2016-03 | May 2016

ISBN 978-92-79-54735-5, ISSN: 2315-3113

Competition *policy brief*

Occasional discussion papers by the Competition Directorate–General of the European Commission

How evaluation can help:
The case of financial support to business R&D&I

Introduction

Impact evaluation is a powerful tool for public authorities to understand the effects of their policies ("what works?") and to allocate scarce resources more efficiently. It should be seen as a learning opportunity that can lead to better policy design and implementation of more effective public intervention.

Since mid-2014, evaluation of a selection of significant aid schemes according to a set of substantive and procedural guidelines, including of Research & Development & Innovation (R&D&I) schemes, has been required by state aid rules[1]. The aid schemes for which an evaluation has been required until now account for approximatively €16 billion in total annual budget, which – to put it in context – corresponds to 25% of the total non-crisis aid expenditure reported by Member States for the year 2013. The evaluation reports will be available towards the end of the schemes' implementation, in 2020.

The objective of this policy brief is to show what we can learn from evaluations in the field of financial support to business R&D&I: what types of evidence can be found and policy lessons learned that can help public authorities improve the design of their support schemes.

It also provides an initial progress report on the implementation of the evaluation requirement for R&D&I aid schemes.

The EU R&D&I policy in a nutshell

The EU has set a target of investing 3% of GDP in R&D (two-thirds of which from private investment). Public policies and well-designed subsidies can be mobilised to leverage private investment where market failures exist. The Commission has launched a €80 billion programme for 2014-2020 ('Horizon 2020') to promote cross-country projects in R&D&I.

More information on the R&D&I priorities: http://ec.europa.eu/research/innovation-

Focusing on financial support for business R&D&I is justified for at least two reasons.

- Firstly, innovation is widely recognized as one of the main engines of long-term sustainable growth, and consequently support for business R&D&I investments is explicitly at the core of both EU and national growth strategies.
- Secondly, this topic has been extensively analysed in both academia and policy circles, so it is possible to draw some potentially useful lessons on the effectiveness of some types of support schemes.

[1] See Competition Policy Brief 7/2014.

KD-AK-16-003-EN-N, doi 10.2763/866680

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This policy brief cannot be exhaustive, and the "broad lessons" outlined below would require numerous specifications and caveats[2] that cannot be included here, but they are intended to whet the appetite for more and increasingly rigorous evaluations in this and other fields.

Evaluation of business R&D&I support: A selection of broad lessons

1. The fundamental question: is there an incentive effect?

Broad lessons from evaluations:

R&D&I public support can successfully induce additional business investments and activities.

However, there is also evidence of full or partial crowding-out effects.

A crucial question is whether public funding for business R&D&I activity shows an *incentive effect;* that is, whether public financial support induces *additional* activity compared to what the beneficiary would have carried out without such support.

Two main types of additional activities can be expected: input additionality (defined as the change in private R&D expenditure that can be attributed to public funding) and output additionality (the increase in firms' output as a result of public funding)[4].

Study[3]	Country/period	Input additionality
Lokshin and Mohen (2012)	Netherlands / 1996-2004	€3.24 and €1.21 (small enterprises) €0.78 and €0.428 (large enterprises)
Duguet (2010)	France / 1993-2003	€2.33
Alecke *et al.* (2012)	Germany / 2003	Subsidies increase R&D spending on average 2.4%
Colombo *et al.* (2011)	Italy / 1994-2003	Grants increased private R&D expenditure 5%

Several evaluation studies show a positive yet relatively modest impact of public funding on business R&D expenditure (see results in the table).

However, it should be stressed that even a small increase in R&D expenditure can boost firms' performance. In particular, R&D subsidies not only help to increase the probability that beneficiaries will introduce new products, but also may raise firms' productivity. This effect appears to be stronger the further firms are from the technology frontier (Sissoko, 2011).

Negative incentives may also arise. There are cases where public funding acted as a substitute for private capital, suggesting partial or total *crowding-out* effects.

