. For the US, Antolín-Díaz and Surico (2025) show that defence-related spending focused on R&D can generate sustained gains in GDP, private investment, and total factor productivity (TFP) in the long run. Similarly, Rabobank (2025c) projects euro-area GDP up to 3.4% higher by 2045 under a R&D-intensive strategy. These findings highlight that spending composition, timing, and financing structure are key to long-term growth outcomes.

4.1.2 Spillover channels and supply-chain propagation

Defence spending influences the wider economy through supply-chain and production linkages. Input–output (IO) studies highlight that import dependence, industrial structure, and procurement patterns determine domestic value-added and employment effects.

Greenpeace (2023) applies IO data for Germany, Italy, and Spain and finds that high import content in arms and equipment procurement reduces domestic multipliers, while redirecting funds toward civilian or green investment could create stronger domestic spillovers. Complementary EU analyses report that roughly 78% of EU defence acquisitions between 2022 and 2023 were sourced abroad, mostly from the US. This heavy import dependence underscores the case for joint procurement and European industrial coordination (Clapp, 2024 and Mejino-Lopez and Wolff, 2024). Blagoeva et al. (2019) add that Europe remains dependent on non-EU suppliers for critical raw materials and components across robotics, additive manufacturing, and battery technologies. Strengthening these supply chains could enhance domestic spillover potential.

4.1.3 Technology position and comparative advantage of The Netherlands

Caviggioli et al. (2018) find that dual-use patenting in the EU is growing and diversifying, suggesting policy should shift from supporting only traditional defence firms toward broader innovation ecosystems to capture civilian military spillovers. They report that about 41% of European defence-related patents are dual-use, with the Netherlands contributing significantly to radar, maritime, and aerospace technologies. The authors document a rising volume of defence tagged patents spreading beyond traditional military fields into ICT and measurement/control technologies, show increasing nontraditional (non-defence) firms' involvement, and highlight policy implications for R&D support, industrial policy, and technology transfer to enhance strategic autonomy. The National Defence Strategy for Industry and Innovation (Rijksoverheid, 2025) emphasizes leveraging these dual-use strengths to enhance competitiveness and technological sovereignty. Key Dutch assets include Thales Netherlands' radar and sensor technologies, Damen's naval systems, and strong participation in EU defence innovation programs. Expanding R&D collaboration and industrial scaling remain central to the Netherlands' policy agenda. Caviggioli et al. (2023) show that certain technology classes, broader technological scope, and specific citation patterns increase the probability and speed of military to civil knowledge diffusion, while country and inventor characteristics also matter. Patent text and citation patterns provide measurable signals of which military inventions are most likely to transfer to civilian use, allowing policymakers to identify and prioritize technologies with high commercial spillover potential.

4.2 Chapter 1

4.2.1 Data

The empirical analysis of Chapter 1 is based on an unbalanced annual panel dataset covering 17 European economies over the period 1960–2024. The countries included are the Netherlands, Germany, France, Italy, Spain, Belgium, Austria, Portugal, Greece, Denmark, Finland, Ireland, Luxembourg, Norway, Sweden, Switzerland, and the United Kingdom. Differences in data availability across countries and variables imply an unbalanced panel. However, for all the countries in the sample, the data is available for at least 20 years. We obtain data on military spending, population, real GDP, the GDP deflator, and consumer price inflation from World Banks' World Development Indicators. Nominal military spending is deflated by the GDP deflator and both real spending and GDP are divided by population. Private gross fixed capital formation, also divided by population, and the short-term interest rate are taken from AMECO, the macroeconomic database of the European Commission. Private investment is measured using real private gross fixed capital formation. The primary balance to GDP ratio is obtained from the IMF database. We obtain TFP from the Penn World tables. Data on the distribution of income is taken from the World Inequality Database (WID).

4.2.2 Empirical Specification

The baseline empirical framework is a Bayesian panel vector autoregression (VAR) with country effects. Country fixed effects absorb time-invariant heterogeneity across economies, including structural differences in institutions, long-run productivity levels, and persistent features of national defence systems. The VAR includes the following variables: military spending per capita, GDP per capita, labour income share, private gross fixed capital formation per capita, fiscal balance as a share of GDP, total factor productivity (TFP), short-term interest rate, and consumer price inflation. The model is estimated with one lag. All real variables are expressed in levels. Military spending per capita, GDP per capita, private investment per capita, share of labour income and TFP, are transformed into logarithms and multiplied by 100. Impulse responses for these variables can therefore be interpreted as percentage changes. The short-term interest rate and CPI inflation enter in levels and are interpreted in percentage points. Bayesian estimation is implemented using Minnesota-type priors, and posterior inference is based on 20000 draws from the joint posterior distribution of the VAR coefficients and the variance–covariance matrix.

4.2.3 Identification of the Military Defence Shock

Military spending is characterized by long planning horizons, legislative approval processes, and multi-year procurement programs. As a consequence, changes in defence budgets are often anticipated well before expenditure is realized. To capture this forward-looking component, we follow the literature on defence news shocks (e.g. Antolín-Díaz and Surico, 2025) and identify the defence spending news shocks using a medium-run maximum forecast error variance (MFEV) approach following Ben Zeev and Pappa (2014), Ben Zeev et al. (2025), Beirne et al. (2025). The defence news shock is defined as the linear combination of reduced-form VAR innovations that maximizes the forecast error variance of military spending over a five-year horizon, subject to the restriction that it has no contemporaneous effect on military spending. The truncation horizon of five years reflects the medium-run nature of defence planning and procurement and is consistent with the timing of observed adjustments in military expenditure. Formally, identification follows the MFEV procedure described in the literature on anticipated shocks (see, among others, Uhlig, 2004; Barsky and Sims, 2011), adapted to the context of defence spending. The identifying restrictions ensure that the news shock captures innovations that are informative about future defence spending paths while remaining orthogonal to current expenditure movements.

