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Europe in the new NATO era




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Abstract

At the historic NATO Summit in The Hague, member states agreed to a significant increase in defense spending, targeting up to 5% of GDP in the coming years.

In this research note, we explore the potential economic implications for Europe under various assumptions across four scenarios.

The first key takeaway is that execution determines impact: well-implemented strategies could boost euro area GDP by up to 3.4% by 2045, whereas poorly executed approaches may yield negligible returns. We identify and discuss seven critical conditions that distinguish effective execution from ineffective efforts.

The second insight is that economic benefits take time to fully materialize. This is particularly true for increased investment in defense R&D, which tends to deliver substantial long-term economic returns.

Disclaimer: This policy note is based on RaboResearch Global Economics & Markets, Research Note "Europe in the new NATO era", June 2025.

Summary

- **Execution determines impact**: The macroeconomic effects of increased defense spending are highly contingent on implementation quality. Well-executed strategies can raise euro area GDP by up to 3.4% by 2045, while poorly executed approaches yield negligible returns.
- **Short-term fiscal costs, long-term economic gains**: All four scenarios show an initial stimulus effect, followed by a temporary growth slowdown due to tax increases around 2030-2035. But, only well-managed strategies lead to recovery and sustained growth in the long run.
- **Private investment benefits from crowding-in**: Although increased taxes to finance the defense impulse reduce household consumption in de medium term, there is crowding in of private sector investment. This effect is strongest in well-executed scenarios, where defense spending complements rather than displaces private capital formation.
- **Defense R&D as a long-term growth lever**: Although defense R&D initially crowds out civilian R&D, each euro invested yields €7 - €8 in additional output by 2050, provided the investment is well-targeted and sustained.
- **Seven conditions for successful implementation**:
  - ✓ Macroeconomic timing: Countries should differentiate between long-term investments (in the case of a closed or positive output gap, or limited industrial capacity) and short-term stimulus (when facing a negative output gap or ample industrial capacity).
  - ✓ Financing strategy: Debt-finance in the short-term with credible medium-term fiscal consolidation.
  - ✓ Policy coordination: Align investments with national industrial strengths and avoid fragmentation within Europe.
  - ✓ Industrial anchoring: Ringfence a substantial share of spending for EU-based firms to prevent leakage of public funds.
  - ✓ Spending composition: Ensure that a substantial share of the defense stimulus is allocated to defense R&D and the expansion of production capacity.
  - ✓ Delivery focus: Link expenditures to measurable output targets, not just nominal budgets.
  - ✓ Policy alignment: Ensure monetary policy remains neutral or supportive during the fiscal impulse.
- **Strategic patience is essential**: The economic benefits of defense investments – particularly in R&D – require a lead time of 8 to 10 years. Policymakers must adopt a long-term perspective and maintain commitment over time.

Historic NATO Summit in The Hague

At the historic NATO summit in The Hague on the 24th and 25th of June 2025, its members made a firm commitment to significantly increase the alliance's defense spending benchmark. According to this new NATO target, by 2032, member states aim to allocate 3.5% of their gross domestic product (GDP) to direct defense expenditures, with an additional 1.5% of GDP earmarked for investments in defense-relevant assets – such as robust infrastructure and cybersecurity. This add-on also makes the higher target more palatable or acceptable to a broad set of NATO members.

President Donald Trump and Secretary-General Mark Rutte have long advocated for this substantial increase of NATO's spending norm. With a devastating war now raging on the European continent for over three years and geopolitical tensions mounting, Europe has been jolted from its strategic slumber. There is a growing realization that, for decades, defense has been underfunded and that reliance on transatlantic security guarantees is no longer tenable. Moreover, the 12-day war between Israel and Iran, which has been followed by a truce that could still unravel, suggests that a key supplier of weapons to Europe may no longer be available, as it is likely to require its own defense production capacity. This underscores the importance of Europe becoming more self-reliant and accelerating its rearmament efforts in an effective and coordinated manner. The current political climate appears ripe for a decisive shift, with sufficient momentum to persuade European nations to commit to the new NATO spending framework – an evolution that is not only driven by geopolitical necessity but also increasingly supported by public opinion across the continent.[1]

[1] Surveys such as this and this one indicate strong public support for increased defense spending in Europe.

The structural weaknesses of Europe's defense sector were already highlighted in the well-known Draghi Report. And in our own report of 2023, where we underscored the interconnectedness of defense, the industrial complex and raw materials dependencies. While Europe excels in certain areas – such as tanks, submarines, and maritime technology – it suffers from fragmentation where scale is essential, lacks coordination and standardization, and invests relatively little in research & development (R&D). Moreover, Europe remains heavily dependent on non-European suppliers: between June 2022 and June 2023, 78% of defense procurement occurred outside Europe, with 63% sourced from the United States. Even though the EU invested a record €72 billion in defense in 2024, the European Defence Agency (EDA) reports that a large share of this still flows to non-European producers. Moreover, only 1.4% of total EU defense spending is allocated to R&D – far below the structural investments made by the US and China.

In this report, we explore the potential economic ramifications of a renewed defense investment drive across Europe, in terms of economic growth, fiscal consequences and long-term productivity. It is important to note that the economic benefits of European rearmament are far from straightforward. Much depends not only on the scale of the investment – whether 3.5% or 5% of GDP – but also on its design and implementation. Will the stimulus be channelled into strengthening Europe's own defense industrial base and will Europe's existing defense industry be more focused on Europe itself, or will the stimulus predominantly flow to countries outside the EU with well-established defense sectors, such as the United States, South Korea or Israel?

Moreover, will there be sufficient safeguards to ensure that these investments translate into tangible increases in defense capabilities, rather than merely driving up prices and boosting profits for defense contractors? And how can we prevent the defense sector from depleting critical resources – human, material, and financial – that are equally vital to the civilian economy ('crowding out')?

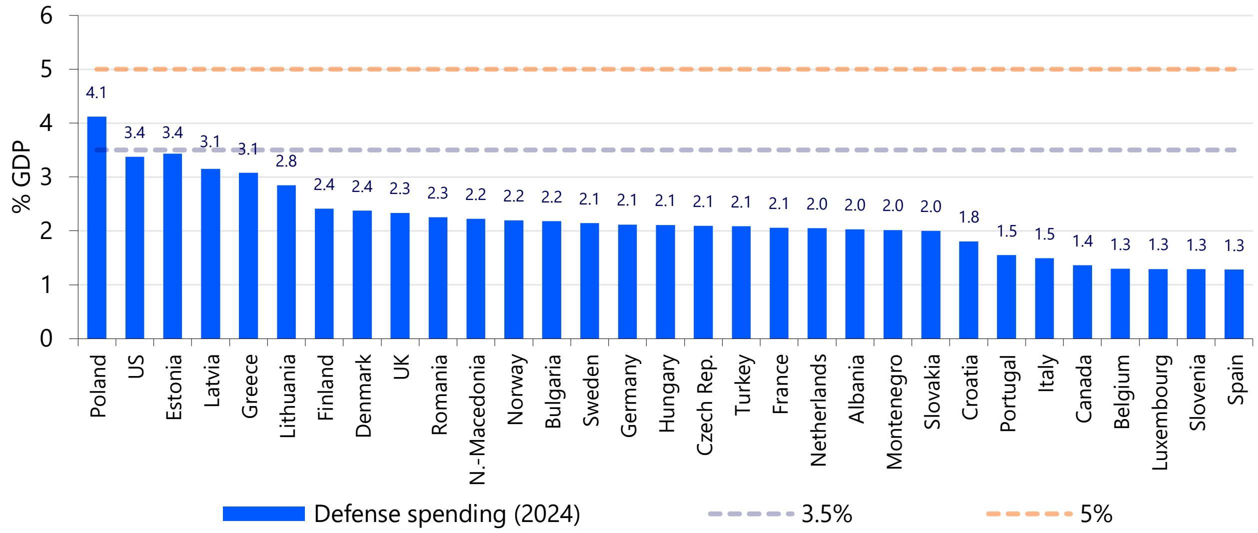
These are the pivotal questions we address through four distinct scenarios, each quantitatively modelled to assess the broader economic impact of Europe's potential defense renaissance. But first, we take a closer look at current defense spending patterns as well as the economic mechanisms and effects of defense investments, based on peer-reviewed literature. The focus here is primarily on the economic aspects, excluding geopolitical and strategic considerations.

How much do we currently spend on defense?

Before we zoom into the economic impact of increased defense spending, it's important to examine current expenditures and where the money is going in each country. Our focus is primarily on NATO member states, but when calculating, for example, the average for the eurozone, we have also included non-NATO members, such as Ireland and Austria in the data.

In 2024 NATO members spent 1.5 trillion USD on defense. Figure 1 illustrates the distribution of these outlays across countries, as a percentage of GDP. Poland is the only NATO member state which is currently meeting the 3.5% benchmark, and the United States and Estonia are also close to reaching this target. Countries falling significantly short of the current 2% NATO target include Croatia, Portugal, Italy, Canada, Belgium, Luxembourg, Slovenia, and Spain, and have a long way to go before 3.5% comes in sight.

Figure 1: New NATO target is still far out of sight for many countries



Source: NATO, Macrobond, RaboResearch 2025

Breakdown in spending components

Defense spending consists of several components (Figure 2):

1. **Equipment**
2. **Personnel**
3. **Infrastructure**
4. **Other (e.g. Research & Development)**

Equipment consists of the procurement of weapons and weapon systems (e.g. artillery systems, missile defense systems), vehicles (e.g. battle tanks, armored fighting vehicles), aircraft (e.g. helicopters, fighter jets), naval systems (submarines, destroyers and frigates, aircraft carriers), cyber and space based systems (e.g. satellites, cyber defense platforms) and ammunition.

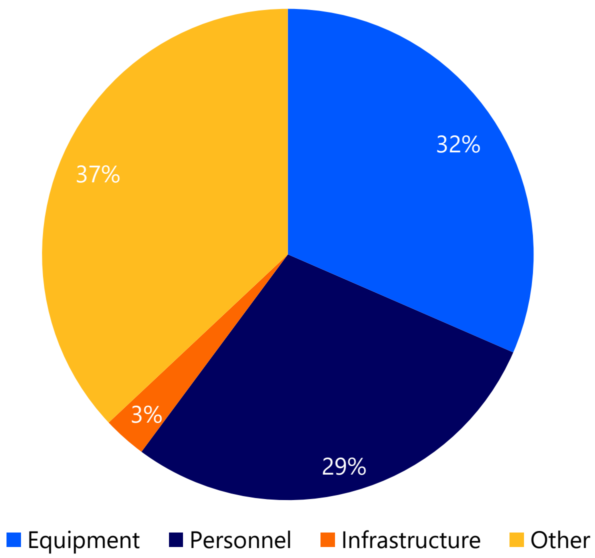
Military personnel expenditures include salaries for both military and civilian defense staff. This category also covers education, training, and pensions. The infrastructure component encompasses the construction and maintenance of bases, airfields, ports, and facilities.

The post *other* consists of a wide range of expenditure not directly covered by the first three components and includes, e.g., defense research & development (R&D), intelligence, cyber intelligence, the maintenance of military bases overseas, maintenance of nuclear arsenal, international missions, and classified programs.

The various components of defense spending differ significantly between countries and regions (see Figure 3). Notably, the relative spending on personnel in the Euro Area and the US does not differ much: the US spends 0.9% of GDP on defense personnel costs, while the eurozone spends 0.7%. However, investment in equipment is considerably lower in the eurozone: the US invests more than 1% of GDP, whereas the EU does not even reach 0.5%.

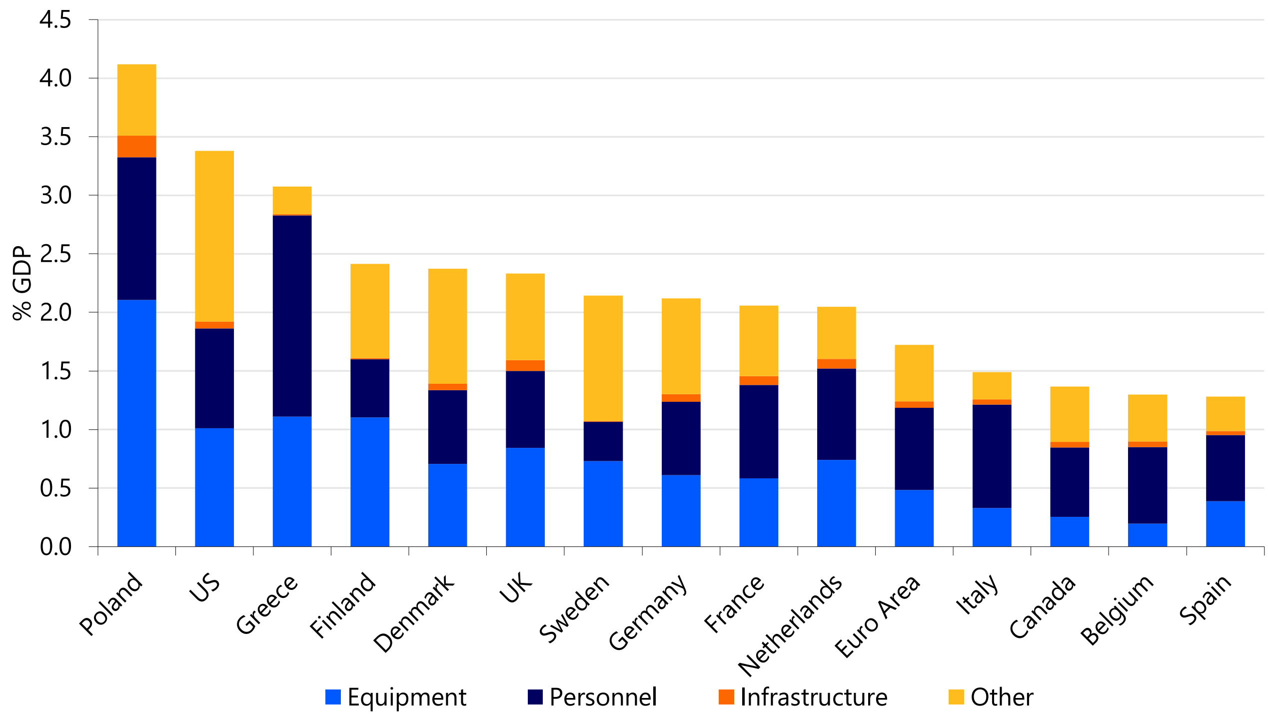
Another striking difference is that the "other" category in the US is much larger than in most other NATO countries. There are several reasons for this. First, the US allocates a significantly larger portion of its defense budget to Research & Development (R&D). This includes investments in new weapons systems, AI, or quantum computing, for example. The US invests 10 to 13 times more in defense-related R&D than the eurozone on average (see Figure 4).