Actually, a significant share of existing studies (surveyed in Alonso-Borrego *et al.* 2012) reveal that public subsidies crowd out (or substitute) private R&D investment. The effect of public subsidies on private R&D investment is characterised by an inverted U-shaped curve: additional activities are stimulated only up to a certain threshold of subsidy. Beyond that level, public support substitutes private funding.

2. What activity should be supported?

Evaluations can also help policymakers to focus on those R&D business activities that are more likely to suffer from market failure.

Broad lesson from evaluations:

Supporting basic and applied research is generally more effective than supporting activities closer to the market.

The long-standing evidence in the R&D&I evaluation literature is that subsidies used to finance closer-to-market activities tend to be less effective and distort competition more.

Basic and applied research appears to have a much greater impact (2.7 times) on total factor productivity than experimental development. At the same time, research projects appear subject to more financial constraints than those that are closer to the market (Luintel and Khan, 2011).

These results suggest that market failure is greater for far-from-the-market activities and explain why the incentive effect of R&D subsidy is stronger when the focus is on the 'R' rather than the 'D' (Czarnitzki *et al.*, 2011).

3. Which types of firms should be given financial support?

Another relevant issue for the efficient allocation of R&D&I aid is on which firms to focus, smaller or larger ones.

[2] Evaluation studies may suffer from methodological issues (e.g. proper identification of causal links) and data issues (e.g. regarding the proper measurement of outcomes), which require careful consideration before general policy conclusions can be drawn.

[3] Source: NESTA, 2012.

[4] Some studies also look at other relevant dimensions, including "behavioural" additionality.

Broad lesson from evaluations:

R&D&I support granted to larger firms is often less effective than that granted to smaller firms.

Additionality varies greatly with the size of beneficiary: generally, it is found to be substantial for smaller firms and much less significant for larger ones. This result holds both for the effects on R&D expenditure (Görg and Strobl, 2007) and for output additionality measures (e.g. patent applications in Bronzini and Piselli, 2014).

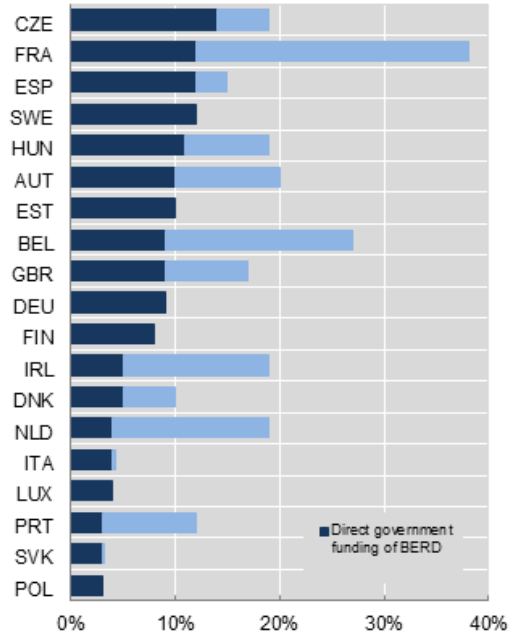
This result is likely to be related to the presence of financial constraints on small firms, which are less likely to have enough resources to fund R&D privately, or to obtain external cash flows. In addition, smaller firms may show increasing marginal returns on R&D intensity. Larger companies, however, may use subsidies to substitute private funding (to reduce internal or borrowing costs) and face flatter marginal returns on R&D intensity.

4. How should support be provided?

Direct subsidies and tax incentives:

In recent years, advanced economies have opted for two main instruments to support business R&D, namely tax incentives and direct financial support:

Direct government funding of business R&D and tax incentives for R&D as % of GDP, 2011



Source: OECD

In general, tax incentive schemes do not target a specific group of firms or projects, but all potential R&D performers. They are therefore "region or industry neutral", in the sense that they tend to produce lower allocative distortion than direct subsidies. In addition, if tax incentives are implemented on a long-term basis, they can reduce the uncertainty faced by enterprises in their financial planning.

