Samfunnsøkonomisk analyse
Rapport nr. 23-2015

EVALUATION OF «SKATTEFUNN» (TAX DEDUCTION SCHEME FOR R&D INVESTMENTS)
– A FEASIBILITY STUDY

ABSTACT

This report proposes a comprehensive feasibility study for evaluating SkatteFUNN following the guidelines provided by ESA.

Our recommendation focus on both the causal economic effects and the additionality of the scheme.

We recommend using Difference-in-Differences modelling. The evaluation should be supplemented by Regression Discontinuity Design and various matching procedure to identify proper, yet synthetic control groups.

We estimate the total cost of the evaluation at NOK 3,387,500 including VAT. and including cost of data.

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Details

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Foreword

The feasibility study has been completed by researchers and analysts at Samfunnsøkonomisk Analyse. The study presents how SkatteFUNN can be evaluated in accordance the ESA guidelines. Furthermore, the study presents how investigation of potential misuse of Skatte-FUNN can be conducted.

As Project manager, I would like to acknowledge the substantial effort by Fernanda Winger Eggen and Emil Cappelen Bjøru. In addition, I would acknowledge the supervision, comments and discussions with both Roger Bjørnstad and Rolf Røtnes, which has contributed significantly to the feasibility study.

3. November 2015

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Summary

This report proposes a comprehensive methodology for evaluating the Norwegian tax deduction scheme; SkatteFUNN. The SkatteFUNN research and development (R&D) tax incentive scheme was introduced in 2002, and is a governmental program designed to stimulate R&D in the business sector. The rationale behind initiating an R&D tax incentive scheme is the overall issue with companies not investing at a socially optimal amount in R&D, because of positive external effects are not fully internalised by the decision makers. SkatteFUNN should, first and foremost, stimulate R&D investments in the business sector (first order effect), and ideally also lead to innovations (second order effect) and to a more knowledge based economy (third order effect).

SkatteFUNN is set to decrease the realised cost of R&D investments for companies. Small and medium sized companies may receive a tax credit of up to 20 per cent of the eligible expenses related to R&D activity for approved projects, whereas large companies may receive a tax credit of up to 18 percent of eligible expenses. All costs must be associated with the approved project. To qualify as R&D, any activity must meet the definitions set out by the Research Council of Norway. If the tax credit for the R&D expenses is greater than the amount that the firm is liable to pay in tax, the remainder is paid in cash to the firm. If the firm is not liable for tax, the entire allowance is paid as a cash grant.

Throughout the last years, SkatteFUNN has been expanded. First in 2009 and later on in year 2014 and 2015. The expansions increased the threshold for tax deductions on private R&D expenditure. In 2008 the threshold on internal R&D projects was 4 mill. NOK a year. In 2009, 2014 and 2015 this threshold was raised, and in 2015 the limit is 15 mill. NOK.

SkatteFUNN has been notified to ESA as a R&D scheme. The scheme has been preapproved by ESA and is view upon by ESA as a scheme the meet the ESA standard for state aid. The preapproval also implies that the Norwegian authorities conducted an impact evaluation in line with the EU Guidelines on Regional State Aid.

The evaluation process

The evaluation process is separated into five phases. The first phase consists of this report; a feasibility study that proposes evaluation methods and data requirements for the actual evaluation. The second phase is a dialogue between the principal, expert groups and evaluation communities in order to discuss the recommendations in the feasibility study. The third stage is an internal process within the Ministry of Finance of writing the tender(s) and selecting the evaluator(s). The Ministry of Finance will select an external expert group to conduct the actual evaluation of SkatteFUNN. The fourth phase is the actual evaluation with the production of the first draft. As with the feasibility study, the evaluator will be asked to seek guidance in the Staff Working Document from the Commission on evaluation methodologies (European Commission, 2014). The fifth stage is the assessment of the evaluation, after the first draft. To provide the best possible assessment, the

ministry will establish an independent peer review group with the aim of giving reasoned opinions on the evaluation. The evaluator will finalise the report based on the comments from the peer review group.

Suggested evaluation approach

This report presents the feasibility study. We argue that the ex post evaluation of SkatteFUNN must focus on two criteria. Firstly, whether or not SkatteFUNN led to activities that would otherwise not have been initiated. This is denoted as additionality and covers, among other aspects, additional R&D investments and innovation. Secondly, the SkatteFUNN must have an effect on the beneficiaries in terms of increased economic performance.