Figure 2: Defense expenditure broken down by category (share of total NATO defense spending)



Source: NATO, Macrobond, RaboResearch 2025

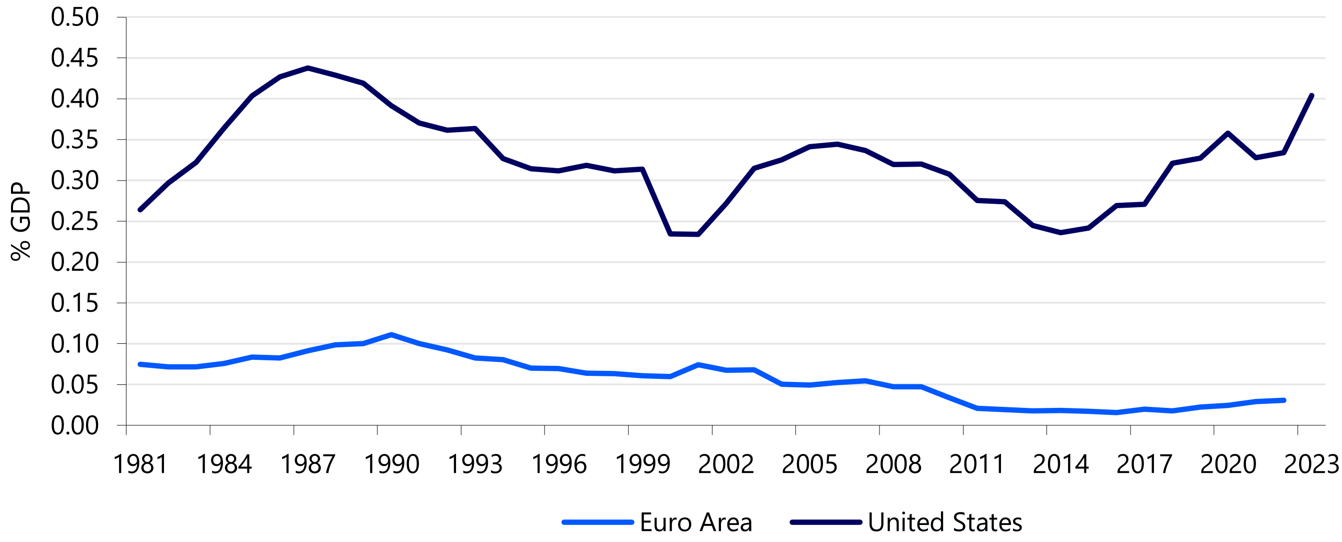
Figure 3: Composition of defense spending varies significantly among countries



Source: NATO, Macrobond, OECD, RaboResearch 2025

A second explanation is the exceptional international role that the US plays, such as being regularly involved in international (covert or not) military operations. In this context, the US maintains an extensive network of overseas bases that require upkeep. The US also plays a leading role in global security monitoring through worldwide intelligence operations. All these costs fall under the "other" category. Finally, the US possesses a large arsenal of nuclear weapons that must be maintained, secured, and modernized. For example, the US also bears the lion's share of the cost of the nuclear infrastructure of other NATO countries.

Figure 4: US invests 10 to 13 times more on defense R&D than Euro Area



Source: OECD, Macrobond, RaboResearch 2025

What do we know from the literature?

The fiscal multiplier

Central to the discussion on the economic impact of government spending – particularly defense spending – is the concept of the **fiscal multiplier**: the extent to which an additional amount of government expenditure leads to an increase in GDP.

The multipliers reported in this study are cumulative, meaning they reflect the total effect on GDP over a longer time horizon, rather than just the first year following the spending impulse.

To give an example how to interpret the multiplier reported in this paper: if a study reports a multiplier of 1.2, this implies that one additional euro of defense spending results in a cumulative increase in GDP of 1.2 euros. In other words, the economy gains an extra 20 cents in output for every euro spent. A multiplier effect can arise when government spending triggers additional private investment – for example, through public-private partnerships or increased demand for suppliers. Moreover, when defense projects lead to knowledge development that eventually spills over into the civilian domain, each additional euro of defense spending can generate a societal return that exceeds the initial investment.

A multiplier below one indicates that the economic return is less than proportional to the fiscal impulse, suggesting limited additionality. A negative multiplier implies a net loss in economic welfare – this may occur when defense spending extracts resources (labor, capital, goods (high-tech components, semi-conductors) and commodities) from more productive civilian uses, effectively 'crowding out' private sector activity.

Whether a multiplier below 1 is "bad" or "acceptable" is largely a political question, which we will and cannot answer. But important to remember is that a having a strong defense act as a deterrent and thus helps avoid future military conflict and the associated destruction of resources and hence future production. Secondly, a strong military also helps protect economic interests around the world, such as keeping waterways open, protecting foreign personnel and assets, etc. These benefits are not visible in the multiplier but should be viewed against the costs.

Overall impact of defense spending

Based on the literature review in Annex 2, defense spending multipliers typically range between 0.6 and 2.4, depending on the type of expenditure, economic conditions, and national context. The economic impact varies significantly across time, countries, and spending categories – namely consumption, investment, and R&D. Multipliers are highest when spending is domestically anchored, well-coordinated, and supported by neutral or accommodative monetary policy. Financing also matters: short-term debt financing combined with medium-term fiscal adjustment tends to be more effective than immediate tax increases, which can erode the stimulus effect.

During periods of economic downturn, multipliers can rise substantially – typically ranging from 1.6 to 3.4 – due to underutilized capacity and reduced crowding-out effects. In contrast, during economic expansions, multipliers often fall below 1.0 and can even turn negative, as public spending competes with private sector demand for scarce resources.

While few studies explicitly distinguish between defense-related consumption (e.g. personnel and operations) and investment (e.g. capital goods and infrastructure), broader fiscal literature suggests that multipliers for government consumption generally range from 0.2 to 1.2, whereas investment multipliers tend to be higher, typically between 1.2 and 2.4. Consumptive expenditures tend to have more immediate but less durable effects on output.

Impact of defense R&D

Defense R&D has long been a driving force behind transformative technologies that are now part of everyday life and have served as a catalyst for broad societal progress. Innovations such as the internet, GPS, and jet engines originated from military necessity but later proved to be of enormous value to the civilian domain. As such, defense-related R&D is associated with long-term productivity gains and broader welfare effects, particularly when it fosters innovation spillovers into the civilian economy.

The economic impact of defense R&D on productivity remains a subject of debate. While it likely shares many characteristics with general R&D – such as knowledge spillovers – empirical evidence has been mixed. Earlier studies point to potential downsides, including the crowding out of private R&D, misallocation of scientific talent, and limited spillovers due to procurement-related restrictions on intellectual property. Some even report negative productivity effects from defense-related public R&D.

However, more recent research suggests a more optimistic view. When governments absorb the high fixed costs of foundational defense research, they may enable private sector participation that would otherwise not occur. This 'crowding in' effect is supported by Moretti, Steinwender, and Van Reenen (2025), who find that a 10% increase in government R&D leads to a 5 to 6% rise in private R&D, with defense R&D playing a central role. Their study also shows that a 1 percentage point increase in defense R&D (as a share of value added) raises TFP[2] growth by 0.08 percentage points.

Given the long lead times of defense R&D, Erken, Every and Remmen (2025) focus on long-run effects. Using cointegration panel models across 19 OECD countries, they find that defense R&D does contribute positively to productivity, albeit with smaller elasticities than civilian R&D. Nonetheless, the return on investment can be substantial (around €8 to €9 per euro spent), particularly when accounting for the relatively low baseline levels of defense R&D spending.

Execution of defense spending: do's and don'ts

Based on our extensive literature review, we identify seven key conditions that ultimately determine the effectiveness of a defense spending impulse (see Table 1). These seven conditions form the foundation for one of the core dimensions along which we construct and evaluate our policy scenarios.

[2] Total factor productivity (TFP) growth measures the residual growth in total output that cannot be explained by the accumulation of traditional inputs such as labor and capital and is generally associated with 'innovation'.

Four defense spending scenarios

In this study, we assess the economic impact of increased defense spending on European economies across four scenarios (see Figure 5). The scenarios are based on two key dimensions: (1) whether Europe allocates 3.5% or 5% of GDP to defense, and (2) whether the spending impulse is implemented in a policy-effective manner or not (see Table 1).

Table 1: Policy execution of defense expenditure impulse: do's and don'ts

Policy dimension	*Do's*	*Don'ts*
Business cycle	Implement during recession or negative output gap	Avoid during economic expansion when crowding-out risks are high
Financing strategy	Short-term debt, medium-term fiscal adjustment for sustainability	Rely on immediate tax increases or long-term debt without adjustment
Monetary policy	Neutral or accommodative	Avoid aggressive monetary tightening that offsets fiscal stimulus
Policy coordination	Coordinate across regions based on comparative strengths; harmonize standards	Allow fragmentation or politically driven allocation without coordination
Industrial anchoring	Ringfence large part of spending to benefit domestic/EU defense industry	Allow excessive import leakage by sourcing primarily from outside the EU
Spending composition	Prioritize defense R&D and defense capital stock buildup	Focus mainly on personnel and operational costs
Delivery focus	Include safeguards on delivered volumes to ensure real output	Focus solely on nominal expenditure without ensuring delivery; risk of inflation

Source: RaboResearch 2025

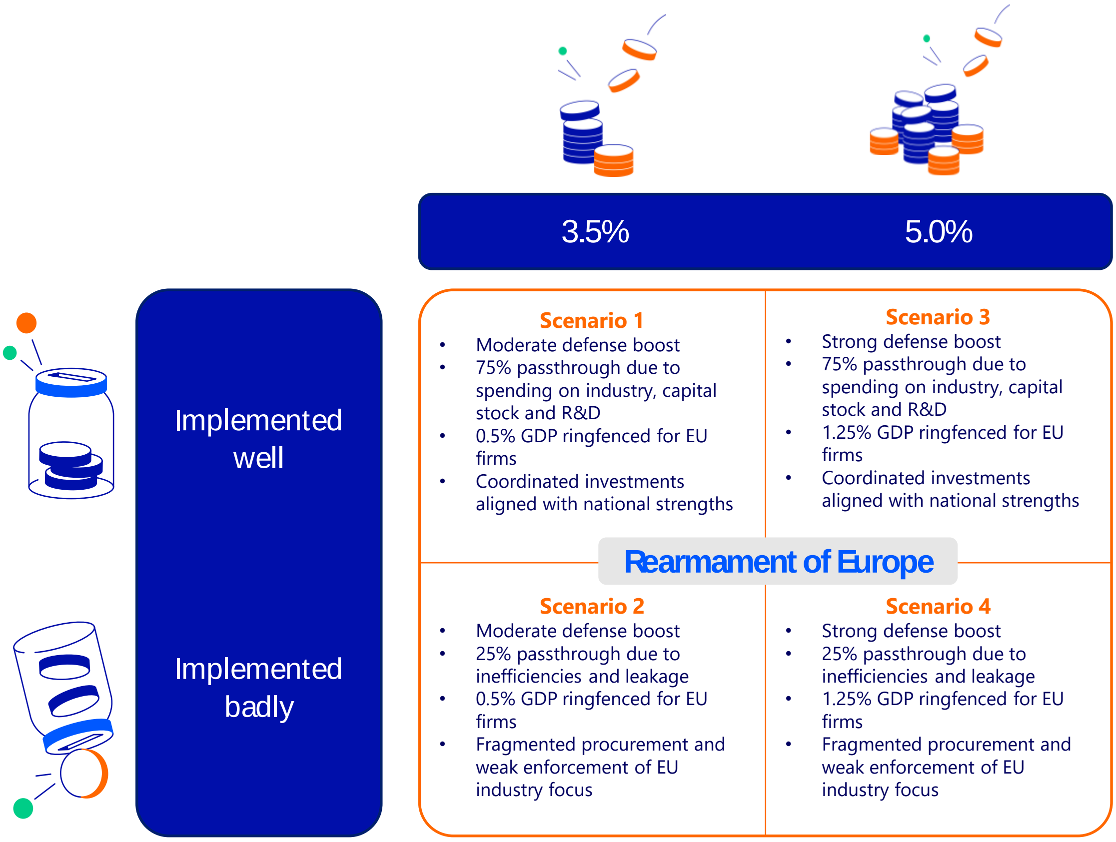
Dimension 1: the 3.5% vs. 5% NATO target

NATO member states have agreed to allocate 5% of GDP to defense spending: 3.5% in direct defense expenditures, and 1.5% through defense-related investments, such as military infrastructure, cybersecurity, and strategic industrial sectors. Whether countries effectively spend 3.5% or the full 5% largely depends on how the additional 1.5% is interpreted and implemented. Although countries may formally meet the target, the discretionary nature of the 1.5% threshold creates ample room for fiscal manoeuvring. This flexibility allows governments to meet the benchmark on paper – without committing additional resources – by reclassifying existing expenditures as defense-related.

In the 5% scenario, we assume, however, that the full 1.5% add-on is used for additional defense-related investments. This could occur in response to heightened geopolitical threats – such as further escalation by Russia or a widening conflict in the Middle East that draws Europe in. Under such conditions, member states would likely feel an even stronger sense of urgency to accelerate defense capacity beyond the formal 3.5%, using the remaining 1.5% for tangible investments in military equipment, research, and personnel.

