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# Evaluation of the Norwegian R&D tax credit scheme

**Abstract:**
We find that the Norwegian R&D tax credit scheme introduced in 2002 mainly works as intended. The scheme is cost-effective and it is used by a large number of firms. It stimulates these firms to invest more in R&D, and, in particular, the effect is positive for small firms with little R&D experience. The returns on the R&D investments supported by the scheme are positive and generally not different from the returns to other R&D investments. We have found examples of what can be interpreted as tax motivated adjustments to the scheme, but to some extent this must be accepted as a cost to subsidy and support schemes intended for use by a large number of economic agents. This is particularly so when attempts are made to keep administrative expenditures and control routines at a low level.

**Keywords:** R&D tax credit, R&D subsidies, Innovation policy, Norway

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# 1. Introduction[1]

Policies to stimulate innovation and economic growth are high on the agenda in all OECD countries. A strong link between investments in research and economic growth is often taken for granted, and many countries have explicit and ambitious goals regarding the economy's R&D intensity. Setting such goals suggests there is a role for government intervention, and that there are many potential market failures in the market for research and development. In theory, these could lead to overinvestment as well as underinvestment, but based on empirical research there is a fairly broad consensus that a free market underinvests in R&D.[2] For this reason OECD countries use large sums on R&D subsidies, and innovation policy receives considerable attention in the public debate. However, there is no strong consensus regarding the effectiveness of such policies.

R&D subsidies can be given as R&D tax credits or as direct grants.[3] Tax incentives have become an increasingly popular policy tool over the last decades, and more than 20 countries now use the tax system in order to increase R&D in industry. Norway has been the first Nordic country to introduce R&D tax credits.[4] When the Norwegian Parliament approved the R&D tax credit scheme, it also decided that the scheme should be evaluated during its first five years of operation. Our research group in Statistics Norway was responsible for most of the evaluation, including the final report and the assessments made therein. In this paper we briefly discuss the main findings of the evaluation. [5]

## 1.1. The introduction of an R&D tax credit Scheme in Norway

The introduction of an R&D tax credit in Norway was proposed by the Hervik Commission in a green paper for the Ministry of Trade and Industry in 2000 (NOU 2000:7). The commission was appointed to suggest policy measures aimed at encouraging industry to invest more in R&D. The Norwegian Parliament had earlier in 2000 agreed to make increased R&D investments a national priority, and decided that R&D relative to GDP should at least reach the OECD average by 2005. This illustrates a general point. Generous R&D tax credit schemes are often introduced in countries where R&D

[1] This paper is an English summary of the main evaluation report "Evaluering av SkatteFUNN", Reports 2008/2, Statistics Norway, Oslo. The Research department of Statistics Norway was responsible for the evaluation, and the project was financed by the Research Council of Norway.

[2] See e.g. Griliches (2000) for a broad survey and Wieser (2005) for a recent meta-analysis.

[3] See Hall and van Reenen (2000), David, Hall and Toole (2000), Garcia-Quevedo (2004), Mohnen and Lokshin (2009) and Ientile and Mairesse (2009) for useful surveys of the literature on R&D subsidies. See also Bloom, Griffith and van Reenen (2002) for an authoritative empirical analysis of R&D tax credits.

[4] See Møen (2007) for a discussion of the *pros et cons* of introducing an R&D tax credit scheme in a small open economy.

investments are low by international standards, and where the sentiment is that "something needs to be done".

The Hervik commission suggested using an R&D tax credit as one of several policy tools to stimulate R&D investments. They argued that the proposed R&D tax credit would be administratively simpler and more robust to informational problems than direct R&D grants. It was intended to be the main policy tool towards small and medium sized firms (SMEs). In the commission's opinion, the Research Council of Norway should focus on R&D of strategic importance, and spend their resources initiating and evaluating large projects. It also argued that an R&D tax credit scheme would provide more stable conditions for the business community than direct grants. The total subsidy would not be subject to annual budget debates, and the detailed regulations would be embedded in the general tax code. Of course, the specifics of the scheme, such as deduction rates and rules on eligibility etc. could change over time, but it was a widely held view that it would be less vulnerable to discretionary budget policy than direct R&D grants.

In connection with the Norwegian Parliament's processing of the revised national budget of 2001, the government was asked by a parliament majority to submit a proposal for a tax relief scheme for firms' R&D expenses. The scheme was presented in connection with the national budget for 2002, passed by the Parliament in December 2001 and brought into force for the fiscal year 2002. The scheme is codified in § 16-40 of the Norwegian Taxation Act.

## 1.2. The details of the scheme[6]

The Norwegian R&D tax credit scheme, "Skattefunn", implies that a certain percentage of a firm's R&D expenditures is deductible against taxes. The deduction is subject to specific criteria. A firm must meet the relevant terms and have its project plan approved by the Skattefunn secretariat which is part of the Research Council of Norway. Another government agency, Innovation Norway, is helping firms through the application process and makes a first assessment of whether the projects qualify for support or not. The actual R&D expenditures have to be approved by the tax authorities, who mainly base their judgement on a statement from the applicant's auditor.

Originally, only SMEs were eligible. An SME was defined as a firm fulfilling two of the following three criteria: (i) Fewer than 100 employees (ii) an annual turnover of less than NOK 80 million –

[5] In total, 17 reports were produced as part of the evaluation project. The reports are available at the project's website www.ssb.no/skattefunn. Some of these reports are written in English.