There are several ways of conduct impact assessments of both additionality and effect of SkatteFUNN. We argue that using various econometric models. Our recommendations are based on a thorough discussion of whether the different econometric approaches comply with the European Commission's evaluation criteria outlined in the Commission Staff Working Document (European Commission, 2014).

The criteria state that the evaluation intends to address the objectives of the scheme, specifically identifying the direct effects, but also the indirect effects and effects of potentially more efficient instruments. Most importantly, the evaluation must use methods that identify causal effects or the counterfactual development.

We recommend that the evaluation is conducted using three different variants of Difference-in-Differences (D-i-D) econometric estimation. This is also consistent with recommendations in the Commission Staff Working Document. The D-i-D method is established as well suited for policy evaluation, albeit not without its pitfalls. The main challenge is to find suitable control groups, which in turn is crucial for establishing the counterfactual development. Consequently, our analysis recommend using three different methods, capturing different delimitations of the measured population:

1. Using D-i-D modelling and add explanatory variables to control for differences between beneficiaries and non-beneficiaries. Furthermore, the explanatory variables must ensure that the parallel trends assumption is met.
2. Using a matching procedure to establish control groups of non-beneficiaries. We suggest both Propensity Score Matching (PSM) and Coarsened Exact Matching (CEM). Both procedures produce control groups that can be implemented in D-i-D modelling, potentially ensuring the parallel trends assumption is met. It is important to note that both PSM and CEM allows for testing the consistency between beneficiaries and their control group by completing balancing tests.
3. As a third method, we suggest implementing regression discontinuity design (RDD). This allows us to establish a group of beneficiaries and non-beneficiaries on both sides of a given threshold. Again, this approach can be implemented with D-i-D modelling.

Throughout the years, SkatteFUNN has been elaborated. A central part is measuring the return on additional investments. International literature on measuring return on R&D investment is quite clear, and has been developed for more than three decades. We recommend following the international literature.

Furthermore, our feasibility study possible ways of analysing the proportionality and appropriateness of SkatteFUNN. Proportionality and appropriateness covers several aspects, e.g. whether the impact of SkatteFUNN is proportional with the costs of financing the scheme, whether alternative measures could achieve similar impact, whether there are distortive effects of SkatteFUNN and whether SkatteFUNN is linked to other schemes in the public support system for R&D and innovation.

Among others we suggest to do a coherence analyse of SkatteFUNN and other schemes. By following SkatteFUNN beneficiaries we can trace them across various schemes and thus see how various schemes are linked. By controlling for alternative schemes in the D-i-D estimation, the evaluator could also reveal the proportionality and appropriateness of SkatteFUNN. Since the econometric models are based on micro-level data, it will be possible to delimit the population to a selected industry level and then estimate effects of the SkatteFUNN on R&D investments, innovation, labour productivity other variables of interest. E.g. if the impact is strong on the EU-export oriented industries, one can argue that there are distortive effects on competition and trade with EU member countries.

In order to investigate misuse of SkatteFUNN we suggest comparing reported information to tax deduction with various data sources. By doing so we can identify potential disproportionality between reported figures and de facto figures stemming from accounting data, R&D statistics or other eligible data sources.

Data, costs and tentative timeline

The present report also lists the data needed for the proposed evaluation methodology. Statistics Norway will not provide any estimate of the costs of delivering these data. Nevertheless, data costs have been estimated based on available information on Statistics Norway's pricing policy and our own experience with ordering data.

When we sum up the costs for each stage in the proposed evaluation using econometric estimations, investigating potential misuse, literature review and include data costs we estimate the total cost for evaluating SkatteFUNN at NOK 2,710,000 excluding VAT, and NOK 3,387,500 including VAT. Details are provided in the table below.

Table: Estimated time, tentative timeline, hours of work and costs for evaluating SkatteFUNN scheme using suggested methodology

	Period	Hours of work	Costs excl. VAT based on NOK 1400* per hour
Establishing the analytical and logical approach, including an extensive literature review	May 2016 – Dec. 2016	250	350,000
Ordering and collecting data	Sep. 2016 – Jan. 2017	100	Data: 330,000 Work: 140,000
Preparing necessary databases	May 2016 – Nov. 2016	200	280,000
Estimation and interpretation	Jan. 2017 – Dec. 2017	750	1,050,000
Documentation	Nov. 2017 – Feb. 2018	250	350,000
Meetings, coordination and administration	Oct. 2015 – Feb. 2018	150	210,000
Total		**1,700**	**2,710,000**

*Measured in 2015 prices/wages, Source: Samfunnsøkonomisk analyse, 2015

Content

1. Introduction

SkatteFUNN is a research and development (R&D) tax incentive scheme introduced in 2002. The scheme aimed at stimulate R&D in the business sector. The rationale for initiate an R&D tax incentive scheme is that the business sector alone will not supply the socially optimal amount of R&D because of positive external effects.