In MFEV-based news identification, the choice of the endogenous variables to include in the model matters significantly. Changes in the information set alter the residual covariance matrix, the moving-average representation of the system, and the admissible space of orthogonal rotations, so that the identified shock itself changes rather than merely its impulse responses. This feature fundamentally distinguishes news identification from recursive, narrative, or external-instrument approaches. Sensitivity to the specification is further amplified by the fact that many macroeconomic variables proxy for similar latent forces, so modifying the variable set redistributes forecastable variance across equations and affects which residual combinations qualify as "news." Finally, the long and unbalanced sample, spanning the Cold War, EMU formation, post-EMU fiscal rules, the Global Financial Crisis, COVID-19, and recent geopolitical rearmament, implies that the estimated shock pools multiple defence news episodes that likely operated through different economic mechanisms. Imposing a single time-invariant transmission structure on these heterogeneous episodes naturally generates variation in impulse responses, peak timing, and multipliers across specifications.

The chosen specification is designed to capture the main real, fiscal, and monetary transmission channels through which defence news shocks are expected to operate. Defence spending, output, and private investment constitute the core real block needed to trace the aggregate demand and capital-accumulation effects of anticipated defence expansions. Labour income is included as a parsimonious indicator of labour-market and income responses. The fiscal balance-to-GDP ratio allows us to assess the financing implications of defence news shocks, in particular whether higher defence spending is associated with larger deficits or is partly offset by higher revenues. Total factor productivity is included to capture potential supply-side effects, including channels related to innovation and efficiency gains that have been emphasized in recent work on defence-related R&D. Finally, inflation and the short-term nominal interest rate form a minimal nominal block that captures the interaction between fiscal expectations, price dynamics, and monetary policy responses. Overall, this specification is sufficiently rich to characterize the main transmission mechanisms highlighted in the literature, while remaining parsimonious enough to yield stable and interpretable defence news shocks. The resulting impulse responses indicate persistent increases in output, investment, labour income, and productivity, accompanied by moderate fiscal and nominal adjustments, consistent with a medium-run transmission driven primarily by investment and supply-side dynamics.

4.2.4 Calculation of the Defence Spending Multiplier

Recent literature shows that fiscal multipliers for government spending vary substantially with economic conditions and the type of expenditure, with larger multipliers generally observed in downturns and for investment-type spending relative to consumption. Evidence from international studies suggests a broad range of multipliers and highlights the importance of context for interpretation. CPB (2023) provides a comprehensive summary of these insights from fiscal multiplier research.

In this appendix, we clarify what the empirical framework identifies, how defence spending multipliers are constructed, and the main limitations that arise when interpreting these multipliers for policy analysis. Our empirical framework estimates the dynamic responses of output and defence spending to structural defence news shocks using historical macroeconomic data. These shocks are identified by combining observed macroeconomic dynamics with economically motivated identification restrictions that reflect institutional features of defence policy, in particular the anticipation and gradual implementation of military spending.

Because the model is estimated in logarithms, the primary objects identified are elasticities, defined as the percentage change in GDP associated with a one-percent change in defence spending:

$$\frac{\partial \ln Y}{\partial \ln DF}$$

These elasticities are identified locally, around the historical operating point of the economy and around the historically observed defence share of GDP. As a result, the framework captures how the economy has responded to marginal fluctuations in defence spending under past institutional and macroeconomic conditions.

Importantly, while the shocks are structural in the sense that they are interpreted as exogenous innovations to expected defence spending, the framework does not impose a fully specified structural model of the economy. Unlike models that derive global relationships from explicit assumptions about preferences, technologies, and market-clearing conditions, the approach recovers a local propagation mechanism from historical data. The estimated elasticities should therefore be interpreted as marginal responses, informative about adjustment dynamics under historical conditions, but not as invariant structural laws that can be mechanically extrapolated to arbitrarily large or unprecedented defence expansions.

Fiscal multipliers expressed in levels, euros of GDP per euro of defence spending, are obtained by rescaling elasticities using the steady-state ratio of GDP to defence spending:

$$M = \frac{\partial \ln Y}{\partial \ln DF} \times \frac{\bar{Y}}{\overline{DF}}$$

Because defence spending represents a small share of GDP, the scaling factor $s = \frac{\bar{Y}}{\overline{DF}}$ is mechanically large. This has three important implications. First, even modest elasticities can translate into large euro-for-euro multipliers purely for arithmetic reasons. Second, statistical uncertainty is amplified, since any estimation error in the elasticity is magnified by the inverse of the defence share. Formally, the variance of the multiplier increases proportionally to $\frac{1}{s^2}$. Third, this rescaling implicitly assumes that the estimated marginal elasticity remains stable when extrapolated to much larger changes in defence spending relative to GDP. This is a strong external-validity assumption. At larger scales, non-linear mechanisms, such as capacity constraints, import leakages, inflationary pressures, monetary policy reactions, and financing effects, may alter the relationship between defence spending and output. For this reason, euro-for-euro multipliers should be interpreted as local policy guidance, not as precise forecasts for large rearmament programs.

In the case of defence news shocks, output typically responds immediately to the announcement of future defence plans, while actual defence expenditures materialize only gradually over time. Under these conditions, the standard cumulative multiplier:

$$M_h^{cum} = \frac{\sum_{i=1}^{h} \Delta \mathrm{Y}_{t+i}}{\sum_{i=1}^{h} \Delta \mathrm{DF}_{t+i}}$$

can become extremely large or unstable at short horizons. This occurs because the denominator, the cumulative change in defence spending, may remain close to zero for several periods, while the numerator, the cumulative GDP response, is already positive. Such behaviour does not reflect implausibly strong economic transmission. Rather, it is a mechanical consequence of fiscal anticipation and implementation delays. As a result, short-horizon conventional cumulative multipliers are poorly suited for assessing the macroeconomic effectiveness of anticipated, multi-year defence programs.