[6] The following description borrows from OECD (2007, p. 112), Cappelen, Raknerud and Rybalka (2007b, Appendix A) and http://web.skattefunn.no/index.php?kat=English.

about EUR ten million (iii) an annual balance sheet total of less than NOK 40 million – about EUR five million.

Already in 2003 large enterprises were included as well. Large enterprises may deduct 18 percent of expenses related to an approved R&D project from taxes owed. A 20 percent deduction is possible if the following conditions for being a "small enterprise" are fulfilled: (i) Fewer than 250 employees, (ii) an annual turnover not exceeding EUR40 million or an annual balance sheet total not exceeding EUR 27 million and (iii) less than 25 per cent of the company is owned by a large enterprise. This distinction between large and small enterprises follows EU/EEA state aid rules.[7] The maximum basis for deduction was at the outset NOK 4 million per year (about EUR 500 000) for R&D projects conducted by the enterprise itself. Stimulating cooperation between academia and commerce is considered an important objective of the scheme. For this reason, a firm could purchase R&D services from universities and R&D institutes for another NOK 4 million under the scheme. If the firm did not conduct in-house R&D, it could purchase R&D services for a total of NOK 8 million. This cap was the maximum sum from which a tax deduction could be calculated. In 2009, the caps were increased to NOK 5.5 and 11 million, respectively.

In order to qualify for the tax credit, the R&D activity must come under the definition of R&D as stipulated in the scheme. This definition is very similar to that given in the Frascati manual. The project must be limited and focused, and it must be aimed at generating new knowledge, information or experience which is presumed to be of use for the enterprise in developing new or improved products, services or manufacturing/processing methods. Standard product development with no research component is not covered by the scheme.

There are no constraints or extra incentives in the scheme based on industry or region. Enterprises that are not currently liable to taxation are also eligible. If the tax credit exceeds the tax payable by the firm, the difference is paid to the firm in the form of a negative tax or a grant. If the firm is not in a tax position at all, the whole amount of the tax credit is paid to the firm as a grant. In practice this has turned out to be a very important feature of the scheme. Around three-quarters of the total support given through the scheme is paid out as grants. The payment is made when the tax authorities have completed their tax assessment, and takes place the year after the actual R&D expenses have occurred. The R&D tax credit is thus neutral with regard to qualifying projects, regions, industries and the tax position of the qualifying firms, but lowers the marginal cost of low R&D spenders and is slightly

[7] EEA is the European Economic Area of which Norway is a part. Norway is not a member of the EU.

more generous to small firms than to large firms. For firms that would have spent more on R&D than the maximum amount in the scheme even without the presence of the tax credit, the scheme gives little or no incentive on the margin to increase R&D investments, although they have a clear incentive to qualify for the scheme and receive the tax deduction.[8]

## 1.3. Applications, R&D expenses and tax deductions

The total maximum tax deduction for a small establishment was at the outset NOK 1.6 million per year (20 % of 8 million). For large establishments included in the scheme in 2003, it was NOK 1.44 million (18 % of 8 million).[9] However, the average tax deduction per tax credit project has been much lower than this. Table 1 below shows the development in the number of applications, budgeted and actual R&D expenses, as well tax deductions in the years 2002-2009. Figures for R&D are based on data from the Research Council of Norway and tax data from the Directorate of Taxes.

**Table 1: Applications, R&D expenses and tax deductions**

| | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|---|---|---|
| *Number of applications by year of submission* | | | | | | | | |
| Total number of applications | 3287 | 4739 | 4225 | 3176 | 2624 | 2104 | 2071 | 2121 |
| Applications approved | 2798 | 3532 | 2762 | 2177 | 1801 | 1530 | 1549 | 1596 |
| Applications rejected | 397 | 974 | 1160 | 699 | 543 | 574 | 522 | 525 |
| Percentage approved (incl. withdrawn applications) | 85 | 75 | 65 | 69 | 70 | 73 | 75 | 75 |
| | | | | | | | | |
| *Active projects, budgeted and actual R&D costs, NOK mill.* | | | | | | | | |
| Number of active projects | 2798 | 5571 | 6079 | 5137 | 4055 | 3735 | 3527 | 3560 |
| Total budgeted R&D costs (approved projects, figures from NFR) | 4526 | 9032 | 9643 | 9003 | 8457 | 7500 | 8300 | 9300 |
| Total actual R&D expenses approved by auditor (figures from SKD) | 4098 | 7543 | 8189 | 7412 | 6889 | 5900 | 6300 | *n.a* |
| | | | | | | | | |
| Total tax reduction | 690 | 1274 | 1388 | 1220 | 1126 | 952 | 1004 | *n.a* |
| Of which paid out as a grant | 568 | 991 | 1055 | 908 | 824 | *n.a* | *n.a* | *n.a* |
| Total corporate taxes payable for firm receiving tax deductions | 164 | 2743 | 4960 | 4055 | 4648 | *n.a* | *n.a* | *n.a* |
| | | | | | | | | |
| Actual R&D expenses in per cent of the budget | 91 | 84 | 85 | 82 | 81 | 79 | 76 | *n.a* |
| Paid deduction in per cent of total deductions | 82 | 78 | 76 | 74 | 73 | *n.a* | *n.a* | *n.a* |
| Deductions in per cent of corporate taxes payable | 42 | 46 | 28 | 30 | 24 | *n.a* | *n.a* | *n.a* |

[8] In theory, the presence of liquidity constraints or internal political processes related to the investment budget could also give firms whose R&D expenditures exceed the maximum amount of the scheme an incentive to increase their R&D investments.

