dfir brief
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Research and Innovation is an Investment, Not an Expense

Research and innovation (R&I) contribute to long-term GDP growth.[1] Yet, the long-term socio-economic effects of public R&I investments are not included in Danish macroeconomic models. In the United Kingdom, the United States and the EU, macroeconomic estimates indicate long-term returns of between 8:1 and 12:1. These figures do not include public productivity gains, health and climate benefits, the value of public enlightenment, etc. From DFIR's perspective, efforts should be made to incorporate the dynamic effects of public R&I investments into Danish macroeconomic models. This can inform the approach to public R&I investments and political decision-making.

Why should the public sector invest in R&I?
Calculating the societal returns to investments in R&I is difficult. It can take years before the benefits materialise, the pathways to value creation can be complex, and they may emerge far from the original source of funding.[2] At the same time, new ideas often build on earlier technological advances, while their realisation renders outdated technologies obsolete and erodes the returns on previous investments.[3] Public R&I investments, however, rest on a well-established economic rationale. Knowledge is a public good that generates broad societal effects, while individual R&I projects are often associated with uncertain and long-term returns. This limits private R&I investments, which are therefore lower than what is socially optimal. Public R&I investments can reduce the risks faced by private investors, contribute to foundational knowledge, and support the development of competences. This will increase prosperity and welfare in the long term.[4]

Public R&I investments may also be associated with challenges. These may include crowding-out effects, where public funding replaces rather than complements private investment; misallocation, where funds are allocated to less productive environments or lock the system into outdated technologies; or misuse, where funds are used for operations with limited innovation value. Research shows that the larger public R&I investments are, the greater the risk of negative effects and that the R&I system lacks sufficient capacity to absorb the investments. The relationship between public R&I investments as a share of GDP on the one hand and socio-economic returns on the other is thus inverted U-shaped. Investments increase returns up to a point, after which negative effects outweigh positive ones and the marginal effect declines. The research literature does not identify the optimal point. It depends on the economy's capacity to translate investments into value as well as on research and innovation policy and priorities.[4] This highlights the importance of data-driven policy design with clear objectives, systematic monitoring and evaluations.

In Denmark, the Ministry of Higher Education and Science initiated a comprehensive evaluation of public R&I investments in 2017.[4] However, a systematic follow-up on the dynamic effects of public R&I investments in Danish macroeconomic models—used to analyse the long-term consequences of policy initiatives and public investments—remains outstanding. As a result, R&I is effectively treated as an expense in the models, which may influence political priorities.

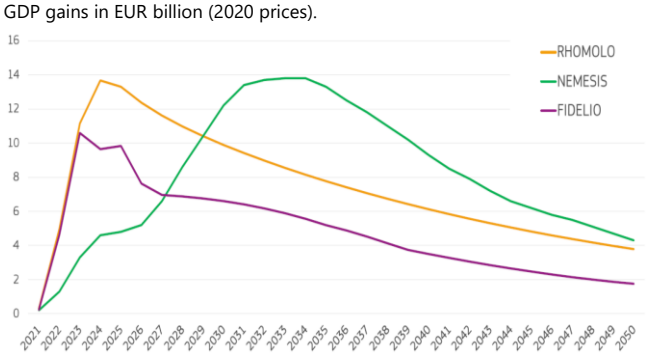
International evaluations of R&I investments
In the United Kingdom, the EU and the United States, public authorities have developed detailed macroeconomic models that make it possible to estimate economic gains. These indicate that public R&I investments are associated with substantial and long-term returns.

In the United Kingdom, the Department for Science, Innovation and Technology (DSIT) conducts portfolio and programme evaluations based on input from external experts and studies. DSIT's estimates show that public R&I investments increase private R&I investments and productivity in the private sector. DSIT assesses that the total economic return is eight pounds for every pound invested by the public sector in R&I over 60 years. DSIT does not include non-economic benefits such as the impact of health research on quality-adjusted life years or the importance of research in green technologies for climate and environment, which are assessed through specific programme evaluations.[5]

At the European Commission, the Joint Research Centre has developed models to estimate the effects of major research and innovation programmes such as Horizon Europe. Three key models are based on macroeconomic effects, regional dynamics and broader socio-economic implications. The NEMESIS model builds on endogenous growth theory and estimates how, among other things, investments in research, innovation and intangible assets affect competitiveness, productivity and employment. RHOMOLO enables analysis of regional growth patterns

and structural transformations by accounting for regional trade flows and mobility of labour and capital. FIDELIO integrates industrial policy, innovation dynamics and firm types and can illustrate how changes in one sector propagate to others through supply chains and trade flows. Based on the NEMESIS model, the JRC estimates that Horizon Europe generates growth gains corresponding to up to eleven times the investment by 2045.[6] The models' estimated annual impact on GDP is illustrated in Figure 1.

Figure 1 Estimated annual economic gains from Horizon Europe 2021–2024 over the period 2021–2050 using the RHOMOLO, NEMESIS and FIDELIO models. GDP gains in EUR billion (2020 prices).



Source: Interim evaluation of the Horizon Europe Programme, (2025)

In the United States, the Congressional Budget Office (CBO) conducts detailed projections of federal R&I investments. The latest evaluation from the CBO shows that increased public R&I investments raise the level of GDP over the coming decades while reducing the deficit in the long term—even if R&I investments are financed through borrowing. More specifically, each dollar invested in research leads to an increase in US GDP of up to 12 dollars by 2055.[7]

Effects of research in Danish macroeconomic models

For some, the international estimates of returns on public R&I investments may appear high, while others consider them too low.[8] Similarly, recent studies suggest that productivity in R&I has declined over time and that the "low-hanging fruit" with high social returns have already been harvested,[9] while others argue that productivity and returns from R&I will increase going forward with the use of AI.[10]

The estimates are subject to considerable uncertainty. This is due, among other things, to complementary R&D activities, including firms' investments in development and implementation of new services and technologies, which do not appear as R&D expenditure but are based on new knowledge, materials and technologies. In addition, Denmark is a small open economy, and Danish R&I is embedded in the international R&I system. Foreign companies build on research results produced in Denmark, just as part of Denmark's economic growth is based on foreign R&I.[4]

Overall, international estimates show that public R&I investments contribute to substantial economic and societal gains, but also that the effect depends on policy design, implementation and evaluation. There are strong arguments for public funding of R&I, but there is a need to strengthen systematic knowledge about the socio-economic effects of R&I investments.

Macroeconomic models can shape how we approach R&I investments and influence political decisions on the allocation of funding for research and innovation. Given the increased political focus on research and innovation for Danish competitiveness, strategic autonomy and security, it should be a priority going forward to incorporate the long-term productivity gains and GDP growth from public R&I investments into economic models. This could support a discussion of Denmark's R&I investments, including the rationale behind the offsetting of Danish researchers' uptake of Horizon Europe funding. As a first step, the government could prepare a background note ahead of next year's negotiations on the research reserve, estimating the impact of investments on productivity and GDP growth.

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Notes

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