To address these issues, we follow Ben Zeev et al. (2025) and adopt a present-value, program-based multiplier that relates cumulative output responses to the full expected cost of the defence spending program induced by the shock:

$$M_h = \frac{\sum_{i=1}^{h} \Delta \mathrm{Y}_{t+i}}{h \sum_{i=1}^{30} \beta_{\mathrm{i}} \Delta \mathrm{DF}_{t+i}}$$

Where the discount factor is defined as $\beta_i = 1/(1+\mathrm{r})^{-(\mathrm{i}-1)}$. This definition is motivated by three considerations. First, it avoids the near-zero denominator problem that affects conventional cumulative multipliers under news shocks. Second, it explicitly accounts for the full present-value cost of the defence program, rather than conditioning the denominator on when spending happens to be disbursed. Third, it delivers a conservative measure of fiscal effectiveness by benchmarking output gains against the entire expected spending path.

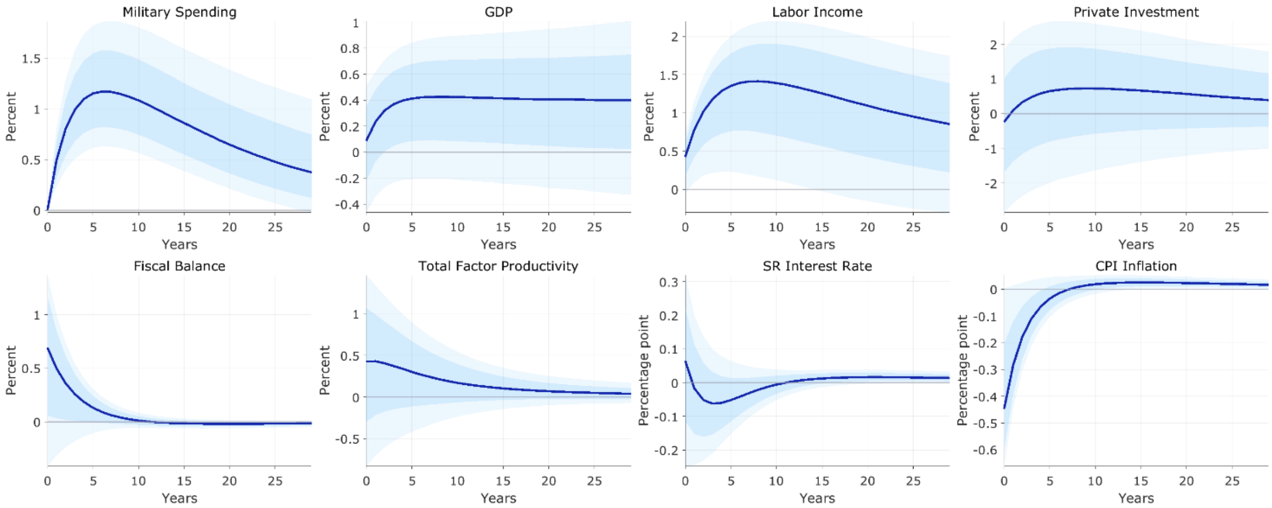
Under this definition, the reported multiplier answers the following question*: How much cumulative GDP is generated, on average per year over horizon h, per euro of the present-value cost of the full defence spending program induced by the shock?* This is neither an impact multiplier nor a short-run cash-flow multiplier. Instead, it is a program-level, present-value efficiency metric, designed to be robust to fiscal anticipation and gradual implementation. Because defence spending is scaled relative to its long-run cost, the multiplier should be interpreted as a measure of the macroeconomic return per euro of long-term defence commitment, rather than as a literal short-term productivity ratio. While no fiscal multiplier can be regarded as a structural constant, this choice provides a stable, conservative, and policy-relevant summary of the macroeconomic effects of defence spending under anticipation and gradual implementation. It avoids both the short-run instability of conventional cumulative multipliers and the exaggeration risks associated with scaling small-share elasticities into large euro-for-euro projections without carefully accounting for timing, scale, and fiscal cost.

At the national level for the Netherlands, defence spending displays very limited variation over time and an extremely small share in GDP. This makes euro-for-euro multiplier estimates highly sensitive to scaling and potentially dominated by mechanical effects rather than by robust economic identification. To avoid misleading interpretations, we therefore focus on European-level estimates, where the defence spending signal is stronger and the resulting multipliers are more stable and economically meaningful. Nevertheless, it is important to emphasize that multipliers estimates are extremely sensitive to modelling, data and specification choices for all the reasons discussed above, making the numbers found in the literature hardly comparable and to be used with caution.

4.2.5 Robustness

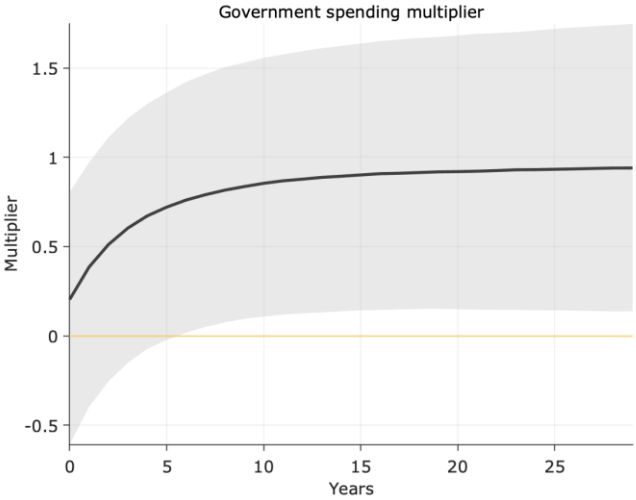
The second specification that we run includes year fixed effects and controls for shocks that are common to all countries in a given year, such as global business cycle fluctuations, changes in commodity prices, or widespread geopolitical events. With both dimensions of fixed effects included, identification relies on within-country variation over time, conditional on common global shocks. As a result, the interpretation of impulse responses changes reflecting the dynamic effects of a country-specific defence spending shock relative to the contemporaneous European average. The responses therefore reflect how a national shock to defence expenditure propagates through GDP, inflation, investment, and productivity, after netting out contemporaneous global influences.

Figure A1. Macroeconomic Effects of Defence Spending for a panel of EU countries – time fixed effects



Notes: Impulse responses from an unbalanced panel Bayesian VAR estimated on 17 European economies over 1960–2024. The figure reports the response of military spending, real GDP, labour income, private investment, fiscal balance, TFP, short-term interest rate and cpi inflation to a defence news shock. This specification includes country and time fixed effects. Shaded areas denote 84 and 95 percent credible intervals.