[9] The maximum deductions increased by 37.5 per cent in 2009.

For the years 2002-2006, the table corresponds to Table 1.1 in Cappelen et al (2008). The table is updated with three more years using numbers from annual reports published by the Skattefunn secretariat at www.skattefunn.no. SKD is the Norwegian Directorate of Taxes. NFR is the Research Council of Norway. *n.a* means not available.

The number of applications received by the R&D tax credit secretariat has varied over time. In the first year, 2002, there were 3300 applications. When the scheme was made universal in 2003 the number increased to 4700 applications, but thereafter it has gradually fallen. In 2009 there were 2100 applications. About 25-30 percent of the applications are rejected, withdrawn or returned due to incomplete information. Some of the applications are for projects that last for several years, and the number of "active projects" under the scheme has varied between 3000 and 6000. Some firms apply for several projects simultaneously, and the average number of projects per firm is 1.5-1.6. The total R&D expenses under the scheme have been fairly stable because the average project size has increased over time. About two thirds of the R&D expenses are personnel costs, which is quite typical for R&D-projects. The actual R&D costs reported to the tax authorities tend to be about 20 percent lower than what is proposed in the original applications to the Research Council. About 85 percent of the costs applied for are accepted by the tax authorities as a basis for deduction.

In 2006, the total tax deduction was 140 million Euros. Out of this as much as 100 million Euros were paid out as a grant from the tax authorities to firms that were not in a tax position or would have paid less in taxes than their R&D tax relief. This illustrates the fact that the scheme is particularly popular with small and newly established firms. Roughly 85 percent of all approved projects are undertaken by firms with less than 50 employees. 50-60 percent of the applications are from firms with less than ten employees. These firms perform about 45 percent of the total R&D under the scheme. For all firms receiving subsidies through the R&D tax credit scheme, the average tax credit is about 1000 Euros per employee. Average corporate tax paid per employee for the same firms in absence of the subsidy would have been 2300 Euros. Hence, in these terms, the subsidy is rather substantial.[10]

The R&D tax credit scheme is used by 10-15 percent of all manufacturing firms, but only one percent of the firms in construction and most service sectors.[11] Due to a large number of firms in the service sector, however, the number of applications from service firms is somewhat larger than the number of applications from manufacturing firms. Low average R&D intensity is a general characteristic of the

[10] These numbers are based on an analysis of data for 2005.
[11] These numbers are based on an analysis of data for 2004.

service industries worldwide, and in most tax credit schemes in Europe, services are not included. The number of applications from firms in the service industries has increased over time, and in 2008, 55 % of the applications where filed by firms in a service industry.

Within the service sector, firms using the tax credit are concentrated in two industries, computing (NACE 72) and consulting (NACE 74.1-74.4). The ICT-industry in total performs 19 % of the R&D that is supported under the tax credit scheme. No other industry has a larger share. In addition a large number of projects in other industries are ICT-related. In 2009, 42 percent of all accepted applications were classified as ICT.

## 1.4. OECD Asessment and Recent changes to the scheme

OECD (2007, p. 112), describes the Norwegian R&D tax credit scheme as rather generous by international standards. The OECD's "B-index" calculations averaged about 22 percent in 2006. This is well above the OECD average and is exceeded only by Canada, the Czech Republic, Portugal, Mexico and Spain. It should be noted, however, that the calculations do not take into account caps in tax deduction schemes. For Norway, therefore, the B-index applies to a firm not constrained by the cap in the tax credit scheme. Direct government funding of private R&D in Norway was 0.11 percent of GDP in 2004. This is close to the OECD average, and well above the median. As mentioned already, the caps were increased in the fiscal year 2009.

As from the fiscal year 2007, a maximum hourly rate and a maximum number of hours per year for in-house R&D personnel were introduced. The ceiling for payroll and indirect expenses was set at NOK 500 per hour (around 60 Euro). Up to 1850 hours per year may be approved per person associated with the project. This has made the scheme slightly less generous than in previous years, in particular for firms in the ICT-industries where salaries are high.

The Norwegian Parliament decided in 2005 to include financial support to unpaid labour in R&D activities in the tax credit scheme, in order to reach high tech entrepreneurs that do not draw wages from their firms. The amendment needed approval from the EFTA Surveillance Authority (ESA). ESA did not conclude until March 2008. Support to unpaid labour was paid for the years 2002-2005, but the Norwegian government decided not to continue this type of support despite the positive ruling by ESA.

The 2007 OECD survey makes some normative comments about the scheme:

- The broadly neutral construction of the Skattefunn is a point in its favour, especially in Norway where there is a long tradition of including regional, social and sectoral goals in industrial policy. Of course, lower taxes on firms have to be compensated by higher taxes elsewhere. It is also possible that firms now claim tax credits against spending that they would not previously have classified as R&D. ... The effectiveness of the Skattefunn in stimulating additional private R&D is currently under evaluation. ... [T]here is the possibility that even if the tax credit stimulates genuine additional R&D, the tax expenditures could have been better used in other areas.