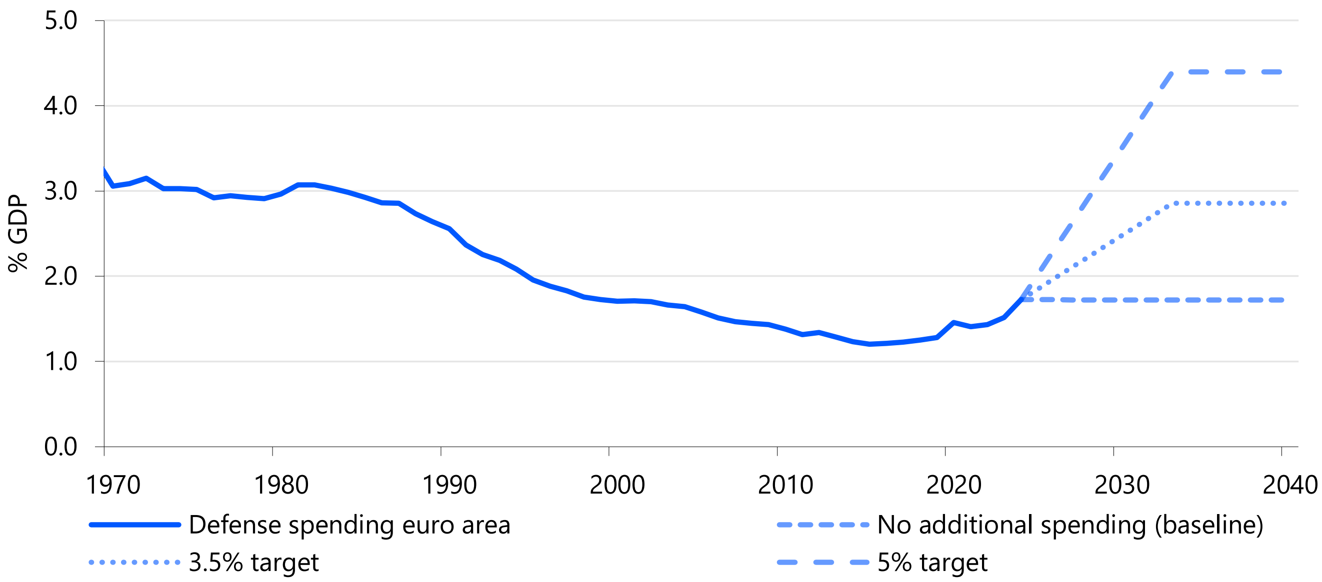
Since the NATO target should be fully achieved by 2032 and beyond, we assume a gradual increase towards the new targets in both scenarios, as it is impossible to increase expenditures with so much in such a short time in a productive way. Speed of this phase-in may vary between countries depending on limitations from resources, such as staffing, materials and financing.

Figure 5: Four scenarios for rearmament of Europe



Source: RaboResearch 2025

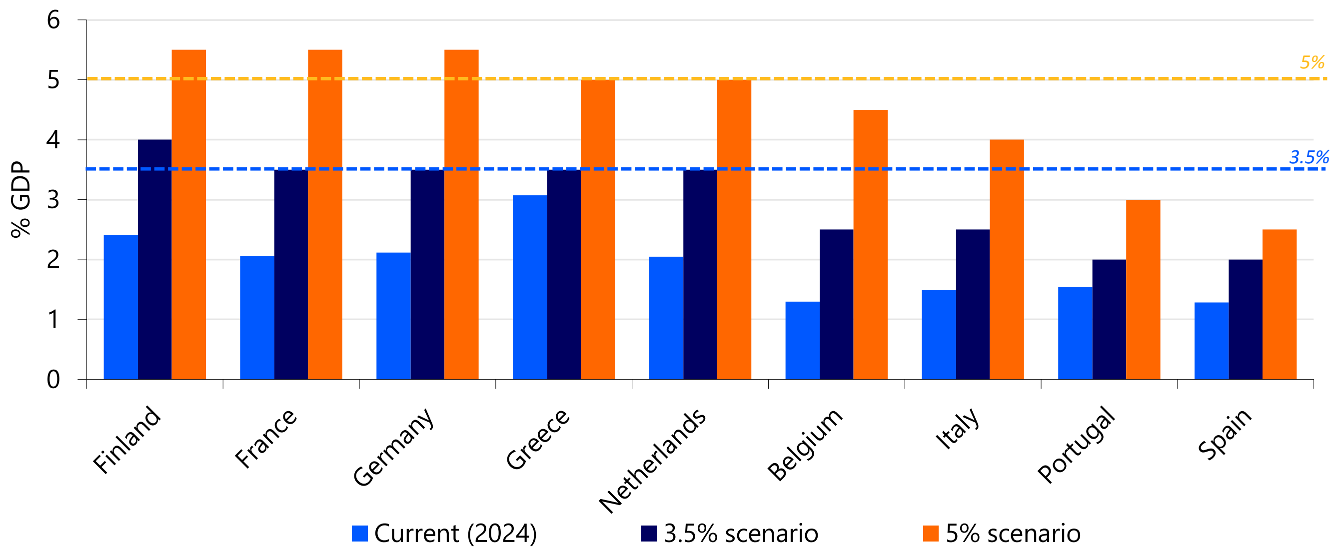
Figure 6: Defense spending in Euro Area in 3.5% and 5% target scenarios



Source: NATO, Macrobond, World Bank, RaboResearch 2025

Ultimately, we expect that the euro area will come close to meeting the 3.5% and 5% defense spending targets in our scenarios, but will not fully achieve them (Figure 6). It is unrealistic to assume that countries currently even falling short of the 2% NATO benchmark will be able to reach 3.5% – let alone 5% – in the foreseeable future. Therefore, in our 3.5% and 5% scenarios, we do not assume full compliance across all member states (see Figure 7). Countries such as Belgium, Italy, Portugal, and Spain are not expected to meet the target. In contrast, for countries like Finland, France, and Germany, we assume defense spending will even exceed the agreed 5% threshold.

Figure 7: Assumed defense spending per country in 3.5% and 5% target scenarios



Source: NATO, Macrobond, World Bank, RaboResearch 2025

Dimension 2: executed well vs. executed badly

As highlighted in the literature review, the effectiveness of a large-scale defense spending impulse in the coming years will depend heavily on how it is designed and implemented. It is entirely possible to spend hundreds of billions on defense without producing a single additional frigate, fighter jet, or tank in Europe – without expanding production capacity, recruiting more military personnel, or boosting R&D capabilities. The case of Poland (see Box 1) illustrates how difficult it is for a country to scale up defense spending effectively in a short period of time. This challenge becomes even more complex when an entire economic bloc attempts to do so simultaneously. Below, we outline four key conditions that determine whether the spending impulse is likely to be effective or not, and how these are incorporated into our scenario framework.

Condition 1: Output commitments and prevention of leakage abroad

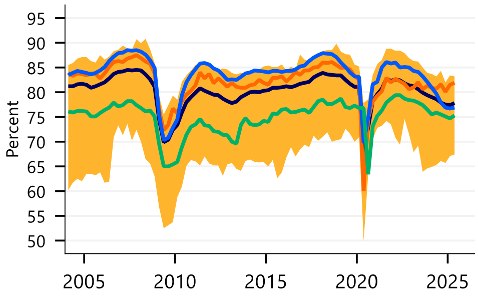
A poorly executed impulse may arise when policymakers focus more on spending the allocated funds than on securing actual delivery volumes. Without clear agreements, a large share of the impulse could be absorbed by rising prices for defense equipment, higher wages for military personnel, or increased profits and stock prices of defense firms. There is also a risk of capital leakage to non-European suppliers – such as the US, South Korea, or Israel – who have traditionally dominated the European defense market. In our well-executed scenarios, we assume a 75% passthrough from spending to real volumes, while in poorly executed scenarios (Scenarios 2 and 4), this passthrough is only 25%. Additionally, we assume that in the 3.5% target scenarios, 0.5% of GDP in extra spending is ringfenced for European firms, rising to 1.25% in the 5% scenarios.

Condition 2: Macroeconomic timing and composition of the impulse

It is essential that the impulse is tailored to the macroeconomic context of each country. In our scenarios, we account for the fact that countries operating near or above full capacity may trigger inflationary pressures if the impulse is not carefully designed. Countries should differentiate between long-term investments (in the case of a high capacity utilization or positive output gap) and short-term stimulus (when facing a low capacity utilization or negative output gap).

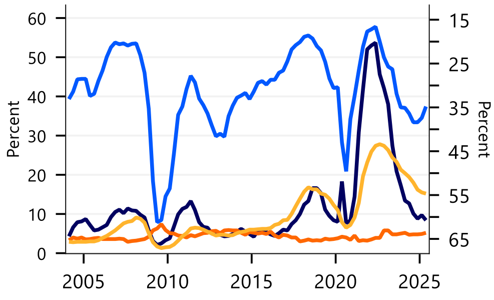
As the chart below shows (Figure 8 and 9), in most EU member states industry is currently operating below its average capacity utilization rate. Notably in big defense producing countries such as Germany and Italy there appears to be room to increase production without causing immediate supply constraints (of course there can be significant differences between sectors within industry). Labor shortages, however, remain a cause for concern in industry. That implies that a labor-intensive investment impulse may be more difficult to deliver than an equipment-intensive investment impulse.

Figure 8: Industry operating below capacity: is now a good time to spend?



Note: Capacity utilization reported by industry (EC survey)
Source: RaboResearch 2025

Figure 9: Shortages in industry have eased, although labor availability remains an issue



Note: Percent of respondents reporting shortages (EC)
Source: Macrobond, RaboResearch 2025

Condition 3: Policy coordination and strategic focus on R&D

Effective implementation also requires coordination across countries, aligning spending with national comparative advantages. For example:

- The Netherlands specializes in **radar and sensor technologies**,
- France and Sweden in **fighter aircraft and submarines**,
- Germany in **tanks and air defense systems**,
- Italy and Spain in **naval shipbuilding**,
- Finland and Poland in **land force equipment**.

To maximize the impact of the European defense impulse, spending should be aligned with these strengths through coordinated planning, harmonization, and joint procurement. Moreover, sufficient emphasis must be placed on expanding production capacity and boosting defense R&D. In the end the interplay between available personel, fixed capital and technology determines the quality of the defense force. Coordination is also essential in relation to "platforms" and "interconnectedness" of military equipment. Since its strength is essentially determined by the weakest element in the chain.

Condition 4: Avoiding counterproductive fiscal and monetary policy

The macroeconomic policy stance of governments and central banks will also shape the effectiveness of the defense impulse. If countries finance the impulse through cuts in other areas, or if central banks (e.g., the ECB) respond by tightening monetary policy, the positive Keynesian effects of the impulse could be neutralized. In all our scenarios, we assume neutral monetary policy and that short-term spending is debt-financed, with fiscal adjustments only occurring in the medium term.

Raising defense spending: the case of Poland and Greece

Since the Russian invasion of Ukraine, Poland has acted swiftly by significantly increasing its defense investments. In 2022, the country allocated 2.7% of its GDP to defense, rising to 4.2% by 2024. This places Poland well above NATO's current 2.0% benchmark, making it the undisputed European leader in defense spending.

A portion of this funding has been directed toward domestic production. PGZ, a major Polish state-owned defense company, manufactures howitzers for the Polish army. WB Electronics, Poland's largest private drone manufacturer, is also in talks with South Korea's Hanwha Aerospace to produce missiles on Polish soil. In 2022, PGZ signed a contract with South Korea's Hyundai Rotem to purchase 820 K2 tanks. As part of the agreement, production and maintenance of the tanks will be transferred to Poland starting in 2026.

However, a substantial share of Poland's defense budget has been spent on foreign equipment, and scaling up domestic production has proven challenging. PGZ initially aimed to produce 150,000 artillery shells annually by 2025, but due to a shortage of skilled labor and missed deadlines, this target has been postponed to 2028. A key bottleneck is the limited availability of critical raw materials. Since the war began, Europe has ramped up ammunition production, but demand for gunpowder, TNT, and other explosives far exceeds supply. Europe has relatively few producers of these essential materials, and supply chains remain complex and vulnerable. Many of the raw materials are sourced from China, and high energy prices combined with strict environmental regulations make local production economically unattractive. As a result, shortages persist despite ambitious expansion plans by firms such as Germany's Rheinmetall.

Greece offers another example of why the destination of defense spending matters. The country has consistently met NATO's 2% target – even during its debt crisis a decade ago, it spent relatively more on defense than, for instance, Germany. Despite having several major defense firms, such as Hellenic Aerospace Industry, which manufactures components for F-16s, the vast majority of Greece's defense budget has gone toward imports and personnel, with relatively little invested in R&D.

Results

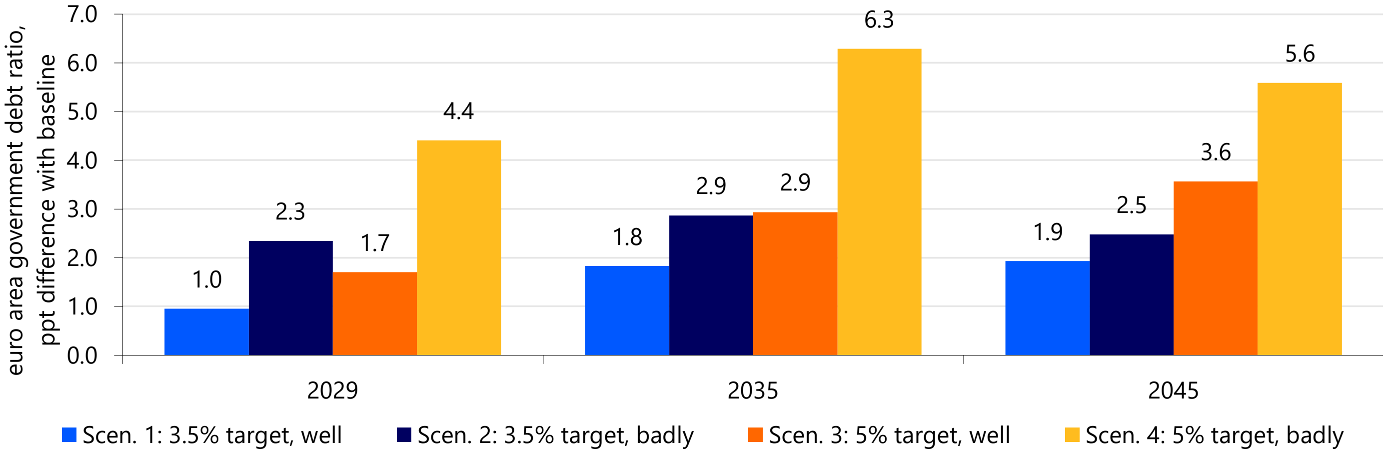
We analyse the impact of the scenarios on the European economy using two models: the National Institute Global Econometric Model (NiGEM) and a self-developed European productivity model. More information on the assumptions and the technical explanation of both models can be found in respectively Annex 1 and 3. In this section we discuss the results from the scenario analysis. We show differences with a baseline without a new defense spending package.