SkatteFUNN is set to decrease the realised cost of R&D investments. Small and medium sized businesses may receive a tax credit of up to 20 per cent of the eligible costs related to R&D activity for approved projects, whereas large businesses may receive a tax credit of up to 18 percent of eligible costs. All costs must be associated with the approved project. To qualify as R&D, any activity must meet the definitions set out by the Research Council of Norway. If the tax credit for the R&D expenses is greater than the amount that the firm is liable to pay in tax, the remainder is paid in cash to the firm. If the firm is not liable for tax, the entire allowance is paid in cash.

The evaluation should cover the entire scheme and will be carried out by an expert team. The evaluation will be finalized in year 2018 and consists of the following five phases:

1. A feasibility study that proposes evaluation methods and data requirements for the actual evaluation
2. A dialogue between the principal, expert groups and evaluation communities in order to discuss the recommendations in the feasibility study
3. An internal process for the Ministry of Finance writing the tender(s) and selecting the evaluator(s)
4. Completing the actual evaluation with the production of the first draft
5. An assessment of the evaluation(s) after the first draft. To provide the best possible assessment of the evaluation, the ministry will establish an independent peer review group with the aim of giving reasoned opinions on the evaluation. The evaluator will finalise the report based on the comments from the peer review group.

Following a tendering process, the Ministry of Finance assigned the feasibility study to Economic Analysis Norway (Samfunnsøkonomisk analyse). This report documents the study.

The forthcoming evaluation has to be in line with the Guidelines on Regional State Aid (RGA) published by the ESA, which is also the basis for the feasibility study. The most recently updated methodology for state aid evaluations is outlined in the Commission Staff Working. Document, *Common methodology for State aid evaluations* (European Commission, 2014). In the next chapter, before we turn to the description of SkatteFUNN and possible evaluation methods, we comment briefly on the most important elements of the Commission Staff Working Document.

Chapter 3 discusses the common objective of the scheme and its historical background. Chapter 4 discusses further the intervention logic of SkatteFUNN. In Chapter 5, we review relevant and

feasible evaluation methods and data. Finally, in Chapter 6, we put forward our recommendations regarding the choice of evaluation methodology.

2. Evaluation criteria according to the European Commission

In recent years, there has been an increased focus on the evaluation of state aid schemes. The European Commission has highlighted this issue on their agenda, and produced the Commission Staff Working Document, *Common methodology for State aid evaluations* (European Commission, 2014). This document outlines the necessity for following a comprehensive plan in an evaluation of a state aid scheme. The document describes such a plan in detail, and provide a guideline on how to conduct an evaluation. The plan should consist of the following elements:

1. The scheme's contribution to the common objective
    - Objectives of the aid scheme to be evaluated
2. Identification of the direct effects on beneficiaries
    - Result indicators that capture quantified information about results achieved by the state aid scheme
3. Identification of the indirect effects on beneficiaries
4. Methods: finding an appropriate basis for comparison of beneficiaries and non-beneficiaries
5. Proportionality and appropriateness, including the effects of alternative schemes
6. Administration of the evaluation
    - Data collection: using the best possible sources
    - Timeline of the evaluation
    - The body conducting the evaluation: ensuring independence and expertise
    - Publicity: facilitating the involvement of stakeholders

In this chapter, we highlight several important points regarding elements 1 to 5.

2.1 Definition of "contribution to common objective" – the intervention logic

The first stage in evaluating a scheme is to describe what the common objective that the scheme intends to achieve is, and precisely how the scheme is contributing to this. To understand how a scheme contributes to a common objective it is necessary to put forth the underlying "intervention logic" of the aid scheme in a clear fashion. This includes describing the needs and problems of the target beneficiaries of the scheme, its general and specific objectives, and the expected impact. Finally, the external factors that might affect the scheme and its effectiveness are to be addressed.