# 2. Main findings from OUR evaluation: Does the tax credit work as intended?

Statistics Norway was asked to evaluate the R&D tax credit scheme along several dimensions:

- The scheme's ability to stimulate extra R&D effort and change firms' R&D behaviour
- The scheme's effect on innovation and value creation in firms
- The scheme's user-friendliness
- The scheme's administrative costs for users, tax authorities, the Research Council and other public agencies
- The scheme's effect on R&D cooperation between firms and research institutes
- The relation between the R&D tax credit scheme and other R&D incentives
- How the Norwegian scheme compares to R&D tax credit schemes in other countries, and the experience other countries have with such schemes
- The quality of the projects supported under the scheme and the extent to which they are tax motivated (including reclassification of other costs)

Below, we summarize our main findings. The evaluation utilized data from 1993 to 2006. The evaluation project started in 2004 and concluded in January 2008.

## 2.1. Input additionality: Does The tax credit scheme lead to more R&D in firms?

Hægeland and Møen (2007a) evaluate the degree of input additionality, i.e. to what extent the scheme induces firms to invest more in R&D than they otherwise would have done. This is obviously a critical aspect when evaluating the overall efficiency of the scheme. Identifying this effect in a non-experimental setting, where access to the scheme is in principle universal, is difficult. Hægeland and Møen use a difference-in-difference regression approach in their main analysis.

Their descriptive analyses clearly show that firms that have received support through the tax credit scheme have more growth in their R&D investments than other firms. The difference-in-difference regressions show that firms that previously invested less than the 4 million in-house R&D cap have increased their R&D investments more than those previously above the cap. The latter group is used as a control group because firms that invest more than the 4 million cap are not subsidized at the margin and hence have little or no incentive to increase their R&D expenditure as a result of the R&D tax credit scheme.[12]

The estimated input additionality is mainly driven by firms that did not invest very much in R&D before the tax credit scheme was introduced. Hægeland and Møen also find that firms that previously did not invest in R&D were more likely to start doing so after the introduction of the tax credit scheme. The additionality appears to be strongest in small firms, firms in non-central areas, firms in which the employees have a relatively low level of education and firms in industries that are traditionally not research intensive. Obviously, these firms are typically small R&D performers.

The empirical results in Hægeland and Møen (2007a) are consistent with the tax credit scheme being effective in stimulating R&D investments. The main results are qualitatively the same across various data sources and model specifications. The estimates of how much extra R&D the tax credits trigger per NOK in lost tax revenue vary between 1.3 and 2.9, with 2 representing the best point estimate. This is high in comparison to other estimates in the international literature, see e.g. Ientile and Mairesse (2009), and it implies that for every Norwegian krone received by the firms in tax deduction, two kroner are spent on R&D. However, it is worth noting that the strategy used to identify the effect of the tax credit scheme is not bullet proof. The main reason for this is that the tax credit scheme is available to all firms. A causal interpretation of the results rests among other things on the assumption that small and large R&D firms (below and above the 4 million cap) are equally affected by changes in economic trends and macroeconomic framework conditions other than the tax credit scheme. In addition, the effects are estimated with considerable uncertainty.

## 2.2. Output additionality: Does the tax credit lead to increased added value and more innovations?

Cappelen, Raknerud and Rybalka (2007a) find that the tax credit scheme contributes to an increase in the rate of innovation in firms. Tax credit projects contribute to the development of new production processes and to some extent to new products for the firm. It is shown that firms that collaborate with

[12] See, however, our remark in footnote 8.

other firms are more likely to have successful innovations. However, the scheme does not appear to contribute to innovations in the form of new products for the market or firms' patenting. Cappelen, Raknerud and Rybalka (2007b) find that tax credit projects have a positive effect on productivity and productivity growth, to about the same extent as other R&D activity. There is a tendency for the return to be slightly higher for pure company-financed R&D work than for R&D carried out under the tax credit scheme. This is in line with expectations. On average, Cappelen, Raknerud and Rybalka find that business profitability increases moderately as a result of the tax credit scheme. However, the return on R&D financed under the scheme is very unevenly distributed between recipient firms, and 28 per cent of the firms have zero returns. These return estimates are based on data from the first few years after the scheme was introduced. This may imply that the estimates are somewhat on the low side. However, the R&D that the tax credit has stimulated is probably so market oriented that the results of the innovations will typically emerge shortly after the project has been completed.

External effects of R&D are difficult to estimate with any precision. Cappelen, Raknerud and Rybalka (2007c) find that the increased R&D investments that the tax credit scheme leads to, have the greatest positive effect in R&D-intensive industries and counties. This may suggest that there are positive external effects. However, the innovations that the scheme mainly stimulates – new products for the firm and not for the market – are not of such a nature that large external effects should be expected.

## 2.3. Behavioural additionality: Does the tax credit lead to changes in R&D behaviour in firms?[13]

A main finding in the input additionality analysis is that the tax credit scheme stimulates firms with no or limited previous R&D activity to initiate such activity. One might argue that this implies a change in firm behavior. However, the fact that a firm changes its *adaptation,* by responding to the introduction of the tax credit scheme, does not mean that it changes its behaviour, i.e. *the way* it responds. In order to explore this issue, Alsos et al. (2007) examine the firm's internal working methods and processes, with particular focus on the significance of entrepreneurial information and dynamic capabilities for change. A survey among firms that applied for the tax credit shows that a very high percentage of these firms have increased their focus on R&D as a result of the tax credit scheme, and that the scheme has resulted in the firms having closer contact with universities, university colleges, research institutes, customers and suppliers. Whether firms have the motivation, ability and resources to succeed with innovation, is vital to what effect public policy instruments have on R&D behaviour. The survey shows that many firms receiving the tax credit change their R&D

[13] The sub-project on behavioural additionality, was carried out by Nordland Research Institute.

behaviour, and that positive development in R&D behaviour to a large extent can be explained by internal conditions of the firms, e.g. the firms' resource base, dynamic capabilities and entrepreneurial information. Alsos et al. find that firms with limited R&D experience at the start-up of a project have changed their R&D behaviour the most. Firms with a high level of R&D activity before the start-up of an R&D tax credit project do not report a positive change in R&D behaviour. The analysis shows that these firms do not manage to increase their level of R&D activity over time.