Government finances

Euro area government debt rises significantly during the first four years (see Figure 10). This is due to increased defense spending, which is not offset by spending cuts or tax hikes, as these expenditures are assumed to fall outside the EU's budgetary framework. The debt increase is most pronounced in poorly executed scenarios, where limited positive macroeconomic feedback effects occur to partly offset the higher spending.

In the years that follow, taxes are gradually raised, which is necessary to contain further debt accumulation. Without fiscal adjustments, long-term public debt in scenario 4 would end up being 50 percentage points of GDP higher than in the baseline scenario. With fiscal adjustment, debt continues to rise until around 2035 in all scenarios, but then begins to decline – falling further by 2045 and continuing to decrease in the subsequent years.

Figure 10: Impact of scenarios on Euro Area public debt in 2045



Source: RaboResearch 2025

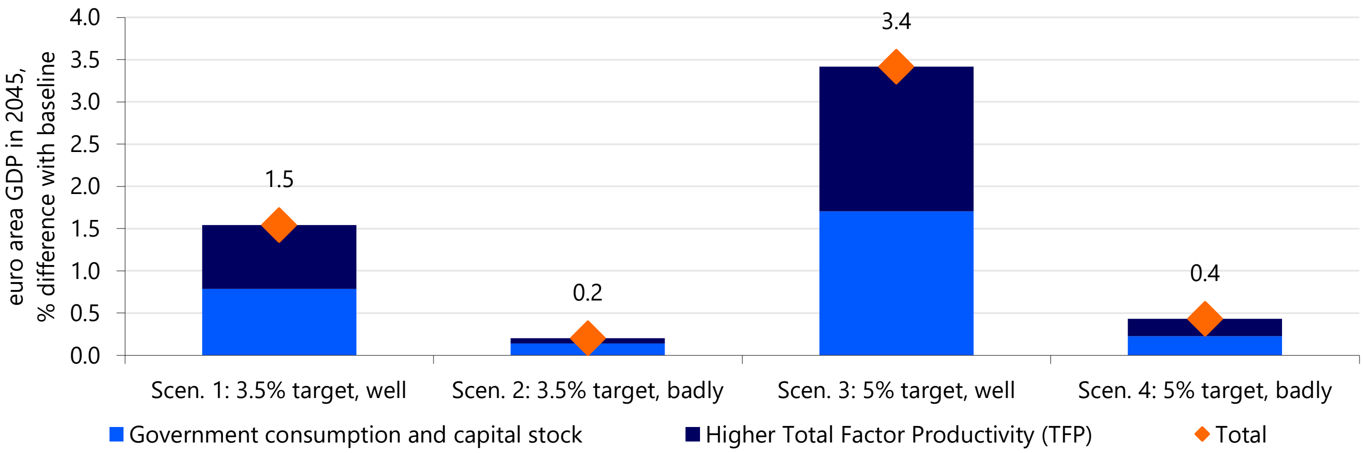
Macroeconomy

Ultimately, what matters is how the additional debt is used. The long-term impact of increased defense spending on Euro area GDP varies significantly across scenarios (see Figure 11). If the spending boost is well-coordinated, GDP in 2045 is projected to be 1.5% higher than in the baseline under the 3.5% target scenario, and even 3.4% higher under the 5% target scenario. Roughly half of this growth stems from increased government consumption and a larger capital stock, while the other half is driven by gains in total factor productivity (TFP).

In contrast, if the spending impulse is poorly executed, GDP remains roughly unchanged compared to the baseline. This suggests that the additional government debt yields little to no benefit in terms of economic growth – effectively making it a missed opportunity.

However, the path to 2045 is far from linear. In the first four years, net government stimulus provides a boost to the economy across all four scenarios (see Figure 12). But starting in 2030, when tax increases take effect, the positive impact on GDP fades by 2035 – and even turns negative in poorly executed scenarios.

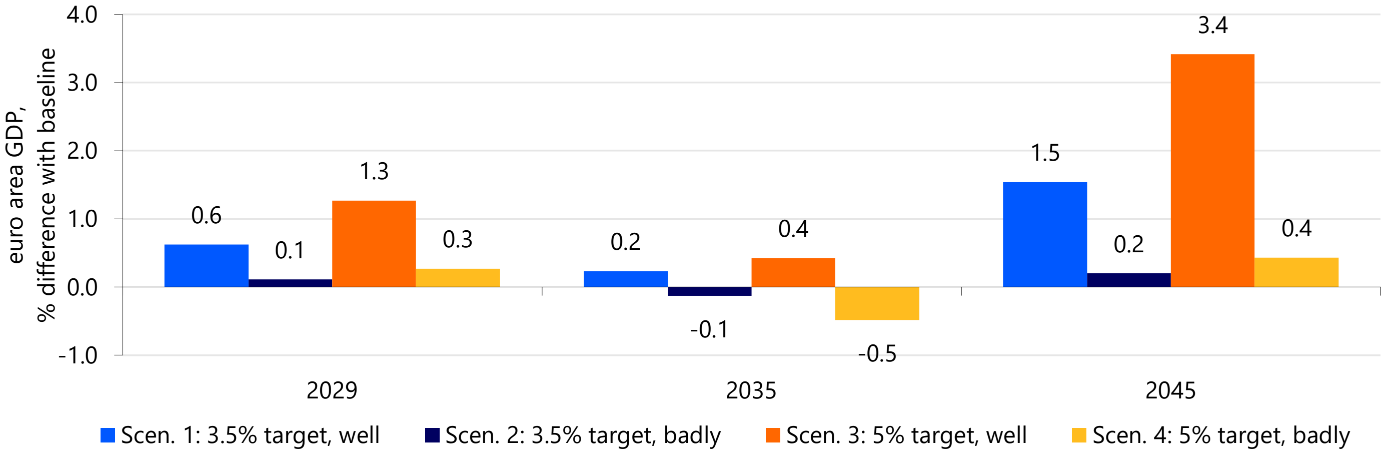
Figure 11: Impact of scenarios on euro area GDP in 2045



Source: RaboResearch 2025

This decline is driven by two main factors: (1) a portion of government spending is inefficiently allocated to costly and/or foreign defense equipment, financed by economically distortionary taxes; and (2) defense-related R&D partially crowds out private R&D, which typically delivers economic returns more quickly. After 2035, the long term positive effects begin to emerge, as the expanded capital stock and higher total factor productivity (TFP) translate into increased productivity. The key takeaway is that the economic benefits of such investments take time to materialize. Countries should not expect short-term gains, but rather prepare for a waiting period of over a decade before reaping the rewards of today's higher spending.

Figure 12: Impact of scenarios on euro area GDP over time



Source: RaboResearch 2025

Private consumption and private investment

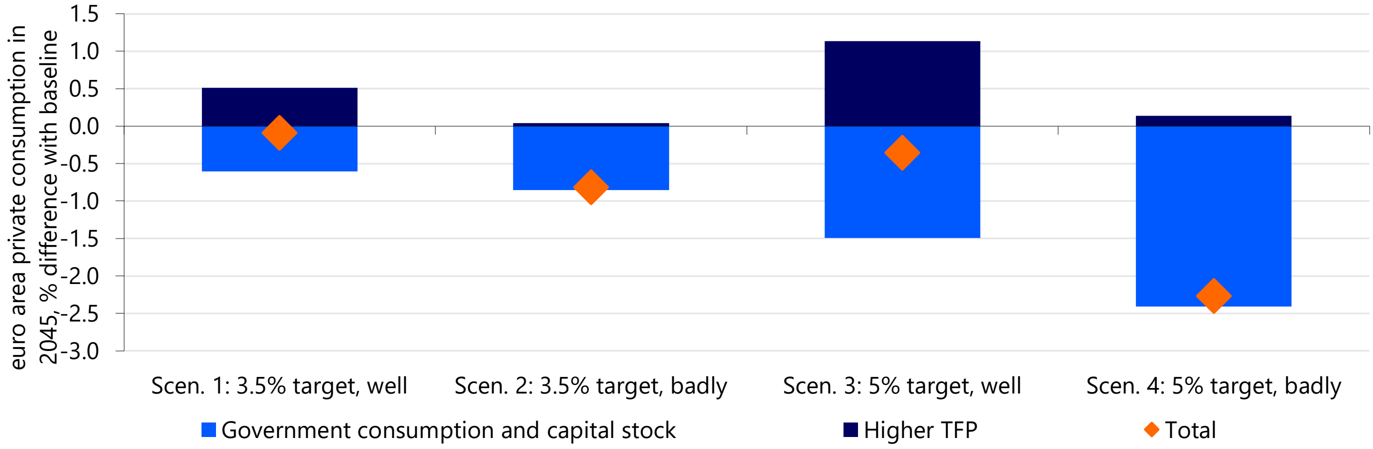
Looking more closely at the economic effects, we see clear differences in the components of GDP. Naturally, government expenditures increase, but the higher taxes that accompany them have a negative effect on private consumption (see Figure 13). Nevertheless, the impact on private consumption remains limited in the well-executed scenarios (scenario 1 and 3). This is because higher productivity leads to higher real wages in the long term. On balance, this roughly offsets the effects of higher taxes.

In the case of poor implementation (scenario 2 and 4), however, this is not the case, and only the negative effect of higher taxes remains. This once again underscores the importance of proper execution.

As with GDP, the trajectory of private consumption toward 2045 is uneven (see Figure 14). In the short term, the effects are minimal, as tax increases have not yet been implemented. However, beginning in 2030, taxes start to rise, leading to a significant decline in consumption across all scenarios compared to the baseline. This negative impact gradually fades after 2035 – but only in cases of effective policy implementation (scenario 1 and 3). Without it, there is little to no recovery (scenario 2 and 4).

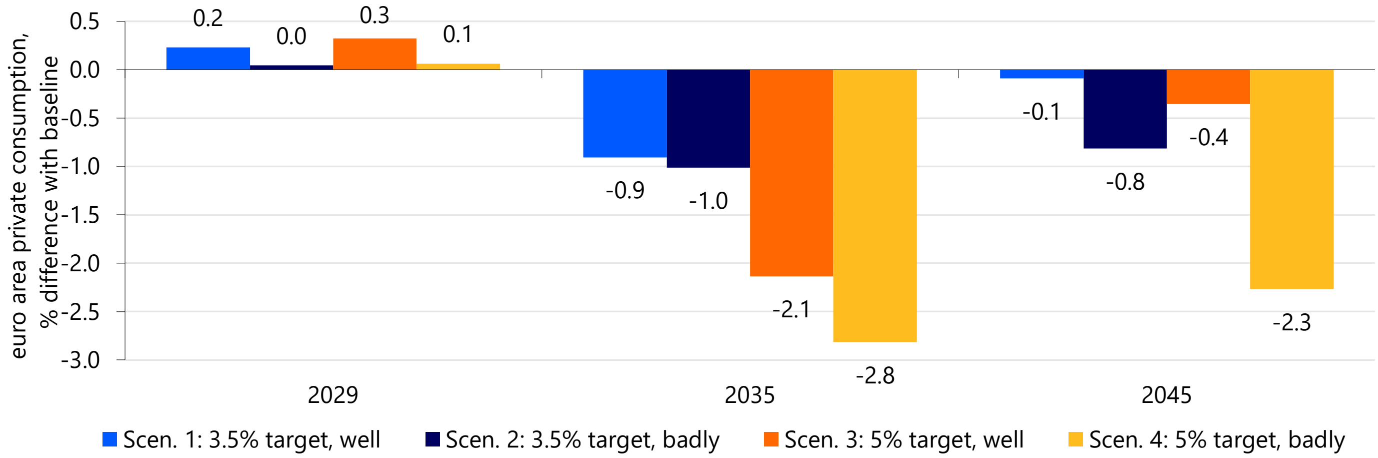
In contrast to private consumption, private sector investments do benefit from higher defense spending (see Figure 15). Both the increase in total factor productivity (TFP) and the boost in GDP growth driven by higher government expenditures have a positive effect. This implies there is additionality between public and private investments. The impact is by far the strongest in the well-executed scenarios (1 and 3). That said, this is also a long-term process – even by 2035, the effects remain relatively limited.