On the other hand, direct financial support can be the right way to sustain large-scale projects and to reduce uncertainty for government budgets. In some cases, tax incentives might actually be *less* effective than project-based financial support, as they even allow firms to deduct tax payments for R&D activities that would be carried out anyway.

Small and new firms are important players in radical innovation – and some tax incentives targeting SMEs appear to be effective (Dechezleprêtre *et al.*, 2016) – yet tax incentives may mainly support large multinational enterprises and thus prove particularly distortive and give rise to rent-seeking behaviour (OECD, 2013).

Broad lessons from evaluations:

Both direct support and tax incentives can be effective in boosting business R&D&I activities.

Tax incentives may raise specific concerns and their effectiveness is linked with several elements such as their stability and time horizon and their design.

Features of tax incentives:

The effectiveness of R&D tax incentives appears to depend on the policy's stability and time horizon. When R&D tax policy changes frequently, the impact of the tax incentives appears to be lower (Westmore, 2013). Indeed, responses to R&D tax credits may initially be small, but tend to increase over time (Hall and Van Reenen, 2000).

The specific design of the tax incentives should also be carefully considered. Those that are refundable and contain carry-over provisions are likely to be more effective and better meet the needs of young firms. Effects of multinationals' cross-border tax planning strategies should also be looked at (Andrews and Criscuolo, 2013).

State aid evaluation for R&D&I schemes: Initial experience

Nine evaluation plans for large R&D&I aid schemes in six Member States[5] have been approved so far by the Commission, accounting for about €5.5 billion in total annual budget. The evaluations will be conducted by independent bodies having the appropriate skills, and the results will be made public.

The evaluations will first address the crucial dimension of the aid's incentive effect, which typically will be assessed by looking

[5] Cases SA.40324, SA.40391, SA.40098, SA.40761, SA.40266, SA.41471, SA.41386, SA.41884, SA.42799.

at three main dimensions of additionality: input additionality, output additionality, and behavioural additionality.

"Conditional differences-in-differences" is the main method that will be used to estimate the direct impact of the aid. This approach combines statistical matching techniques (i.e. identification of a sample of non-assisted firms that are as close as possible to the assisted ones, given a set of observable characteristics such as the firms' size, sector, productivity level, etc.) and differences-in-differences, which compares the changes in differences (i.e. subtracting pre-existing differences that may reflect unobservable characteristics) of the group of beneficiaries with the sample of non-assisted ones for a given outcome indicator.

In a couple of instances, the aid allocation mechanism will be used to allow for a different (and potentially even more rigorous) type of comparison: that between the beneficiaries and firms that applied for the aid but did not quite reach the necessary score to be successful.

The evaluation of indirect impacts of these schemes will generally be quite detailed, with a look at potential distortive effects such as biases by sector or by company age, or at adverse effects on competition in the main affected markets.

Conclusions

Public support to business R&D&I is a striking example of the benefits of impact evaluation. In this crucial and complex area, evaluations conducted with robust methodologies are able to provide solid evidence and useful lessons on the activities that should be subsidised, the beneficiaries that should be targeted, and the most appropriate instruments to generate a genuine incentive effect and minimise undesirable market distortions.

But while our knowledge has increased, more evidence will be needed on several aspects. For example, the broader impact on competition (direct and indirect) of such support schemes has rarely been evaluated in a specific manner. Here evaluation of state aid schemes is likely to play a useful role.

Also, a large share of the existing studies does not appear to meet the appropriate methodological standards (What Works Centre, 2015) and further steps should be made to apply the most advanced methods, both experimental and quasi-experimental ones[6], to the evaluation of these schemes.

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[6] Such as those described in the Commission Staff Working Document "Common methodology for State aid evaluation" – SWD(2014)179.