## 2.4. Does the R&D tax credit lead to more collaboration between industry and research institutes?

One of the purposes of the tax credit scheme is to stimulate collaboration between firms and research institutes and universities. Cappelen et al. (2008, ch. 5) report that between 2002 and 2006 almost every fifth firm purchased R&D services from a research institute approved by the Research Council. Hægeland and Møen (2007a, ch. 6.4) find that the probability of initiating such an external collaboration has only increased slightly after the introduction of the tax credit scheme, and that the probability of continuing such collaboration for those who already collaborate, remains unchanged. Hægeland and Møen also find that the input additionality effect of such collaboration projects is slightly lower than for R&D activities carried out solely in-house.

Cappelen, Raknerud and Rybalka (2007a) find indications that the tax credit scheme stimulates collaboration between firms to a limited extent only. One reason is obviously that the tax credit scheme is not designed with this purpose in mind. Another reason may be that projects under the scheme lead to innovations of the type "new production processes" or "developing a new product for the firm, not for the market". It is not surprising that there are not many collaboration projects between firms carrying out innovations of this nature. However, firms that do collaborate with other firms are more likely to succeed with their innovations.

## 2.5. To what extent does the tax credit scheme affect the utilisation of other innovation policy instruments?

Hægeland and Møen (2007b) analyse the relationship between the R&D tax credit scheme and other innovation policy instruments. They find no evidence suggesting that the R&D tax credit increases the probability of receiving direct R&D grants from the Research Council of Norway in the future, but they cannot exclude the possibility of an immediate positive effect. Firms with R&D tax credit projects have an increased likelihood of receiving direct R&D grants from the Research Council in the same year. At the individual firm level, therefore, direct subsidies and the tax credit seem to be

complements. At the more aggregate level, however, the two instruments seem to be substitutes as the probability of receiving direct R&D grants fell after the introduction of the tax credit scheme.

In the years after the introduction of the tax credit scheme, firms that applied for support from the Research Council or received support from Innovation Norway in one year, were much more likely to reapply the year after as compared to the years prior to the scheme. It therefore seems that the R&D tax credit scheme has stimulated greater persistence in the use of other policy instruments. It is easy to demonstrate that firms receiving the R&D tax credit are in contact with the innovation policy system to a greater extent than other firms, but this cannot be interpreted as a causal effect. Both the Research Council of Norway and Innovation Norway require firms to apply for the R&D tax credit before other additional support is provided. However, firms that have not previously been in contact with the innovation policy system are more likely to have such contact after the R&D tax credit scheme was introduced. This suggests that the tax credit scheme has made the innovation policy system available to a new group of firms.

Hægeland and Møen (2007b, ch. 5) also analyse how the input additionality varies between different R&D policy instruments. They find that the additionality is high for both R&D tax credits and for direct R&D grants from the Research Council of Norway, while project support from ministries and the EU has lower additionality.

## 2.6. To what extent does the R&D tax credit affect the strategy of research institutes?

Cappelen et al (2008, ch. 5) report that 19 per cent of the firms receiving an R&D tax credit in 2006 had deductions for the purchase of R&D services from approved R&D institutes. Even more firms stated in questionnaires that they had formed collaborations with such institutes, and it is of course possible to collaborate without purchasing of services partly financed by the R&D tax credit scheme. The firms believed that these collaborative relations are important for the execution and success of projects. A survey of 18 approved research institutes showed that many institutes had no knowledge as to which of the projects they were involved in that were partly financed by R&D tax credits. This is not surprising since the firms receiving the R&D tax credit do not have any incentives to report this to the institutes.

The R&D tax credit scheme does not seem to have a great bearing on the research institutes in terms of research volume, nor does it seem to have affected the research institutes' behaviour to any notable degree. One institute stated that it had a tendency to increase its prices if it knew that the project was

financed through the tax credit scheme. Some institutes had mentioned the possibility of receiving the tax credit to firms that made contact regarding project collaboration, but no institute had used the fact that collaborative R&D would qualify for a tax credit actively in their marketing efforts.

## 2.7. To what extent are the supported R&D projects tax-motivated?

Money allocated through the R&D tax credit scheme should be spent on R&D, but the tax authorities must to a large extent rely on the taxpayer's own declaration when calculating the tax deduction. Fjærli (2007) reports that the majority of auditors believe that it is difficult to control whether the sums specified are actually spent on R&D. The most difficult aspect is whether the reported man-hours used are realistic. 80 per cent of the auditors perceived this to be difficult, and their perception is strengthened by Fjærli's own analysis. He reviews around 300 project accounts collected from one county for the years 2003 and 2004. The time sheets were often of poor quality and only about half were of sufficient quality to be used in the analysis. A comparison of the usable parts of these time sheets with what firms report in the R&D surveys conducted by Statistics Norway, shows that time recorded per employee in the timesheets is 50 to 100 per cent higher than expected based on the firms' characteristics. This could be an indication that the time spent on R&D in tax credit projects is overestimated in the project accounts. Some firms have extremely high tax deductions, high budgeted R&D costs measured per employee, and unreasonably high personnel costs measured in relation to the firm's actual salary costs. It is, however, difficult to obtain an accurate picture of the extent of the inflation of R&D costs. The suspicious numbers seem to be driven by the five to ten per cent of the firms with the highest values. These firms are generally small, typically having less than 10 employees.