Figure 13: Impact of scenarios on euro area private consumption in 2045



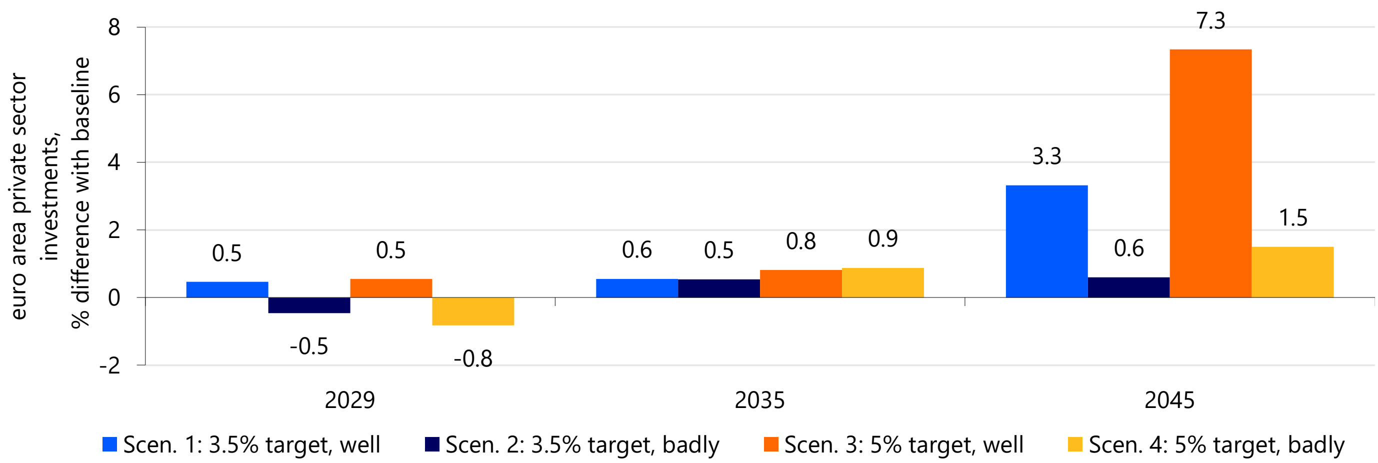
Source: RaboResearch 2025

Figure 14: Impact of scenarios on euro area private consumption over time



Source: RaboResearch 2025

Figure 15: Impact of scenarios on euro area private sector investments over time

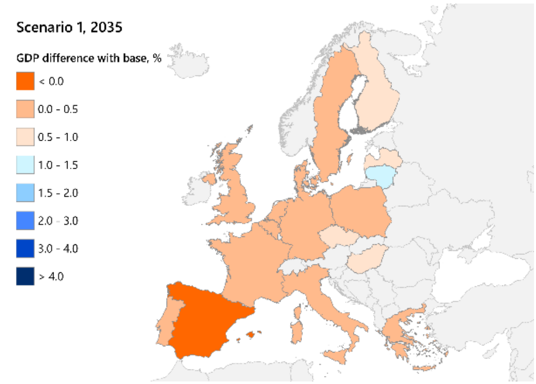


Source: RaboResearch 2025

Country-specific effects

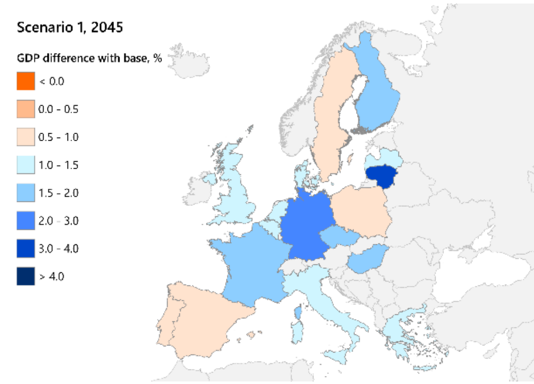
The long-term impact across individual European countries in our scenarios varies significantly. These differences depend not only on whether a country already has a substantial defense sector and industry – such as Greece and France – but also on the extent to which its broader industrial base can be transformed to support defense production, as in the cases of Germany and Italy.

Figure 16: GDP impact equally distributed, effects somewhat larger in the East



Source: RaboResearch 2025

Figure 17: Germany and Lithuania benefit the most

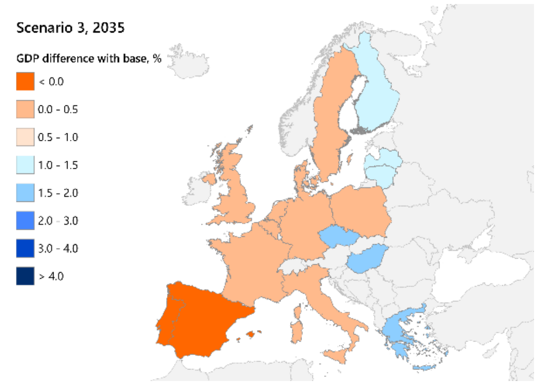


Source: RaboResearch 2025

Given that the overall economic impact in the poorly executed scenarios (2 and 4) remains limited, we focus here on the outcomes of the well-executed scenarios 1 and 3. In both cases, the medium-term effects up to 2035 (Figure 16 and 18) show a relatively even distribution across European countries, with nearly all European economies experiencing a GDP increase of around 0.5% as a result of the defense spending impulse. Notably, countries in Eastern Europe – such as Finland, the Baltic States, Bulgaria, Greece, and the Czech Republic – tend to benefit more. This may reflect their stronger incentive to accelerate the defense buildup in response to the geopolitical threat posed by Russia.

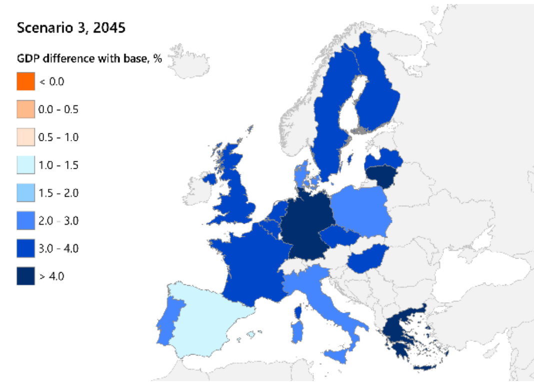
Spain shows the weakest effects of all European countries in our scenarios. Coincidentally, or not, it is also the only country that has expressed reluctance to fully commit to the new NATO spending target. In contrast, the countries that benefit most in the 5% target scenario in the long term include Lithuania, Germany, and Greece, each showing more than 4% cumulative economic growth (Figure 19). Additionally, the defense spending impulse is expected to generate cumulative growth of 3 to 4% in the Netherlands, Latvia, Finland, Sweden, the United Kingdom, France, Bulgaria, and the Czech Republic.

Figure 18: Larger effects in the East



Source: RaboResearch 2025

Figure 19: Germany, Greece and Lithuania benefit the most, Spain the least



Source: RaboResearch 2025

Bang for the bucks

For policymakers, it is essential to assess the economic return on each additional euro of public spending – commonly referred to as the bang for the buck. This metric compares the cumulative increase in GDP over a given period to the total amount of additional government expenditure. A value greater than one implies that each euro spent generates more in economic output than it costs, indicating a net gain. Conversely, a value below one suggests that the economic return falls short of the initial investment, implying a net loss.

Based on our scenario results, we calculate the bang for the buck separately for two categories:

1. additional public defense consumption and investment
2. additional defense-related R&D investment.

Government consumption and investment

It is by no means guaranteed that the bang for the buck from public defense consumption and investment will exceed one (see also the extensive literature review in Annex 2). This is partly due to the inclusion of compensating tax increases from 2029 onward in the calculation. A bang for the buck below one does not necessarily imply inefficiency – such spending may still be justified on strategic or security grounds. Moreover, part of the additional funds may be allocated to more expensive or foreign-sourced defense equipment, which does not directly contribute to domestic productivity.

The results (see Table 2) show that the bang for the buck is relatively high in 2029 in the well executed scenario 1 and 3, as tax increases have not yet taken effect. However, it still remains below one, since the economic benefits of a larger capital stock take time to materialize. From 2030 onward, as taxes rise, the bang for the buck declines – and in poorly executed scenarios, it may even vanish or turn negative.

In contrast, in the well-executed scenarios 1 and 3, each additional euro of spending more than pays for itself in the long run – even after accounting for higher taxes. However, this requires patience: the economic returns take time to materialize.

Table 2: Bang for the buck of extra government spending

	1: 3.5% target, executed well	*2: 3.5% target, executed badly*	*3: 5% target, executed well*	*4: 5% target, executed badly*
Until 2029	0.6	0.1	0.6	0.1
Until 2035	0.5	0.0	0.4	-0.1
Until 2040	0.5	0.0	0.4	-0.1
Until 2045	0.6	0.0	0.5	-0.1
Until 2050	0.8	0.0	0.7	-0.1
Until 2060	1.5	0.1	1.4	-0.1

Source: RaboResearch 2025

Defense R&D investments

When shifting our focus to the bang for the buck of defense R&D (Table 3), a striking pattern emerges: in the well-executed scenarios (1 and 3), **the short-term return of defense R&D is actually negative**. This implies that for every euro invested in defense R&D, the economy contracts by €0.70 to €0.80 in the near term compared to a no-investment baseline. The primary reason is that a sharp increase in defense R&D spending diverts talent and resources away from civilian R&D, which typically yields faster productivity gains.

This reallocation – essentially a crowding-out effect – leads to short-term welfare losses, as civilian R&D projects tend to have shorter innovation cycles (five years in our model) compared to defense R&D (ten years). The longer lead time in defense R&D is largely due to procurement processes, which delay the diffusion of new technologies into the civilian domain where productivity-enhancing spillovers can occur.

In contrast, in the poorly executed scenarios, a significant portion of the impulse leaks abroad or is absorbed inefficiently, resulting in less competition for domestic R&D resources. As a result, the crowding-out effect on civilian R&D is more limited.

Looking at the long-term horizon, however – up to 2050 – the picture changes dramatically. In the well-executed scenarios 1 and 3, the cumulative return on defense R&D becomes substantial, with **each euro invested yielding €7 to €8 in additional economic output**. These multipliers are consistent with the findings of Erken, Every, and Remmen (2025).

Bottomline: patience is required, as the economic benefits of defense R&D take considerable time to materialize.

Table 3: Bang for the buck of defense R&D investments

Scenario ->	*1: 3.5% target, executed well*	*2: 3.5% target, executed badly*	*3: 5% target, executed well*	*4: 5% target, executed badly*
Until 2035	-0.7	0.2	-0.8	0.6
Until 2040	1.7	0.6	1.3	0.9
Until 2045	5.2	0.6	4.6	1.0
Until 2050	7.9	0.7	7.0	1.2

Source: RaboResearch 2025

Is defense R&D really the silver bullet?

From our econometric analyses, defense R&D appears to yield the largest impact. But does such an enormous effect really make sense? Looking ahead, there are several compelling examples of defense R&D technologies that have resulted in breakthrough innovations with the potential to transform our daily lives – just as previous defense R&D efforts have done. Examples include the internet, the microchip, mass production of penicillin, nuclear energy, and the jet engine. Table 4 summarizes these promising technological areas.

One compelling example is quantum technology, which could redefine how we sense, communicate, and navigate. Quantum sensing enables ultra-precise measurements, while quantum radar uses entangled photons to detect objects with high accuracy and resistance to jamming. These technologies enhance detection of submarines, UAVs, and stealth aircraft, enable secure quantum-encrypted communication, and offer GPS-independent navigation. Potential civil applications may include advanced medical diagnostics, geophysical mapping, secure data transmission, and even agricultural monitoring – unlocking powerful tools for public benefit.

Although Artificial intelligence (AI) is increasingly embedded in daily life, its potential extends far beyond current applications. In defense R&D, AI enables next-generation dual-use capabilities. A key example is Edge AI, which allows autonomous drones, vehicles and sensors to make real-time decisions without cloud connectivity – supporting faster battlefield responses and cyber resilience. Civil uses include health wearables, predictive maintenance in industry, traffic optimisation and precision agriculture. Cybersecurity is also an important field for defense that is deeply linked to AI, with AI-driven tools securing communications, detecting intrusions and executing offensive operations such as jamming and spoofing. These innovations strengthen digital resilience across sectors, from infrastructure and finance to healthcare.

Table 4: Dual-use potential of defense R&D

Technology	*Military Use*	*Civil Use*
Quantum sensing & -radar	GPS-independent navigation, stealth detection, submarine detection	Medical imaging, infrastructure monitoring, precision timing in telecom
Edge AI	Autonomous drones, real-time decision-making, swarming operations	Self-driving vehicles, agricultural robots, emergency response, smart devices
Internet of Military Things (IoMT)	Networks of sensors and weapon systems, situational awareness	Smart cities, health monitoring, logistics management, disaster detection
Directed Energy	Drone neutralization, missile defense, non-lethal crowd control	Airport security, industrial lasers, material processing
Hypersonic technology	Superfast weapons, evading air defenses, strategic strike capability	Hypersonic transport, space exploration, heat-resistant materials
Terahertz communication (6G)	Ultra-low latency communication, integrated radar/sensor systems	Immersive extended reality (XR), wireless data centers, smart infrastructure
Biotechnology & synthetic biology	Biomanufacturing in the field, CBRN detection, soldier care	mRNA vaccines, sustainable materials, precision nutrition, environmental technology
Cybersecurity & electronic warfare	Cyber-attacks, spoofing, SIGINT, disruption of enemy systems	Protection of critical infrastructure, anti-drone systems, cyber resilience
Additive manufacturing (3D printing)	Production-on-demand, field parts, lightweight structures, mobile AM labs	Aerospace, medical devices, construction, decentralized production
Nanotechnology & advanced materials	Lightweight armor, stealth, nano sensors, self-healing coatings	Health, energy, sustainable coatings, electronics, smart materials
Energy management & advanced batteries	Energy for DEW and portable systems, field generation, electric vehicles	Electric mobility, grid storage, disaster management, energy for remote areas
Space technology & satellite infrastructure	SATCOM, ISR, navigation (PNT), space awareness, tactical coordination	Earth observation, satellite broadband, navigation, commercial spaceflight
Neurotechnology & Human-Machine interface (HMI)	Brain-computer interfaces, cognitive monitoring, tactical interaction	Neuroprosthetics, contactless control, gaming/XR, mental health monitoring

Hypersonic technologies is also an important field in defense R&D. Capable of speeds exceeding Mach 5, hypersonic systems offer rapid strike capabilities and advanced interception tools in defense. On the civilian side, their development opens the door to ultra-fast passenger travel, rapid cargo transport, and more efficient satellite launches. Moreover, the extreme thermal and aerodynamic demands of hypersonic systems are driving breakthroughs in heat-resistant materials and propulsion systems – advancements that benefit commercial aviation and space exploration alike.