Figure A2. Defence spending multiplier resulting from a model with time fixed effects



Notes: Government spending multiplier following a defence news shock. The multiplier is computed over a 30-year horizon using a present-value, program-based definition following Ben Zeev et al. (2025). Shaded areas denote 84 percent credible intervals. See Appendix 5.1.4 for a discussion on the multiplier calculation.

4.3 Chapter 2

4.3.1 Data and input-output objects

The analysis in Chapter 2 uses the 24ed Figaro input-output industry-by-industry tables from Eurostat. The Figaro tables rely on the ESA 2010 methodology and combine i) national accounts, ii) national supply and use tables as well as input-output tables, iii) international goods trade data, iv) international services trade data, and v) business statistics to produce a standardized EU inter-country input-output framework. The methodology is continuously improved under the OECD Regional-Global TiVA initiative. The tables use NACE Rev. 2 (International Standard Industrial Classification (ISIC) Rev. 4) to classify industries. The edition we use covers 46 regions and provides an industry breakdown of 61 activities.

From these tables, we construct the technical coefficients matrix, A, with $a_{\{ij\}}$ as general element. $a_{\{ij\}}$ are called the input-output coefficients and are the value of sector j's inputs purchased from sector i relative to total sales of sector j. Note that according to the Neumann series Lemma, with A being symmetric and spectral radius less than one, we can construct the Leontief inverse, L, as usual: $L = \sum_{m=0}^{\infty} A^m = (I - A)^{-1}$.

In the following, we go through each of our applications and explain how we construct the respective measures. Different than the exposition in the main text, we organize the discussion by increasing complexity: first, the backward linkages, then the Katz centrality, and finally the indirect import measures.

4.3.2 Backward linkages

The backward linkages follow directly from the columns of the Leontief inverse. General element $l_{\{ij\}}$denotes all direct and indirect import shares from sector i to sector j. Hence, for each Dutch sector of interest j, we select the respective column and arrange its entries in descending order. Then, we only show the top five suppliers. When we look at the backward linkages by origin (see Figure A8), we select the respective columns, sum up the respective origin regions, and normalize using the total sum of the column.

4.3.3 Downstream centrality, or Katz authority centrality

We follow standard graph theory and construct the Katz authority centrality (in the main text 'downstream centrality') of sector j as $\kappa_j = \beta \sum_{i=1}^{N} a_{ij} \kappa_i + 1$, where N denotes the number of sectors. Hub centrality is defined likewise by switching indices. We set the attenuation parameter β to unity, which is allowed since the spectral radius of A is smaller than one (see above). The recursive definition shows that the centrality measure is high if the sector j has high input shares from these suppliers (large a_{ij}), that is, has strong and concentrated demand, and if these suppliers are themselves central (high κ_i).

4.3.4 Indirect import exposure

Evaluating a sector's reliance on imported inputs entails considering both its direct imports and any indirect dependence through domestic suppliers that themselves import part of their inputs. For the sake of clarity, we explain our computations for a situation with two domestic (d_1, d_2) and two foreign (f_1, f_2) sectors. Denote the domestic input output matrix by

$$A^D = \begin{bmatrix} a_{d1,d1} & a_{d1,d2} \\ a_{d2,d1} & a_{d2,d2} \end{bmatrix}$$

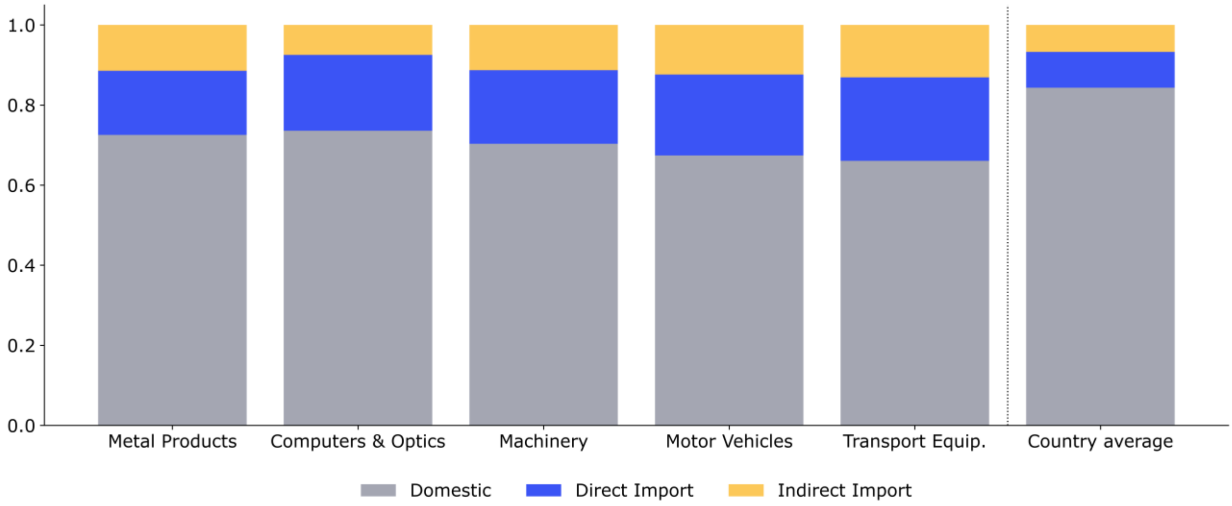
and define the foreign share vector by

$$m \equiv \begin{bmatrix} a_{f1,d1} + a_{f2,d1} \\ a_{f1,d2} + a_{f2,d2} \end{bmatrix}.$$

The foreign share vector collects the sum of foreign input shares going to the domestic sectors. The indirect import shares are then computed as $A^{D'}(I - A^{D'})^{-1}m$. The transpose $A^{D'}$ is necessary because we want to capture backward linkages. Intuitively, we follow the entire production chain backwards through the *domestic* network via $(I - A^{D'})^{-1}$ and only stop if we hit a foreign sector m. However, $(I - A^{D'})^{-1}m$ by itself also captures direct imports (the first entry of the infinite series is the identity matrix). Hence, we pre-multiply by $A^{D'}$ to only capture the indirect effect. This is different from the backward linkages above, which take into account all linkages throughout the supply chain and do not stop at a foreign sector.