Small firms with just one employee are often sole proprietor limited companies with an active owner. These firms are well suited to investigate tax-motivated disposals since other explanations such as the demand for expensive well-educated personnel are eliminated. Among these firms, Fjærli often finds that both the tax deduction and the budgeted R&D costs are high compared to the firm's actual salary payments. This may indicate that tax adjustments are made through the reporting of inflated man-hours in the R&D tax credit projects, or that the hourly rate of pay used does not correspond with actual salary. The salary paid is sometimes very high in these firms, however, often despite low operating profit. In similar firms with no R&D tax credit financed activities, the operating profit adjusted for own salary is higher, while the actual salary is lower. This suggests that tax adjustments sometimes are made through an increase in the calculation basis for the hourly rate of pay.

## 2.8. How accessible and user-friendly is the tax credit scheme?

As a part of the evaluation, Statistics Norway conducted two surveys asking firms' about their experiences with the R&D tax credit scheme, one in 2005 and one in 2007. These are analyzed in Foyn and Kjesbu (2006) and Foyn and Lien (2007), respectively. A general finding is that firms with approved projects are far more positive to the scheme than firms that have had projects rejected. Furthermore, the firms are generally more positive to the tax credit scheme in the 2007 survey than in the 2005 survey. The 2005 survey showed that the tax credit scheme was well known already at that time. On the whole, the firms are satisfied with the information about the scheme that is available at the Skattefunn website, www.skattefunn.no. The responses in 2007 are similar to those of the first survey, but reveal that a relatively high percentage of firms are not sufficiently familiar with the regulations of the scheme. This applies in particular to the provision that the calculated tax deduction is paid out as a grant in cases where firms are not liable to taxation, or where the assessed tax is less than the deduction.

Although many firms state that the information on the Skattefunn website is good, almost half of them contacted the Skattefunn secretariat or Innovation Norway during the application process. The majority of enquiries related to whether or not their project met the criteria of the scheme. The firms would like more precise information about the requirements for a project to be approved, i.e. they ask for more predictability. Numerous firms have used consultants with extensive knowledge of the R&D tax credit scheme to formulate applications, in order to make it easier to facilitate the approval of their application. Firms that have had their application rejected tend to claim that policy makers and public servants do not understand the specifics of their industry. A particularly common claim was that there is a lack of understanding of how R&D is performed in various service industries. This is supported by Skattefunn's own statistics, which show a higher rejection rate for projects in the service industries. However, this has gradually changed as Innovation Norway and the Skattefunn secretariat have gained more experience with service industry projects.

Firms with approved projects were very satisfied with the R&D tax credit scheme. Within this group 90 per cent reported in the 2007 survey that they were very or fairly positive to the tax credit scheme, 57 per cent said they had not changed their opinion since the scheme was introduced, 30 per cent said they had become more positive to the scheme, and only ten per cent said they had become more negative. The latter is perhaps due to the introduction of a maximum hourly rate of NOK 500 in 2007. Numerous firms commented on this change. Even though firms that had had projects rejected were more negative than firms with approved projects, a majority of the former firms were also positive to

the scheme. 12 per cent said that they had become more positive to the scheme than when it was first introduced despite having had their projects rejected. The vast majority of these firms, 80 per cent, found the rejection to be unreasonable. Most firms, 60 per cent, also perceived the basis for the rejection to be poor. A number of firms think that the process, involving three government bodies, needs to be simplified. With regard to approval of the R&D content, the Skattefunn secretariat has the final word and receives the most criticism. A high number of firms complain about the detailed project accounts that are required by the tax authorities. It seems that this requirement is not communicated clearly enough in the guidelines to the scheme. Many firms are also critical to the tax authorities' corrections to their project accounts. The share of firms that think the ceiling for deductible costs should be raised increased between the two surveys. This is most likely because the ceiling had remained nominally constant from the introduction of the scheme in 2002. However, only 22 per cent of all firms receiving the tax credit in 2006 made full use of the cap of NOK 4 million for in-house R&D. About 60 per cent of the firms suggested that the scheme should be changed so that they would not have to wait a whole year to receive the tax relief payments.

## 2.9. The administrative costs of the tax credit scheme

The administrative costs of the tax credit scheme consist of the firms' costs and the government's costs. Firms incur costs when writing applications, preparing annual and final reports and providing control and certification of the project accounts. The government incurs costs in running the scheme in Innovation Norway, the Research Council of Norway and the tax authorities.

Based on user surveys, Foyn and Lien (2007) estimate the firms' own costs for applications and final reporting to be NOK 35 million for 2006. This is based on an average of 30 hours for completing applications and ten hours for preparing the final reporting for a total of 2,500 applications and 2,000 annual reports (approved projects). The costs per firm vary considerably. An hourly rate of NOK 365 was used when estimating costs. However, if the maximum hourly rate that applies to R&D tax credit projects for 2007 is used (NOK 500), the costs increase to NOK 48 million. About a third of the firms report that they use a consultant for this work. Assuming that an average of four hours are invoiced at an hourly rate of NOK 1,000, this amounts to NOK four million. The user survey shows that it is not uncommon for consultants to work on a "no approval, no fee" basis. Auditing costs are estimated at NOK 12 million. This estimate is also uncertain, since there are large variations in how much time the auditors spend on each form. A survey conducted among auditors suggests that they spend on average four hours on each form and that the hourly rate is about NOK 1,250. The firms' total costs therefore

amount to NOK 47 million, excluding consultancy costs and assuming an hourly rate of NOK 365 for the firms' use of time. This makes up about four per cent of the firms' total tax deductions.