Beyond these highlighted areas, defense R&D is advancing numerous other technologies with high civil potential. For instance, nanotechnology and advanced materials are enabling breakthroughs in both military and civilian contexts – from lightweight armor and radar-absorbing coatings to targeted drug delivery and self-repairing infrastructure. Similarly, Directed Energy systems, which rely on high-powered lasers and microwave beams, are capable of disabling drones, missiles and other threats with speed and precision, but may also be translated to laser surgery and advanced manufacturing. Directed Energy systems are also driving innovation in high-capacity energy storage – yielding advances in battery technology that benefit electric vehicles, smart grids, and portable power solutions. Other promising fields include terahertz communication for ultra-fast wireless data, biotechnology and synthetic biology for healthcare and sustainable materials, additive manufacturing for localized production, and neurotechnology for enhanced human-machine interaction. All in all, defense R&D remains a powerful engine of innovation with far-reaching civil benefits. From AI and energy to aerospace and biomedicine, the dual-use potential is vast. As illustrated by some of the examples, the innovations emerging from defense research are not isolated to the battlefield – they increasingly shape the tools, systems, and infrastructure that underpin modern society.

Conclusions

Europe's renewed focus on defense spending represents a critical inflection point – not only for its security posture but also for its economic trajectory. In this report, we demonstrate that the effectiveness of such an investment drive hinges not just on the size of the fiscal impulse alone, but even more so on the quality of its design and execution.

When implemented in accordance with the seven identified success conditions – ranging from macroeconomic timing and financing strategy to industrial anchoring and delivery safeguards – the defense impulse can serve as a catalyst for long-term productivity growth, industrial resilience, and strategic autonomy. Under these conditions, the euro area could see GDP gains of up to 3.4% by 2045. This means that each additional euro of spending more than pays for itself in the long run – even after accounting for higher taxes. This analysis does not take into account the benefits of increased security, the protection of economic interests around the world and -hopefully- the avoidance of future conflict and associated destruction of life and economic assets.

However, the path to these gains is not linear. From 2030 onward, the fiscal burden of the defense impulse – primarily through higher taxes – leads to a contraction in private consumption. In poorly executed scenarios, this effect persists, while in well-executed cases, productivity-driven wage growth helps mitigate the impact. At the same time, private investment benefits from a crowding-in effect, particularly when public spending is targeted toward capital formation and innovation.

Particularly in the domain of defense R&D, the findings underscore the importance of long-term commitment. While short-term crowding-out effects are a risk, the long-term returns are substantial – provided investments are well-targeted, domestically anchored, and strategically aligned with dual-use innovation potential.

The current weakness in European industry, particularly in several big member states, may offer an opportunity to scale up defense spending in the next few years without causing significant price pressures. But we would also add that it is imperative that this is done in a coordinated fashion and with an eye for potential shortages in materials, personnel etc.

In conclusion, the defense spending impulse offers Europe a unique opportunity to simultaneously enhance its security and economic resilience. Realizing this potential will require disciplined execution, coordinated policymaking, and a sustained commitment to long-term value creation.

Annex 1: Methodological approach

Modelling additional defense spending in NiGEM

In this Annex, we translate the scenario characteristics mentioned in the description of our scenarios in the main text to NiGEM input. These modelling assumptions are summarized in Table A.1.

Table A.1: Modelling assumptions NiGEM

Scenario ->	*1: 3.5% target, executed well*	*2: 3.5% target, executed badly*	*3: 5% target, executed well*	*4: 5% target, executed badly*
Extra defense spending	From 2026 onwards: 200bn euros per year in EU	From 2026 onwards: 200bn euros per year in EU	In 2026: 200bn euros in EU. Increases gradually to 450 bn euros in 2029 and later years	In 2026: 200bn euros in EU. Increases gradually to 450 bn euros in 2029 and later years
Passthrough of spending to volumes	75%	25%	75%	25%
Allocation of impulse between consumption and investment	Both 50%	Both 50%	Both 50%	Both 50%
Additional inflationary impact	Based on output gap in 2026, proportional to size of output gap and defense spending shock	Based on output gap in 2026, proportional to size of output gap and defense spending shock	Based on output gap in 2026, proportional to size of output gap and defense spending shock	Based on output gap in 2026, proportional to size of output gap and defense spending shock
Ringfencing EU	Minimal 0.5 ppt EU GDP	Minimal 0.5 ppt EU GDP	Minimal 1.25 ppt EU GDP	Minimal 1.25 ppt EU GDP
Risk premium government bonds	0	Gradual increase to 0.5 ppt in 2029. Gradually back to base thereafter	Gradual increase to 0.5 ppt in 2029. Gradually back to base thereafter	Gradual increase to 1.0 ppt in 2029. Gradually back to base thereafter
Government budget rule	Off in 2026-2029, on in later years	Off in 2026-2029, on in later years	Off in 2026-2029, on in later years	Off in 2026-2029, on in later years
Central bank response	None	None	None	None
Productivity effects	From Euro Area productivity model	From Euro Area productivity model	From Euro Area productivity model	From Euro Area productivity model

Source: RaboResearch

We divide the additional government expenditures from the previous section into three components:

1) volume of government consumption
2) volume of government investment
3) prices of government expenditures

Within the expenditures that lead to higher volume, we assume that half is consumption and half is investment. This is a simplified assumption based on the current distribution of defense expenditures (see Figure 2).

For simplicity, we assume that in the 3.5% scenarios (1 and 2), expenditures increase sharply to the desired final level (200 billion euros extra per year), starting in 2026. In reality, the pattern may be more gradual, but this assumption has little impact on medium- to long-term results. In the 5% scenarios (3 and 4), we assume that expenditures increase by the same amount in 2026 as in the 3.5% scenarios and then rise linearly until the end of 2029 to reach the required level in those scenarios. In all four scenarios, expenditures remain permanently at the higher level.

Because we assume the extra defense spending is debt-financed until 2029, government deficits in many countries will temporarily be higher than normally allowed, resulting in higher national debt. This puts upward pressure on government bond interest rates. In scenarios 2 and 3, these increase by 0.5 percentage points, and in scenario 4 by 1.0 percentage point.

Defense R&D and productivity

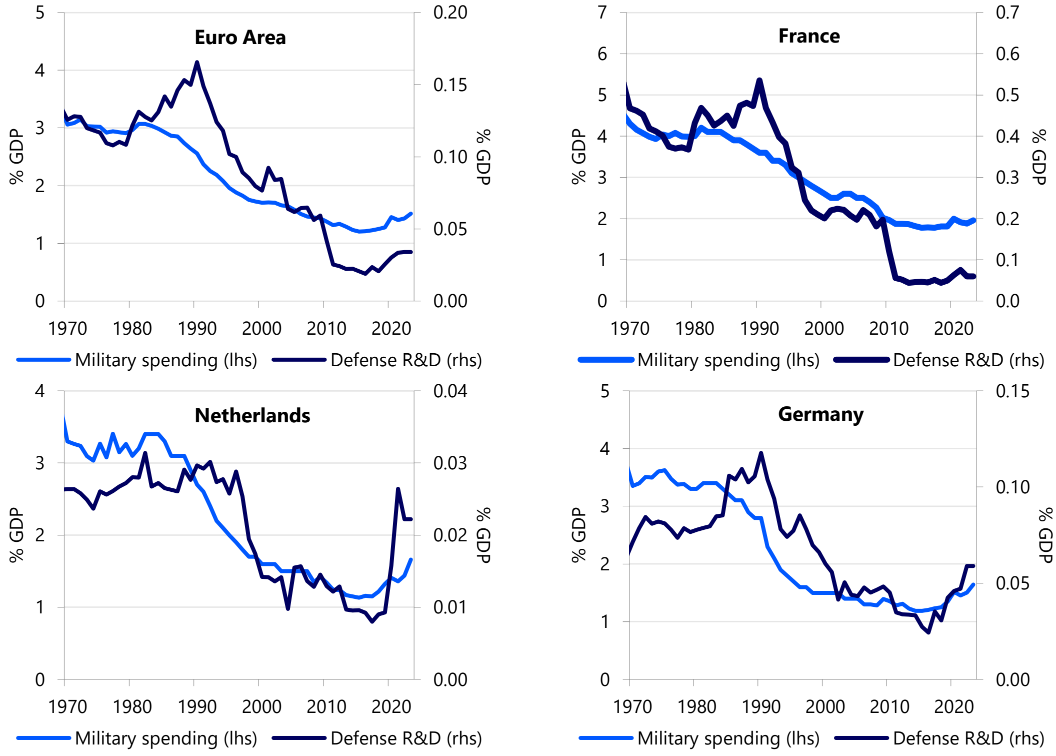
Our study distinguishes itself from the European Commission's 2025 assessment of a defense spending impulse (European Commission, 2025) by explicitly modelling the impact of defence R&D investment on productivity growth. We do this through a developed productivity model for the Eurozone, in which defence R&D capital is explicitly included as a determinant (see Annex 3 for a detailed description of the model).

Defence R&D expenditure is strongly correlated with overall defence spending (see Figure A.1). For each Eurozone member state, we use these correlations to estimate the defence R&D impulse under each of the scenarios described earlier. These national impulses are then weighted by the relative size of each economy to derive a Eurozone-wide average. However, we do not assume a one-to-one translation based on these correlations. Instead, we apply a passthrough factor to arrive at the final defense R&D impulse per scenario. As with the fiscal impulse in the NiGEM model, we assume that spending can filter through to the R&D domain either effectively or ineffectively. In the more favourable scenarios (1 and 3), we assume that 75% of the observed correlation between defence spending and defence R&D will hold. In contrast, under less efficient allocation of resources (scenarios 2 and 4), the passthrough is assumed to be 25% and 10%, respectively. In the latter case, this implies that while real defence R&D spending may increase on paper, the actual impact on productivity-enhancing defence innovation will be significantly more limited. Figure 7 presents the final defence R&D spending impulse across all four scenarios, which then serves as input for the Eurozone productivity model.

To ensure a realistic assessment of the potential impact of increased defence R&D spending on Eurozone labour productivity growth, our model incorporates several additional mechanisms. As a result, our estimates can be considered **relatively conservative** in terms of the potential effects.

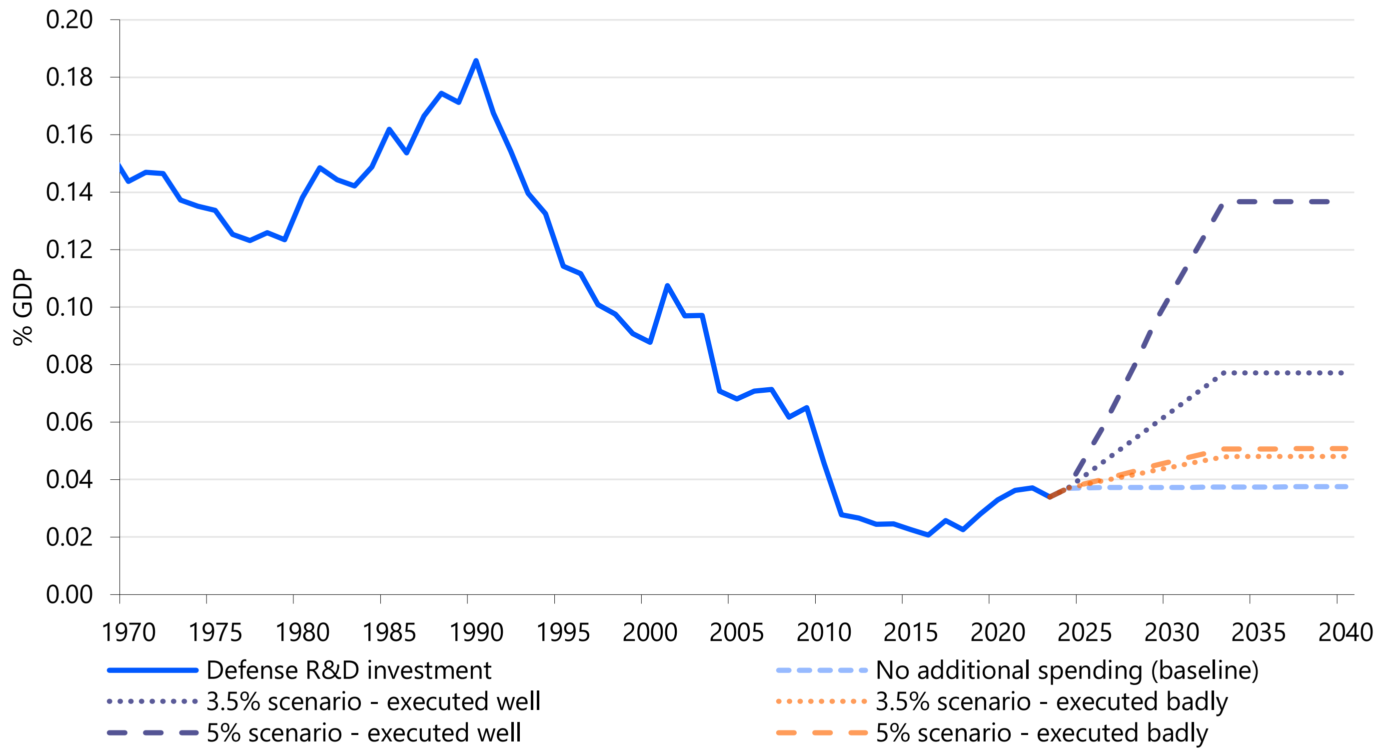
First, we assume a higher depreciation rate for defence R&D capital (25% to 30%) compared to civilian R&D capital (15%), as shown in Table 3. This assumption reflects the high-tech nature of most defence R&D, which typically involves knowledge domains where obsolescence occurs more rapidly.

Figure A.1: Correlation between defense spending and defense R&D in Eurozone is strong



Source: NATO, Macrobond, OECD, World Bank, RaboResearch 2025

Figure A.2: Defense R&D impulse per scenario



Source: NATO, Macrobond, World Bank, RaboResearch 2025

In addition, defence R&D projects are more exposed to early termination due to shifting political or strategic priorities. Procurement processes also limit the short-term commercial exploitation of defence-related knowledge, further reducing the effective lifespan of such investments. Although no study to our knowledge has directly estimated the depreciation rate of defence R&D capital, a wide range of empirical sector studies (e.g. (Bernstein & Mamuneas, 2005; Li & Hall, 2018; Huang & Diewert, 2011) point to high depreciation rates in defence-intensive sectors such as software, aerospace, semiconductors, communications hardware, electronics, and machinery.