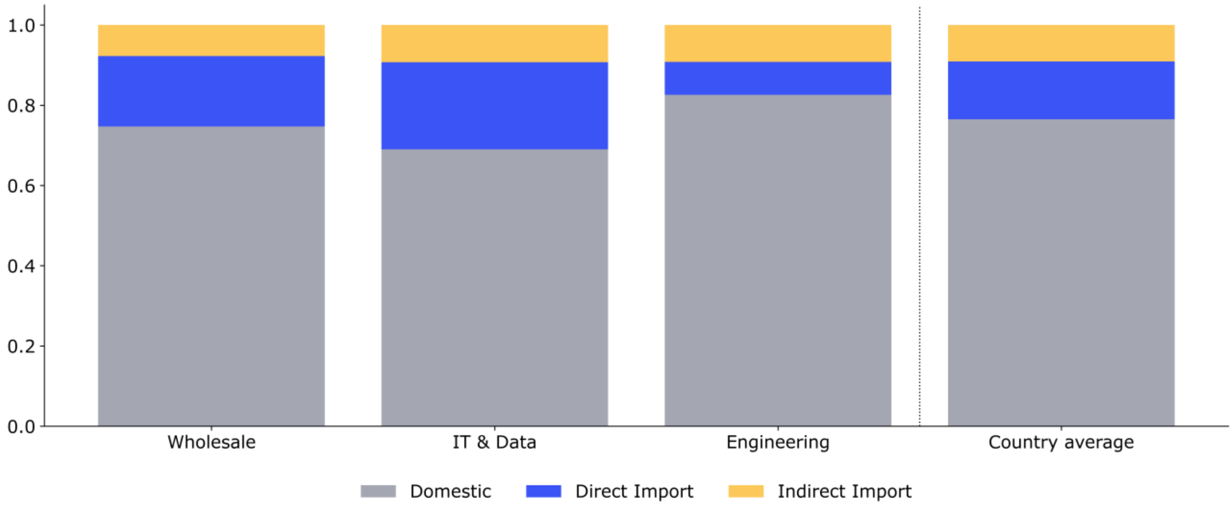
4.3.5 Additional figures on defence manufacturing sectors upstream linkages

Figure A3. Import dependence of German defence-related sectors



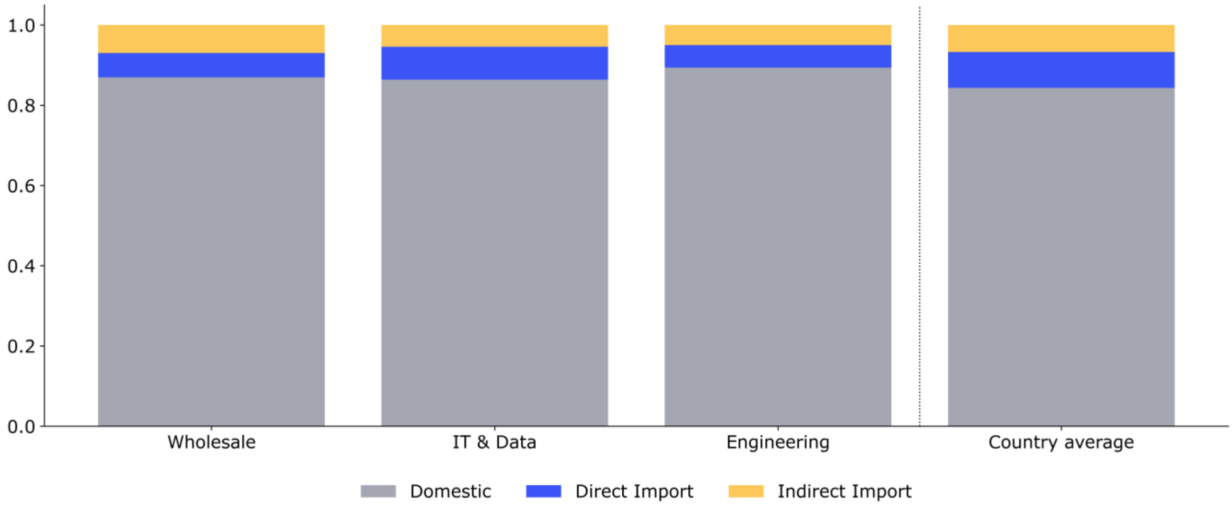
Notes: The figure shows the share of domestic and imported inputs (both direct and indirect) in the production of five defence-related manufacturing sectors. For comparison, the same shares for the overall Dutch economy are shown as 'Country average'. Source: Eurostat's Figaro dataset; own calculations.