In addition to the firms' costs, the government also incurs costs. The Skattefunn secretariat at the Research Council of Norway has a budget of NOK 15 million for running the scheme, and Innovation Norway receives NOK eight million for its Skattefunn services. The costs of the tax authorities are more difficult to calculate, especially since the control efforts vary somewhat from year to year and between regions. The direct costs for tax audits in 2005 are estimated to be only NOK 250,000 based on a survey among tax offices. If estimated costs for auditing and handling complaints are also included, the total cost to the tax administration can be estimated to NOK 3.2 million. Some costs are also incurred by the Ministry of Finance and the Ministry of Trade and Industry. These are estimated by the Government Agency for Financial Management (SSØ) to be NOK 1.4 million. The cost to all government agencies involved therefore amounted to about NOK 28 million in 2006.

The above figures sum up to a total cost of approximately NOK 75 million for the firms and the public sector in 2006. This corresponds to almost seven per cent of the total tax relief that year.[14] The administrative costs in the public sector alone correspond to only two per cent of the tax relief. This is very modest. The total estimated costs for the government are NOK 1,126 million in tax expenses and NOK 28 million in administrative costs, giving a total of NOK 1.15 billion. If we include a tax financing cost in the form of a 20 per cent efficiency loss (in order to account for the amount that needs to be financed from an increase in other taxes which distorts the resource use in the economy), the public costs of the R&D tax credit scheme amount to NOK 1.4 billion for 2006. This is less than 0.1 % of GDP.

# 3. Discussion of our main findings

We have found that the R&D tax credit scheme has a large and positive effect on industry's R&D activity. An input additionality factor of around two is high compared to what is previously found in the international literature. The R&D tax credit scheme, which was introduced in 2002, has been in use during a period in which the increase in industry's overall R&D activity has been modest. In 2005, the total R&D expenses in Norway were NOK 29.6 billion, which constitute 1.5 per cent of GDP. Of this, industry accounted for NOK 13.6 billion, the institute sector for NOK 6.9 billion and the university and university college sector for the remaining NOK 9.1 billion. Our additionality estimate shows that

[14] Mohnen and Lokshin (2009, footnote 4) report that the total administrative costs are about nine per cent of total support in both the Dutch and Canadian R&D tax credit schemes.

without the tax credit scheme, the industry's R&D activity would have been NOK 2.4 billion lower this year. A good half of this can be linked to small firms with less than ten employees, which were excluded from the R&D statistics in 2005. We therefore estimate that the industry's R&D activity according to the R&D statistics would have been around NOK 12.4 billion in 2005 if the tax credit scheme had not existed. Its total share of GDP in 2005 would have been 0.6 per cent, down from 0.8 per cent in 2001 - the last observation before the R&D tax credit scheme was introduced. Even with our lowest additionality estimate of 1.3, the R&D share would have fallen without the tax credit scheme.

It may be questioned whether it is reasonable that the R&D activity in industry should have decreased to such an extent during the period we consider. It is a common assumption that R&D expenses are procyclical, i.e. that their growth in real terms is positively correlated with the GDP growth. If this is the case, business cycle conditions could be an acceptable explanation for the first two or three years after 2001, but not thereafter when the Norwegian economy boomed. On the other hand, a number of Nordic countries have reported a certain stagnation and relative downturn in the intensity of R&D activity in the 2000s, so the development in Norway is not exceptional. Nevertheless, our counterfactual result of what the R&D investments would have been without the R&D tax credit scheme is somewhat surprising when viewed in relation to the macroeconomic development.

That R&D is procyclical, may be most relevant to large firms that are dominant in the R&D surveys in the OECD countries. It is possible that R&D is counter-cyclical for the small firms which are dominant in the Norwegian R&D tax credit scheme. Small firms may not be in a position to increase their R&D activity to any great degree during a boom in the economy. On the basis of limited resources as a whole, small firms may cut down on R&D activities in order to increase their production capacity during times of prosperity. If this is so, it may explain why there was a decrease in the number of tax credit applications after 2004. On the other hand, according to the 2006 R&D survey by Statistics Norway, large firms did not increase their R&D activity very much either during the economic recovery from 2003 to 2006. [15]

We have concluded that the R&D tax credit scheme has made a positive contribution to industry's R&D activity, but, strictly speaking, this is just an essential prerequisite for defending the scheme. In light of our findings, it could be asked why the authorities should stimulate R&D activity in projects

[15] If large and small R&D firms are affected in different ways by the economic cycles, the assumption that we have had to use as a basis for the additionality analysis is not valid. What drives the R&D growth in large and small R&D firms is an issue that we would like to explore further in future research.