Second, we model significant crowding out of private R&D expenditure as a result of the substantial increase in defence R&D spending. After all, technical R&D personnel, research equipment, machinery, and laboratory capacity cannot be scaled up overnight. Especially in the short term, additional defence R&D expenditure is likely to come at the expense of resources that would otherwise have been allocated to civilian R&D by firms and research institutions capable of executing defence-related projects. We therefore assume a substantial crowding-out effect: 40% in the well-executed scenarios (1 and 3), and 50% in the less effective scenarios (2 and 4).

It is important to emphasize that a recent paper by Moretti, Steinwender, and Van Reenen (2025) finds that a 10% increase in government-funded military R&D leads to a ***crowd-in effect*** of 5% to 6% in private R&D investment. This highlights that our estimates should be regarded as a conservative lower bound.

Table A.2: Modelling assumptions Euro Area productivity model

Scenario ->	***1: 3.5% target, executed well***	***2: 3.5% target, executed badly***	***3: 5% target, executed well***	***4: 5% target, executed badly***
Additional defense R&D spending Euro Area	Gradual increase up to USD 16.5bn annually (USD 14bn effectively)	Gradual increase up to USD 16.5bn annually (USD 9bn effectively)	Gradual increase up to USD 31bn annually (USD 25bn effectively)	Gradual increase up to USD 31bn annually (USD 9.3 bn effectively)
Passthrough of correlation between defense spending and defense R&D to effective defense spending investment	75%	25%	75%	10%
Depreciation rate of defense R&D capital	25%	25%	30%	30%
Depreciation rate of non-defense R&D capital	15%	15%	15%	15%
Crowding out of private R&D	40%	40%	50%	50%

Source: RaboResearch

Annex 2: Literature review

General impact of defense spending in the US

The United States is frequently the focus of studies on the economic effects of defense spending due to its exceptionally large military budget, global military presence, and the availability of comprehensive data. Its defense expenditures significantly influence both domestic economic dynamics and international geopolitical stability.

The magnitude of the multipliers found in the literature vary to a large extent (Table A.3). Blanchard and Perotti (2002) adopt a structural vector autoregression (SVAR) model for the United States and distinguish between civilian and defense government expenditures. In their analysis, the effects of defense spending are stronger than those of civilian spending, with a fiscal multiplier clearly exceeding one.

Hall (2009) and Barro and Redlick (2011) use long-run time series data to estimate the impact of defense spending on GDP, finding multipliers around 0.6. Barro and Redlick further argue that when defense spending is more structural in nature, the multiplier tends to be somewhat higher, ranging between 0.7 and 0.9. Ramy (2011) also use very long time series data for the US, but argues that using data on defense spending in VAR estimates suffers from timing (and possibly endogeneity) issues. Therefore, Ramey introduces a news-based variable that captures anticipated changes in defense spending based on military-related announcements (such as the Korean war, Vietnam war, Gulf war and Iraq War, geopolitical crises or presidential or congressional announcement). This forward-looking measure improves the timing of fiscal shocks and also helps address endogeneity concerns, as the news shocks are plausibly exogenous to current economic conditions. The study finds multipliers ranging between 0.6 to 1.1. Ben Zeev and Pappa (2017) adopt a news-based identification strategy similar to Ramey's, embedding it within a VAR framework. However, their model incorporates a broader set of control variables – including defense spending, total factor productivity (TFP), consumption, and investment – allowing for a more comprehensive analysis. They find that news about future increases in defense spending leads to persistent rises in output, hours worked, inflation, interest rates, consumption, and the stock returns of defense contractors. Notably, the estimated output multiplier is substantial, reaching 2.1.

Building on the work by Ramy (2011), Ramy en Zubairy (2018), applying the local projections methodology developed by Jordà (2005) instead of a SVAR estimation approach and arrive at an overall multiplier of approximately 0.6 to 0.8. Moreover, news about potential increases in defense spending is often anticipated by economic agents well before it is reflected in official economic statistics.

There are also studies that find significantly lower effects of military spending on the economy. Perotti (2007) shows that during the Reagan and Bush administrations, the multiplier for defense spending was around 0.5 or lower, because increases in defense spending were often offset by decreases in civilian spending. In a later study, Perotti (2014) reports even lower multipliers of 0.2 to 0.3.

Context dependence

Many of the studies discussed above pay little to no attention to context dependence of the effects, e.g. the position of the economy in the business cycle. Katz and Bettendorf (2023) argue that empirical estimates of fiscal multipliers have improved by making a clearer distinction between the effects of government spending – including defense spending – under different cyclical conditions. When an economy is in a downturn and operating below capacity, additional defense spending can stimulate economic activity without crowding out private sector activity or triggering significant inflation. In such cases, government spending enables firms to take on additional orders and helps unemployed workers find jobs in the defense sector.

Studies that differentiate the effects of defense investments across different phases of the business cycle consistently find that multipliers are significantly higher during periods of economic downturns than during normal economic conditions (see Table A.4).

Owyang, Ramey en Zubairy (2013) find no significant difference in the economic multipliers of defense news shocks across periods of high and low unemployment in the United States. However, their analysis for Canada reveals substantial variation, underscoring the fact that fiscal multipliers can differ markedly across countries and regions.

Table A.3: Multipliers of defense spending in the US

Study	*Data and country*	*Method*	*Multiplier*
Blanchard & Perotti (2002)	US: 1949-1997	SVAR	1.8-2.4 (after two years); 1.1-1.7 (after 5 years)
Hall (2009)	US: 1928-2008	OLS	0.6
Barro & Redlick (2011)	US: 1912-2006	OLS	0.6-0.7 (after two years). When defense spending is permanent: 0.7-0.9
Ramey (2011)	US: 1969-2008	Defense news variable in VAR	0.6-1.1
Ben Zeev & Pappa (2014)	US: 1947-2007	Defense news variable in VAR	2.1
Ramey & Zubairy (2018)	US: 1889-2013	Defense news variable in LP	0.6-0.8 (two to four years)
Perotti (2007)	US: 1954-2003	SVAR	Impact of civil government spending is higher than for military spending (0.5 or lower)
Perotti (2014)	US: 1947-2008	DC-SVAR	0.2-0.3

Note: SVAR stands for Structural Vector Autoregressive estimates. OLS stand for Ordinary Least Squares estimates and LP denotes Local Projections estimates.
Source: RaboResearch 2025

Table A.4: Context dependent multipliers of defense spending in US

Study	*Data and country*	*Method*	*Multiplier 'normal'*	*Multiplier downturn*	*Multiplier expansion*
Auerbach & Gorodnichenko (2012)	US: 1947-2008	SVAR	-0.2 (peak: 1.2)	-0.4 (peak: 0.8)	1.6 (peak: 3.6)
Nakamura & Steinsson (2014)	US: 1966-2006	IV-OLS	1.4-1.9	0.7-1.0	3.5-4.5
Berge, De Ridder & Pfajfar (2021)	US: 1890-2015	LP	0.8[a]-1.6[b]	0.6[a]-0.8[b]	1.9[a]-2.2[b]
Owyang, Ramey & Zubairy (2013)	US: 1890-2010 and Canada: 1921-2011	LP	US: 0.8 , Canada: 0.8	US: 0.9, Canada: 0.8	US: 0.8 , Canada: 0.8

Note: SVAR stands for Structural Vector Autoregressive estimates. OLS stand for Ordinary Least Squares estimates, IV for Instrumental Variable approach and LP denotes Local Projections estimates. Berge et al. (2021) estimate a wide range of specification. We report here: [a] baseline results in Table 4, [b] Estimation results with substantial control (variant 5 and 6) from open economy estimates in Table 6.
Source: RaboResearch 2025

Studies for other countries and regions

Most empirical studies focus primarily on the United States, given its long-standing history of defense spending and the availability of high-quality, long data series. However, there are also studies that examine the impact of defense expenditures in other countries (Table A.5). Sheremirov & Spirovska (2022), for instance, estimate the effects of defense spending for a panel of 129 countries using the methodology developed by Ramy en Zubairy (2018). They find that the fiscal multiplier of defense spending is significantly higher in advanced economies (1.9 after four years) compared to developing countries (0.6). These findings are consistent with Ilzetzki et al. (2013), who analyze general government spending multipliers more broadly across 44 countries.

Moreover, Sheremirov and Spirovska report substantial variation in the multiplier depending on the state of the business cycle: 1.4 during recessions and -0.1 during expansions. Unfortunately, the study does not provide cross-sectional estimates that would show how the multiplier in advanced economies varies across different phases of the business cycle.

A recent simulation by the European Commission (2025), using its QUEST macroeconomic model, assesses the impact of a coordinated increase in defence spending across EU Member States. The scenario assumes a gradual, debt-financed rise in defence expenditure, reaching 1.5% of GDP by 2028. Under this baseline, real GDP would be around 0.5% higher in 2028 compared to a no-policy-change scenario, with a long-term gain of 0.3%.

One key condition for achieving these gains is reducing fragmentation in Europe's defence industry. The report notes that the EU remains heavily reliant on imports – particularly from the US – for critical systems such as missile defence, aircraft engines, and drones. If a significant share of the additional spending leaks abroad, the GDP impact would shrink to just 0.3% in 2028 and a mere 0.1% in the long run.

An alternative scenario, in which a larger portion of the additional spending is channelled into R&D and military infrastructure, yields stronger results: GDP would be 0.6% higher in 2028 and 0.5% above baseline in the long term. These findings underscore the importance of strategic allocation and industrial coordination in maximising the economic returns of higher defence investment.

Table A.5: Multipliers of defense spending in other countries/regions

Study	*Data and country*	*Method*	*Effects*
Sheremirov & Spirovska (2022)	129 countries: 1988-2013	LP	Multipliers (four years cum.): advanced economies: 1.9, developing countries: 0.6. Recession: 1.6, expansion: -0.1
European Commission (2025)	EU	Simulation with QUEST model	1.5ppts higher defense results in 0.5% higher GDP in 2028 (0.3% in long run). Higher import scenario: 0.3% in 2028 (0.1% in long run). Higher R&D and infra: 0.6% in 2028 (0.5% in long run)
Kiel Institute (2025)	-	Literature review	Increasing defence spending from 2% to 3.5% of GDP could boost EU economic growth by 0.9 to 1.5%

Note: LP stands for Local Projections estimates.
Source: RaboResearch 2025

Based on a comprehensive review of the literature, the Kiel Institute (2025) suggests that increasing defence spending from 2% to 3.5% of GDP could boost EU economic growth by 0.9 to 1.5%, but under appropriate conditions. These conditions hinges on a well-calibrated funding strategy, where temporary expenditures are best financed through debt, while permanent commitments may necessitate fiscal adjustments to maintain long-term sustainability. Moreover, the long-term economic returns could be substantial, particularly through investments in 'learning to doing' and defence

R&D (to be discussed later on in this section more extensively). A sustained increase in military expenditure equivalent to 1% of GDP could raise long-term labour productivity by approximately 0.25 percentage points.

There are also some studies covering a broader set of countries that report insignificant or even negative effects of defense spending on economic growth (see Dunne & Tian, 2013; Dunne & Smith, 2020). However, these findings should be interpreted with caution, as methodological limitations may apply. For instance, several studies focus on the relationship between changes in defense investment *levels* and growth, whereas endogenous growth theory emphasizes that it is the accumulation of capital stock – not investment flows per se – that drives long-term economic growth. As such, focusing solely on investment flows might provide an incomplete picture.

Trade and the exchange rate regime

In line with Ilzetzki et al. (2013), Sheremirov & Spirovska (2022) also find that the fiscal multipliers of defense spending are significantly higher in closed economies (1.9) compared to open economies (0.4). This is largely because fiscal stimulus in closed economies is more likely to feed into domestic value chains rather than leaking abroad through imports.

Additionally, in countries with flexible exchange rate regimes, fiscal stimulus tends to lead to currency appreciation (see also Ferrera et al., 2021). This appreciation deteriorates international competitiveness and improves the terms of trade, ultimately resulting in higher imports and lower exports. In short, fiscal stimulus in small open economies with flexible exchange rates is subject to much greater leakage effects than in larger, more closed economies with less exchange rate flexibility.

Industrial base

Another important factor affecting the size of the fiscal multiplier is whether a country already possesses a domestic defense industry – or at least an industrial manufacturing base (such as an automotive or steel sector) that can readily adapt to increased demand for defense-related goods triggered by a government stimulus package. In such cases, the stimulus is more likely to generate domestic production and employment, thereby amplifying the multiplier effect. In contrast, countries lacking such industrial capacity may experience greater import leakage, reducing the overall effectiveness of the stimulus.

A recent analysis by Stamegna et al. (2024), based on input-output analyses, shows that each additional euro spent on arms procurement in Germany generates €1.2 in domestic output. In comparison, the same amount spent on healthcare or environmental protection yields €1.3 and €1.7 respectively. In Italy, the multiplier for arms procurement is significantly lower at just €0.7, due to a high share of imports that limits the domestic economic impact. Interestingly, Spain shows a slightly higher multiplier than Germany at €1.3. This is partly due to Germany's higher import share in military equipment, but also because Spain has a relatively stronger domestic supply chain for key components such as electronics, vehicles, and transport equipment – amplifying indirect effects. The key takeaway from this study is that countries with a strong domestic defence industry – such as Germany or the United States – achieve higher output multipliers from increased defence spending than countries that rely heavily on imports, such as the Netherlands or Italy.

Policy: monetary and fiscal dimensions

The monetary and fiscal policy response plays a crucial role in the effect of a defense spending impulse. If the impulse is implemented appropriately – taking into account the economic cycle and coordinated across countries – but is immediately offset by interest rate hikes from monetary authorities aiming to curb potential inflationary pressures, the multiplier effect of the stimulus will be significantly reduced. In contrast, a neutral or even accommodative monetary stance can amplify the impact. Cloyne, Jordà, and Taylor (2021) show that, for government spending more broadly, the fiscal multiplier can range from 0 to 2, depending on the extent to which monetary policy offsets the fiscal impulse.