Figure A4. Import dependence of additional Dutch defence-related sectors



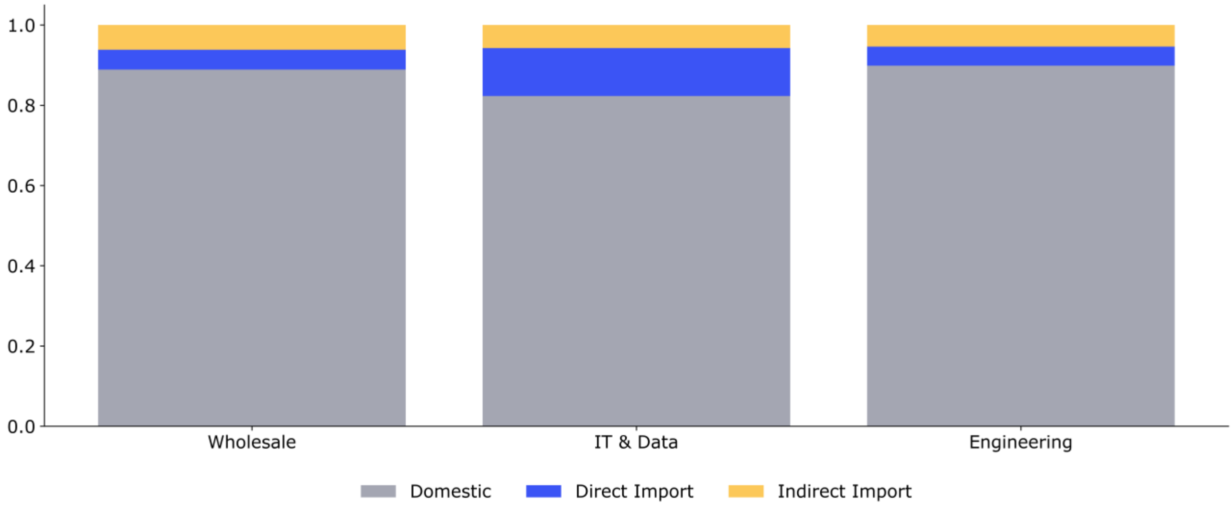
Notes: The figure shows the share of domestic and imported inputs (both direct and indirect) in the production of three additional defence-related manufacturing sectors. For comparison, the same shares for the overall Dutch economy are shown as 'Country average'. Source: Eurostat's Figaro dataset; own calculations.

Figure A5. Import dependence of additional German defence-related sectors



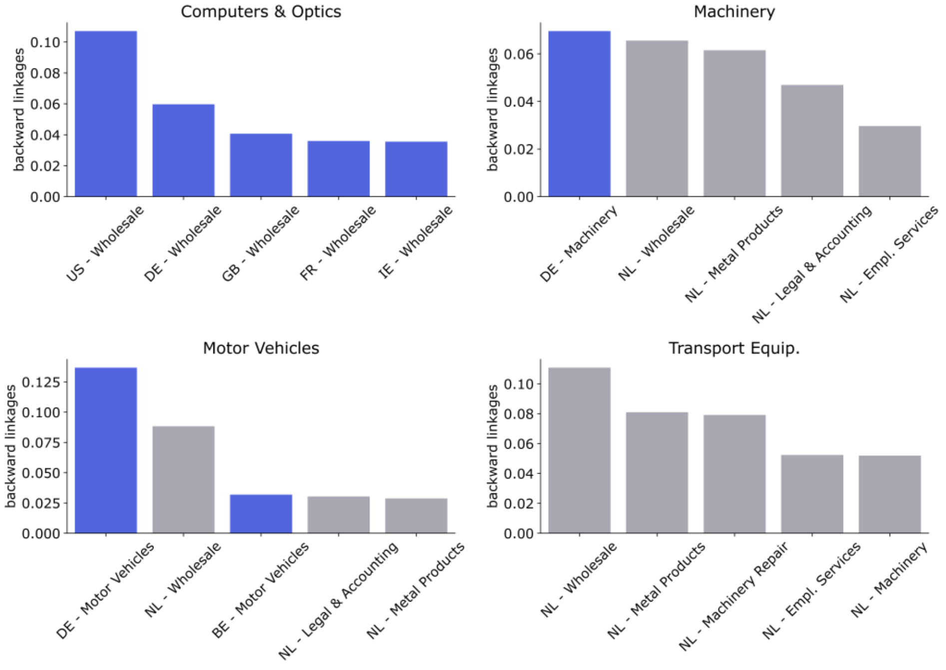
Notes: The figure shows the share of domestic and imported inputs (both direct and indirect) in the production of three additional defence-related manufacturing sectors. For comparison, the same shares for the overall German economy are shown as 'Country average'. Source: Eurostat's Figaro dataset; own calculations.

Figure A6. Import dependence of additional European defence-related sectors



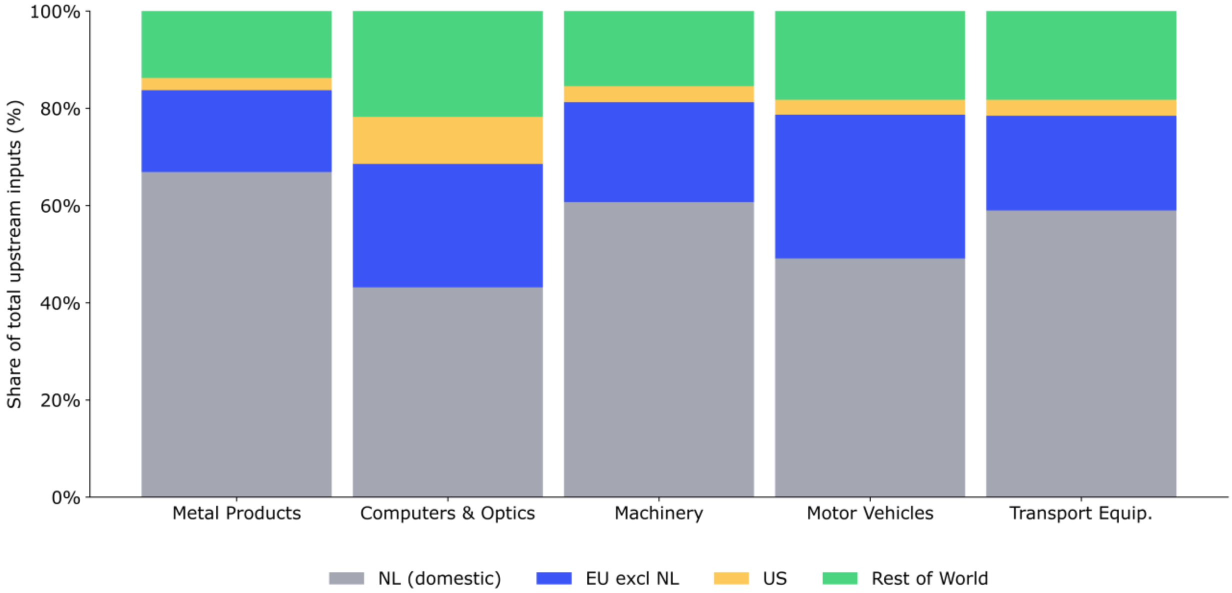
Notes: The figure shows the share of domestic and imported inputs (both direct and indirect) in the production of three additional defence-related manufacturing sectors at the European level. Source: Eurostat's Figaro dataset; own calculations.