that are as market-oriented as those that the Norwegian R&D tax credit scheme seems to be stimulating. What market failure is it that the scheme is correcting? Our evaluation shows that the scheme primarily stimulates small firms' R&D activity, and particularly R&D in firms that have not previously carried out much R&D. The R&D that the tax credit scheme stimulates does not seem to create innovations of a kind that can be expected to have large external effects. When we find that small firms seem to respond most strongly to the R&D tax credit, this can be explained in two ways. These firms have first of all been given a major price reduction on R&D and have responded by increasing their R&D activity. Second, their response may be due to the fact that they face financing problems linked to their R&D activity, and that the scheme has helped solve these problems. The latter explanation is consistent with a large part of the total tax deductions being paid as a grant to firms that are not in a tax position. The first component has nothing to do with market failure, while the second does and has been used to justify government R&D policies, cf. Hall (2002). It could be argued that financing problems are not helped to any great extent in the current scheme since the support that is paid to firms that are not liable to taxation takes place well after the project costs have been incurred. On the other hand, an approved project will act as a kind of security, since it is almost certain to entail a future payout. The evaluation has revealed that many firms regard liquidity as a problem.

In the current tax credit scheme, the Research Council of Norway approves the project, while the tax authorities approve the tax deductions. This implies that even when a firm's project has been approved, there remains some uncertainty as to what support the firm will actually receive. Legal disputes sometimes arise between the firms and the tax administration although the scope for this is limited in Norway as compared to countries in which prior approval of projects is not part of the scheme.

# 4. Conclusions

We find that the Norwegian R&D tax credit scheme introduced in 2002 mainly works as intended. The scheme is cost-effective and it is used by a large number of firms. It stimulates these firms to invest more in R&D, and in particular, the effect is positive for small firms with little R&D experience. The returns on the R&D investments supported by the scheme are positive and generally not different from the returns to other R&D investments. We have found examples of what can be interpreted as tax motivated misuse of the scheme, but to some extent one must accept this as a cost to subsidy and support schemes intended for use by a large number of economic agents. This is particularly so when administrative expenditures and control routines are kept at a low level.

A follow-up question to the above main conclusion is whether there might be alternatives to Skattefunn, that might perform even better. This issue has not been a main focus in our evaluation. However, in our analysis of the interaction between different R&D policy instruments, Skattefunn stands out as a good scheme. In line with the Hervik Committee's argument for having a broad set of instruments in the R&D policy, we believe that a scheme in the style of Skattefunn is well justified.

There are a number of alternatives to the current Norwegian scheme. However, we do not believe that any of the international alternatives have any obvious benefits, and in particular we do not recommend converting to a system supporting the *increase* in R&D as opposed to the *level* of R&D, i.e. we recommend retaining a volume-based scheme rather than choosing an incremental scheme. Experience and common sense tell us that volume-based schemes are the easiest to administer. An incremental scheme might produce higher input additionality than a volume-based scheme because it provides special stimulus for firms that increase their R&D activity significantly, but international studies are not clear on this point. Moreover, it is not clear which market failure argument applies in particular to firms that grow rapidly.

The Norwegian R&D tax credit scheme has two provisions that favour specific types of firms. First, small and medium sized firms receive a slightly higher tax deduction than large firms where size is measured in terms of number of employees, turnover etc. We have no evaluation results that clearly address whether the difference in the deduction percentages (20 versus 18 per cent) is rational. Simplicity suggests that a single deduction rate of 20 per cent could just as well have been applied, but consideration to EEA support regulations places limitations on the formulation of the rules. The other provision is that the upper limit for the deduction is higher if the firm buys R&D services from an approved research institute. We have no evaluation results that allow us to draw strong conclusions regarding the scheme's effectiveness on this point, but we find that this element of the scheme is well argued for.

We do not believe there are good arguments for removing the caps in the scheme. The intention of the scheme is to act as a supplement to other R&D policy instruments, and in particular to ensure that some R&D support is available to firms with little R&D experience and prior contact with the Research Council of Norway or other parts of the innovation policy system. The financing of these firms' R&D activity can be difficult, and to the extent that capital market imperfections are considered the main justification for the scheme, this suggests that the caps should be kept. In a system with no caps, firms with large R&D investments would be able to increase their R&D activity considerably.

There is no reason to believe that these firms face severe financing constraints. In order to stimulate more R&D in large firms, the authorities should rather increase the availability of traditional R&D grants as suggested by the Hervik Commission. These grants should be directed towards projects with large externalities and low private returns.

There is much focus on evaluating R&D subsidy schemes both in Norway and abroad. It is, however, considered an ideal that the schemes should be general, in the sense that they apply equally to all firms. This is somewhat contradictory. The reason for this is that the greater the degree of equal treatment in the scheme, the further away we are from the ideal evaluation situation with a comparison of recipients that are equal, except from the fact that some have access to the scheme and others do not. Given that economists and authorities are uncertain about the effectiveness of R&D policies, an evaluation design should be built into the schemes as argued by Jaffe (2002). Since a valid control group must be part of a good evaluation design, this implies that some agents that would want to use the scheme must be excluded from it. [16] In other scientific fields, such as medicine, this is widely accepted. Hence, there is a trade-off between formulating the scheme optimally in relation to the knowledge available today, and formulating it so that it can be improved and work better in the future.

[16] Using the tax system to discriminate between identical firms would be unconstitutional in most countries. Building in an evaluation aspect may therefore be easier in direct grant systems. However, some randomization can easily be built into R&D tax credit schemes e.g. by limiting the tax credit to SMEs. According to the EU/EEA state aid rules, SMEs are defined as firms fulfilling two out of three size criteria, and firms just above and below the limits will be quite comparable.

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