As emphasized by both the European Commission (2025) and the Kiel Institute (2025), the design of the defence spending impulse is critical. Similar to monetary policy, an immediate increase in taxes to finance the stimulus can more than offset its positive effects. Both institutions therefore recommend financing the short-term defence spending impulse through debt issuance, while ensuring medium- to long-term sustainability through fiscal adjustments.
Distinction by spending component

Beyond the broader economic and policy context in which a surge in military expenditure occurs, the specific nature of defence spending is equally critical in determining its macroeconomic effects. Both the type and timing of expenditures matter significantly.

Short-term consumptive defence spending

Short-term consumptive defence spending – such as hiring additional soldiers and civilian defence personnel, raising salaries, or increasing purchases of ammunition and fuel – can provide a temporary boost to economic activity, assuming fiscal space is available. These expenditures tend to have a strong local impact, particularly through personnel-related spending, as wages are typically spent within the domestic economy. However, such spending does not generate lasting value in terms of enhanced productive capacity or knowledge accumulation. As a result, the multiplier effect of consumptive defence spending is limited. Moreover, in economies operating near full employment and capacity, such spending is unlikely to yield net economic growth, as it primarily reallocates existing labour rather than creating new employment.

Investment in defense capital goods

Capital investments in defence – such as weapons systems, vehicles, real estate, and infrastructure – often have limited direct utility for the broader civilian economy. For example, a tank has few applications outside the military domain. Nevertheless, these investments can stimulate additional activity in the civilian sector, particularly when domestic suppliers are involved. This includes industries such as electronics, metals, and chemicals that contribute components to military capital goods. In larger, more closed economies, such investments tend to generate higher multipliers than in smaller, open economies like the Netherlands or Belgium, where a significant share of procurement is sourced internationally. It is also important to note that the returns on capital investment in defence – particularly in terms of productivity gains – are typically realised over a much longer horizon than those from consumptive spending.

Unfortunately, we have not encountered studies that further disaggregate the economic effects of defence spending into consumptive expenditures and capital investments. However, there is a broader body of literature that distinguishes between the fiscal multipliers of public consumption and public investment (see Table A.6). Boehm (2020), using a panel of 17 OECD countries, finds that public consumption exhibits a significantly stronger multiplier than public investment. This finding is supported by the argument that public investment may crowd out private investment. The result is somewhat counterintuitive, particularly as the study also finds that investment multipliers are lower during periods of high economic slack than during periods of low slack – contrary to conventional Keynesian expectations.

Two studies that clearly demonstrate that investments have a higher multiplier than government consumption are Auerbach & Gorodnichenko (2012) and Haug & Zsnajderska (2024). Especially during periods of economic downturn, the investment multiplier can be significantly greater than one.

R&D

The relationship between defense R&D and productivity has long been debated in the academic literature. While the productivity-enhancing effects of general R&D are well established – driven by non-rivalrous and non-excludable knowledge spillovers – evidence on defense R&D remains more fragmented. Early studies (e.g., Lichtenberg, 1992; Guellec & Van Pottelsberghe, 2004) often found no or even negative effects, citing concerns about crowding out private

R&D, limited spillovers due to procurement restrictions, and the reallocation of scientific talent away from civilian innovation.

More recent work, however, paints a more nuanced picture. Notably, Moretti, Steinwender, and Van Reenen (2025) find that defense R&D can "crowd in" private investment, particularly when governments absorb high fixed costs associated with fundamental research. Moreover, their industry-level panel analysis across 26 OECD countries shows that a 1 percentage point increase in defense R&D (as a share of value added) raises total factor productivity (TFP) by 0.08 percentage points.

Building on this, Erken, Every and Remmen (2025) provides new long-run evidence using cointegration panel techniques across 19 OECD countries over the period 1981–2022. Using cointegration panel techniques they find that a joint 1% increase in defense R&D spending increases productivity by 0.06% to 0.1%. While smaller than the effect of non-defense R&D (0.04% to 0.07%), the relative return on investment is significantly higher: each dollar invested in defense R&D yields an estimated $8.1 to $9.4 in productivity gains, compared to $1.5 to $1.7 for non-defense R&D.

Table A.6: Multipliers of government consumption and government investment

Study	*Data and country*	*Method*	*Multiplier 'normal'*	*Multiplier downturn*	*Multiplier expansion*
Auerbach & Gorodnichenko (2012)	US: 1947-2008	SVAR	Consumption: 1.2 Investment: 2.4	Consumption: -0.3 Investment: 2.3	Consumption: 1.5 Investment: 3.4
Boehm (2020)	Panel for 17 OECD countries: 2003-2016	SVAR	Consumption: 0.8 Investment: 0	Consumption: 0.7 Investment: 0.1	Consumption: 1.3 Investment: -0.8
Haug & Zsnajderska (2024)	US: 1947-2022	LP	-	Consumption: 0.4 (peak), 0.1 (long run) Investment: 1.2 (peak), 0.3 (long run)	Consumption: 0.2 (peak), -1.0 (long run) Investment: 2.0 (peak), 0.9 (long run)

Note: LP stands for Local Projections estimates. SVAR stands for Structural Vector Autoregressive estimates.
Source: RaboResearch 2025

Annex 3: Models

Macroeconometric model NiGEM

NiGEM includes individual models for most advanced economies. The remaining countries are grouped into regional models, such as those for Africa and the Middle East. This structure ensures that the model covers the entire global economy. Countries are interconnected through trade relationships and financial markets.

For most large developed countries, NiGEM provides detailed country models. These models offer a comprehensive breakdown of GDP components, including government consumption and investment, each of which feeds differently into the broader model. They also include data on capital stocks, both private and public. As a result, the policy shocks described in this report can be applied directly to these countries.

In contrast, models for smaller economies provide a more aggregated view of GDP, typically distinguishing only between domestic demand, exports, and imports. These models do not differentiate between government consumption and investment, nor do they include capital stock data. However, since these smaller models represent only a minor share of total EU and euro area GDP, their impact on aggregate results is limited.

By default, NiGEM applies a fiscal rule to maintain sustainable public finances. When government spending increases, the model gradually raises household income tax rates to return deficits to baseline levels. In our analysis, we have disabled this mechanism for the period 2026-2029. From 2030 onward, the rule is reactivated, but the tax burden is distributed across multiple tax types rather than relying solely on income tax.

Despite its strengths, NiGEM has several limitations. First, the model is almost entirely linear, meaning that the effects of shocks are largely independent of the economy's initial conditions. This can lead to overly optimistic results for countries with a positive output gap. To address this, we introduce additional shocks to consumer price inflation, calibrated to the size of the output gap and the magnitude of the initial shock. Second, government bond yields in NiGEM do not respond adequately to worsening fiscal positions. To compensate, we apply additional shocks to bond yields. Third, total factor productivity (TFP) in NiGEM does not respond to increased investment in research and development. As a result, the model underestimates the long-term benefits of such investments. To capture these effects, we use a separate productivity model for the euro area.

European productivity model with defense R&D

To map the productivity impact of additional defense R&D investment, we have developed a productivity model for the European economy. As our starting point we use an extended version of the constant elasticity of substitution (CES) production function of Mankiw, Romer en Weil (1992), for country $i = 1,\dots,N$ at time t:

$$Y_{i,t} = A_{i,t}\left[\alpha K_{i,t}^{\frac{\sigma-1}{\sigma}} + \beta H_{i,t}^{\frac{\sigma-1}{\sigma}} + \gamma RD_{i,t}^{\frac{\sigma-1}{\sigma}} + \delta RC_{i,t}^{\frac{\sigma-1}{\sigma}} + (1-\sigma-\beta-\gamma-\delta) L_{i,t}^{\frac{\sigma-1}{\sigma}}\right]^{\frac{\sigma}{\sigma-1}} \qquad (1)$$

Where:

- Y: is real output
- A: total factor productivity (TFP)
- K: capital stock
- HC: is human capital
- RD: defense R&D capital
- RC: civilian R&D capital
- L: effective labor (total hours worked)
- σ: substitution elasticity
- α, β, γ, δ: share of production factor in total output

This can be rewritten to:

$$\ln A_{i,t} = \ln Y_{i,t} - \frac{\sigma - 1}{\sigma} \ln \left[\alpha K_{i,t}^{\frac{\sigma-1}{\sigma}} + \beta H_{i,t}^{\frac{\sigma-1}{\sigma}} + \gamma RD_{i,t}^{\frac{\sigma-1}{\sigma}} + \delta RC_{i,t}^{\frac{\sigma-1}{\sigma}} + (1 - \sigma - \beta - \gamma - \delta) L_{i,t}^{\frac{\sigma-1}{\sigma}} \right] \quad (2)$$

Linearizing around the steady state (σ→1), we get:

$$\ln(A_{i,t}) = \ln(Y_{i,t}) - \alpha \ln(K_{i,t}) + \beta \ln(H_{i,t}) + \gamma(RD_{i,t}) + \delta(RC_{i,t}) - (1 - \alpha - \beta - \gamma - \delta) \ln(L_{i,t}) \quad (3)$$

Taking first differences and dividing by labor input (hours worked) we get:

$$\Delta\ln(A_{i,t}) = \Delta\ln\left(\frac{Y_{i,t}}{L_{i,t}}\right) - \alpha\Delta\ln\left(\frac{K_{i,t}}{L_{i,t}}\right) - \beta\Delta\ln\left(\frac{H_{i,t}}{L_{i,t}}\right) - \gamma\Delta\ln\left(\frac{RD_{i,t}}{L_{i,t}}\right) - \delta\ln\left(\frac{RC_{i,t}}{L_{i,t}}\right) \quad (4)$$

Equation (4) can be used as a basis for our econometric model, where *TFP* is explained by changes in input intensities and a set of control variables:

$$\Delta\ln(TFP_{i,t}) = \alpha + \beta_1\Delta\ln(H_{i,t}) + \beta_2\Delta\ln(RD_{i,t}) + \beta_3\Delta\ln(RC_{i,t}) + \boldsymbol{\theta}'\Delta\mathbf{Z}_{i,t} + \varepsilon_{i,t} \quad (5)$$

Where:

- $\Delta\ln(TFP)$: growth in residual productivity per hour
- $\Delta\ln(HC)$: growth in human capital
- $\Delta\ln(RD)$: growth in R&D capital
- $\Delta\ln(RC)$: growth in civilian R&D capital

ΔZ: vector of changes in control variables: foreign defense R&D capital (*FRD*) and foreign civilian R&D capital times the import share (*imsh*), openness to trade (*O*)[3], hours worked per worker (*E*), employment rate (*P*), business cycle effects (*BC*) and crisis dummy variables (*DUM*).

Data

Data for the euro area weighted average was compiled using the same sources as in Erken, Every and Remmen (2025). The dataset covers the period from 1969 to 2023. Total factor productivity (TFP) data was derived from the Conference Board's Total Economy Database of the Conference Board, which provides long-term series on GDP, hours worked, capital services, labor force participation, population, and productivity for a broad set of countries. Data on R&D is taken from the OECD Main Science & technology Indicators (MSTI). Defense R&D data is derived from government R&D budget allocations by socio-economic objective, which include areas such as defense, energy, health, and education. The defense share within total R&D outlays is applied to overall government R&D spending (in constant USD PPP). For all details see Erken, Every and Remmen (2025). Human capital data was taken from the Penn World Tables 10.1. Trade data was gather from the World Bank.

Estimation results

Table A.7 shows the estimation results of equation (5) using OLS estimations. The applied lags per variable are also shown. The estimation in column (1) shows statistically significant effects for nearly all variables with the expected signs, except for foreign defense R&D capital and economic openness. In column (2), we exclude foreign defense R&D

[3] To measure economic openness, we first use the trade-to-GDP ratio as an indicator (see Bassanini et al., 2001). As a second step, we adjust export data for country size using the estimates by Donselaar (2011). Smaller economies are, by definition, more exposed to international trade, regardless of their trade policy or competitiveness.

capital, which increases the coefficient of domestic civil R&D, suggesting that it also captures part of the effect of foreign R&D capital. Measuring international spillovers accurately in a single dynamic model with limited observations is inherently difficult. Nonetheless, such spillovers are likely relevant for productivity growth – especially given that the US accounts for the majority of global defense knowledge development. A more suitable approach to capture these effects would be through alternative estimation techniques, such as the international cointegration panel estimates by Erken, Every, and Remmen (2025).

Table A.7: Estimation results

Independent variables		Dependent variable: $\Delta\ln(TFP)$ (1)	(2)
c	Constant	-1.55** (2.95)	-1.66** (3.03)
$\Delta\ln(H_{t-2})$	Human capital	1.10** (3.56)	0.88** (3.30)
$\Delta\ln(SD_{t-10})$	Defense R&D capital	0.03** (2.56)	0.03** (2.56)
$\Delta\ln(SC_{t-5})$	Civilian R&D capital	0.24** (2.51)	0.33** (4.96)
$imsh_{t-2} \cdot \ln(FSD_{t-3})$	Foreign defense R&D capital, trade-weighted	0.04 (0.39)	-
$imsh_{t-1} \cdot \ln(FSC_{t-3})$	Foreign civilian R&D capital, trade-weighted	1.10** (2.45)	1.01** (2.96)
$\Delta\ln(P)$	Employment as share of total population	-0.41** (-4.81)	-0.35** (-4.32)
$\Delta\ln(E)$	Hours worked per worker	-0.08** (-2.41)	-0.10** (-5.84)
$\Delta\ln(BC)$	Business cycle variable	0.87** (15.36)	0.83** (15.91)
$\Delta\ln(O)$	Openness of the economy	0.01 (1.31)	0.01 (1.61)
	Dummy for GFC	-1.87** (10.79)	-1.91** (4.63)
	Adj. R^2	0.82	0.84
	Observations	44	44
	Period	1980-2023	1980-2023

Source: RaboResearch 2025

The primary aim of this model in this study, however, is to assess the impact of a domestic R&D impulse on labor productivity, which can then be incorporated into scenario analysis. The estimates indicate that domestic defense R&D has a robust effect on TFP, albeit with a substantial lag of up to ten years. This implies that investments in defense R&D take considerable time before their effects materialize in the broader economy. The lag is also longer than for civil R&D (5 years), likely due to confidentiality and procurement constraints, which delay the diffusion of new technologies into the civilian domain where they can benefit a wider range of firms and institutions.

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