Figure A7. Top five upstream suppliers to the compute and optical equipment, machinery, motor vehicles, and transport equipment along the entire supply chain



Notes: Backward linkages measure the extent to which each defence-related sector depends on inputs from other sectors along the entire supply chain, including both direct and indirect contributions. The bars show the five sectors with the largest upstream influence on each of the selected defence-related sectors. The abbreviation 'US' stands for United States, 'DE' for Germany, 'FR' for France, 'IE' for Ireland, 'NL' for The Netherlands, and 'BE' for Belgium. 'Wholesale' stands for Wholesale trade (G46), 'Machinery' for Machinery and Equipment (C28), 'Metal Products' for Fabricated Metal Products (C25), 'Machinery Repair' for Repair and installation of machinery (C33), and 'Empl. Services' for Employment Services (N78) Source: Eurostat's Figaro dataset; own calculations.

Figure A8. Main supplier regions for Dutch-defence related sectors



Note: Backward linkages shares by origin for the five Dutch defence-related sectors. Backward linkages measure the extent to which each defence-related sector depends on inputs from other sectors along the entire supply chain, including both direct and indirect contributions. Source: Eurostat's Figaro dataset; own calculations.

4.4 Chapter 3

4.4.1 Patent data and classifications

We use OECD patent data covering the period 2016–2020. We exclude more recent years because 2020 is the most recent year of complete data. To capture high-quality patents and ensure international comparability, we focus on triadic patent families —a widely recognized proxy for patent quality. These families include inventions filed in the United States, the European Patent Office, and Japan. To determine the location, we look at the applicant of the patent.

Patents are classified as "defence" if they correspond to IPC codes that are explicitly military-related. For this classification, we rely on the below list of IPC codes provided by Caviggioli et al. (2018), who identified CPC codes for military technologies through literature review and text analysis of IPC descriptions using defence-related keywords.

Table 3. List of IPC codes selected as defence specific

Source	IPC code	Description
New	A45F 3/06	Travelling or camp articles; Sacks or packs carried on the body specially adapted for military purposes
Acosta et al. (2017)	A62D 101/02	Chemical warfare substances
New	B21D 51/54	Making hollow objects cartridge cases, e.g. for ammunition, for letter carriers in pneumatic-tube plants
New	B21K 21/04	Shaping thin-walled hollow articles, e.g. cartridges
New	B21K 21/06	Shaping thick-walled hollow articles, e.g. projectiles
New	B21K 21/14	Closed or substantially-closed ends, e.g. cartridge bottoms
New	B60R 7/14	Stowing or holding appliances inside of vehicle [...] e.g. travelling articles, or maps. Disposition of racks, clips, or the like for supporting weapons
New	B63G	Offensive or defensive arrangements on vessels; mine-laying; mine-sweeping; submarines; aircraft carriers
New	B64D 1/04	Dropping, ejecting, releasing, or receiving articles, liquids, or the like, in flight ...the articles being explosive
New	B64D 1/06	Dropping, ejecting, releasing, or receiving articles, liquids, or the like, in flight; Bomb releasing; Bomb doors
New	B64D 7	Arrangement of military equipment; Adaptations of armament mountings for aircraft
Acosta et al. (2017)	E04H 9/04	Buildings, groups of buildings, or shelters adapted to withstand or provide protection against air-raid or other war-like actions
Acosta et al. (2017)	E04H 9/08	Structures arranged underneath buildings, e.g. air-raid shelters
Acosta et al. (2017)	E04H 9/12	Entirely underneath the level of the ground, e.g. air-raid galleries
Acosta et al. (2017)	E06B 5/10	Doors, windows, or similar closures for special purposes; Border constructions for protection against air-raid or other war-like action
	F41	Weapons
	F42	Ammunition; Blasting
New	G01S 1/42	Conical-scan beam beacons transmitting signals [...], e.g. for "beam-riding" missile control
New	G01S 19/18	Satellite radio beacon positioning systems; Determining position, velocity, or attitude using signals transmitted by such systems. Military application
New	G06G 7/80	Analogue computers for specific processes, systems, or devices, e.g. simulators; for gun-laying; for bomb aiming; for guiding missiles

For dual-use patents for civilian inventions with potential military applications, no direct IPC-code mapping was available. To address this, we employed a large language model (LLM) to align the EU list of dual-use items (including its December 2025 update) with patent classifications. The EU uses this list to identify dual-use items in export. The assignment was done using two complementary prompts: (1) IPC subclass mapping and (2) IPC/CPC main group mapping (with fallback to subclass). The LLM generated candidate classes with accompanying rationale and confidence levels (low/medium/high). We then cross-checked these outputs, selected the consensus or most strongly supported classes, and conducted a manual sanity check against the full IPC structure at the subclass level to ensure coverage and coherence. Finally, we validated the matches against a second LLM mapping. To maintain clear boundaries between categories, we ensured that no codes overlapped between broader sectors and that defence-specific codes were excluded from categories such as maritime and aviation.

Table 4. List of IPC codes selected for the dual-use domains

DOMAIN	SUBDOMAIN	IPC CODE	EXCLUDED SUBCLASSES (DUE TO OVERLAP WITH OTHER DOMAINS)
NUCLEAR	Nuclear engineering	G21	
SPECIAL MATERIALS	Chemistry: compounds	C01	
	Metallurgy (alloys)	C22	
	Coatings Metallic material	C23	
	Polymers	C08	
	Shaping plastics	B29C	
	Materials for reinforcements	B29K	
	Layered products	B32	
	Peptide synthesizers: preparation and handling	C07K	
MATERIALS PROCESSING	Producing and maintaining machines	F16	
	Mechanical metal working	B21	
	Casting (Metallurgy)	B22	
	Machine tools (metal working)	B23	
	Grinding and polishing	B24	
	Spraying (applying fluent materials)	B05	
	Additive manufacturing	B33	
ELECTRONICS	Electric elements	H01	H01S
	Electronic circuitry	H03	
	Electric techniques	H05	
	Semiconductor manufacturing: lithographic patterning	G03F	
	Semiconductor manufacturing: epitaxial growth	C30B	
COMPUTERS	Computing	G06 G06G7/80	
	Computers & advanced ICs (liquefaction of gases and compression systems for cryogenic cooling)	F25B	F25B3; F25B5; F25B7; F25B11; F2513; F25B15; F25B17; F25B19; F25B21; F25B23; F25B25; F25B27; F25B29; F25B30; F25B31; F25B33; F25B35; F25B37; F25B39; F25B40; F25B41; F25B43; F25B45; F25B47; F25B49
TELECOMMUNICATIONS	Broadcast communication	H04B	
	Secret communication	H04K	
	Transmission and digital communication	H04L	
	Wireless communication	H04W	
	Cryptography	G09C	
SENSORS AND LASERS	Measuring and testing	G01	G01C; G01S
	Optics	G02	
	Laser	H01S	
	Mineral Glass	C03	
	Radio navigation	G01S G01S1/4; G01S19/18	
NAVIGATION AND AVIONICS	Navigation	G01C	
	Aircraft, Aviation and Cosmonautics	B64	
MARINE	Ships, vessels and related equipment	B63	
AEROSPACE PROPULSION	Jet-propulsion plants	F02K	
	Explosive or thermic components	C06B	

Cosmonautics	B64G
Aerospace propulsion (gas turbines)	F02C

4.4.2 Calculation revealed technological advantage (RTA)

The Revealed Technological Advantage (RTA) indicator reflects the degree of specialization in a specific area of innovation. It is calculated as follows: $RTA_i = \frac{p_{i,s}^T}{p_{i,s}} / \sum_i \frac{p_{i,s}^T}{p_{i,s}}$.

With $p_{i,s}^T =$ number of patents with a specific classification (e.g. defence) in country i and sector s, $p_{i,s} =$ total patents in country i and sector s. This measures the share of patenting in a particular country-sector combination compared to patenting by sector peers in reference countries. The index is normalized against broader patenting activity to correct for idiosyncrasies in patenting behaviour in particular countries. This approach helps account for the fact that smaller countries tend to exhibit lower patent activity overall. We combine this with aggregation over multiple years, to smooth out data inconsistencies and random variation. This approach is taken from Fankhauser et. al. (2013).We calculate the RTA based on total number of patents during 2016-2020. Countries with less than 100 triadic patent families during this period are excluded from the analysis because these could easily distort the figures.

Since the distribution is skewed (zero to infinity), we rescale the RTA from -1 to 1 in line with Curran et. al. (2022). This refinement provides a more balanced and interpretable metric. A positive value indicates that a sector in a country has above-average innovation in a given field, while a negative value signals a competitive disadvantage compared to peers.

4.4.3 Product analysis

For the product analysis we use data from the Harvard Atlas of Economic Complexity for the year 2023. Core defence products were mapped using (4 digit) HS code 2012 'arms and ammunition'. These are:

- 9301: Military weapons
- 9302: Revolvers and pistols
- 9303: Firearms
- 9305: parts of military weapons or other accessories
- 9306: ammunition and explosives
- 8710: Tanks and other armoured fighting vehicles, motorized, whether or not fitted with weapons
- 3601: Propellant powders
- 3602: Prepared explosives (other than propellant powders)
- 3603: Safety fuses, detonating fuses, caps, igniter
- 8802: Aircraft (including helicopters)
- 8803: Parts of aircraft and spacecraft
- 8906: Other vessels, including warships and lifeboats other than rowing boats.

Dual-use goods are identified by linking the EU dual-use item list to NC/TARIC codes using the correlation tables from the European Commission. For consistency with the Harvard product dataset, we use the first four digits of these codes, as they correspond to the 4-digit HS codes used by Harvard.

The following concepts originate from the Harvard Atlas of Economic Complexity and are outlined briefly below. For a formal derivation and detailed methodology, see Hidalgo & Hausmann (2009).

Product complexity

Product complexity provides a measure of the diversity and sophistication of the productive know-how required to produce a product. Product Complexity Index (PCI) is calculated based on how many other countries can produce the product and the economic complexity of those countries.

Adjacency

A measure of a country's ability to enter a specific product. A product's distance (from 0 to 1) looks to capture the extent of a location's existing capabilities to make the product as measured by how closely related a product is to its current exports. An 'adjacent' product requires related capabilities to those that exist, which implies greater likelihood of success of expanding production to this product.

Every two products have a globally defined *proximity* between them as measured by the probability of co-export, which measures the probability that if a country exports product A, it also exports product B. The product proximities are fixed globally and measured using 128 countries' export data over 50 years. The *distance* of a product is then the sum of the proximities connecting that product to all the products that the location is not currently exporting. For a more straightforward interpretation we use the inverse of distance; $Adjacency = 1 - Distance$.

Diversification potential

A measure of how much a location could benefit in opening future diversification opportunities by developing a particular product and is included in the Harvard Atlas as 'Opportunity outlook gain'. It quantifies how a new product can open up links to more, and more complex, products. Diversification potential classifies the strategic value of a product based on the new paths to diversification in more complex sectors that it opens up. Diversification potential accounts for the complexity of the products not being produced in a location and the distance or how close to existing capabilities that new product is.

Comparative advantage

The Symmetric Revealed Comparative Advantage (SRCA) metric measures trade specialization. This indicator is based on export data taken from the Harvard Complexity Atlas. For the Netherlands, exports are adjusted based on reexport estimates for product groups to account for potential reexport bias.

SRCA adjusts the traditional RCA measure to a symmetric scale ranging from −1 to +1, making comparisons across products and countries more intuitive. Like RCA, it evaluates whether a country is an effective exporter of a specific product by comparing its share of exports to the product's share in total world trade. A positive SRCA value indicates comparative advantage, while a negative value signals disadvantage.

4.4.4 Additional figures on technologies and products

Figure A9. Share in absolute patenting by category and location (2016-2020)