The purpose of SkatteFUNN is to stimulate businesses' investments in research and development (R&D). The underlying argument for the scheme is that the level of R&D investments

would be below the socially optimal level in absence of the scheme. This is based on the existence of positive externalities of R&D investments that are not fully appreciated by the deciding agents. Furthermore, there may be information asymmetries causing market failure in funding R&D investment. For instance, businesses have better market knowledge and product understanding than banks and investors, leading to credit or liquidity constraints. This is especially an issue for small and medium sized enterprises (SMEs). Providing a tax incentive to increase R&D investment is an aid instrument for correcting these potential market failures.

Chapter 3 of this report discusses the objective of the scheme as well as the historical background in more detail. Chapter 4 further elaborate the intervention logic of the scheme.

2.2 Identifying direct effects on the beneficiaries

The Commission Staff Working Document emphasises that an evaluation should address a broad range of effects (European Commission, 2014). The effects of the SkatteFUNN policy can be direct and indirect. Both are important, but according to the working document, the priority should be to develop a method that is able to identify any direct impact on the beneficiaries.

The working document mentions the following important evaluation questions:

- Has the aid had a significant effect on the course of action taken by the aid beneficiaries (incentive effect)?
- Has the aid had an effect on the situation of the beneficiaries? (For example, has its research activities or default risk changed?)
- Has the aid had the expected effects, and to what extent?
- Have beneficiaries been affected differently by the aid (for example, according to their size, location or industry)?

The working paper underlines the importance of identifying the direct impact by saying:

> *"In particular, where the aid provides no incentive effect, it can be assumed that the aid is distortive, in the sense that it provides the beneficiaries in question with windfall gains."*

Commission Staff Working Document, Common methodology for State aid evaluations

The Commission explicitly mention various result indicators as part of the working document. In the case of research, development and innovation aid, the result indicators suggested include:

- Are private investments matching public support?
- Are additional R&D investments undertaken by the businesses with SkatteFUNN projects (during or after)?
- How many new researchers are employed?
- What is the number of patents registered?
- Does the supported businesses introduce new products to the market?

Chapter 4 of this report elaborates further on the points and issues mentioned above and chapter 5, part 2 specifies our recommended evaluation variables.

2.3 Identifying indirect effects

Although the direct causal effects are of particular importance in an evaluation, it is also important to identify indirect effects of the scheme, since such effects may also influence the result indicators above and thereby strengthen or weaken the overall effect. By indirect effects, we mean the effect on variables not directly targeted by the policy. Positive spillover effects, because of the scheme, may enhance potential positive direct effects. On the other hand, negative spillover effects, such as the crowding out of non-R&D investments, will lower the overall benefit of the scheme.

The Commission Staff Working Document points out that measuring the indirect effects of a policy normally requires the use of different tools than direct effects. Furthermore, they state; "it is more difficult to provide precise guidance on this type of exercise as it has to be tailor-made to the possible and expected positive and negative effects of the policy." The evaluation therefore has to carry out an independent analysis of the most credible method to assess the indirect effects of the SkatteFUNN scheme.

There are many possible indirect effects, however, they are often more subtle and difficult to identify than direct effects. Among the possible positive effects, macroeconomic gains and positive externalities are perhaps the most important. Result indicators for the former, specified in the working document, are employment and productivity and/or gross value added.

Productivity is a gain for both the business itself and the economy as a whole, because it implies a more efficient usage of scarce resources. It entails an aggregated competitive gain for the economy, as productivity is an indicator of an economy's competitiveness. Because the existence of spillover effects is the main market failure that SkatteFUNN attempts to correct, the evaluation could pay specific attention to this matter. Increased cooperation between beneficiaries and approved research institutions could also cause spillover effects, as the information sharing this implies likely eventuate in a wider dispersal of the gains from R&D. The result indicators of positive externalities mentioned in the working document are:

- Is there any effect on employment and activity in other firms and regions?
- What is the extent of indirect beneficiaries?

One specific negative side effect mentioned in the working document potentially impacts competition and trade. The evaluation should therefore also attempt to measure aggregated effects on competition and trade. Identification of trade effects can rely on relevant result indicators. The evaluation plan should choose result indicators and explain why the chosen indicators are the most relevant for measuring the impact of this aid scheme.

The working document does not specify which indicators best capture the impact on trade and competitions. However, some suggestions are provided:

- If a scheme is biased towards a specific industry, but has a multi-sector objective, it is regarded as a negative effect of the scheme. Directly measuring a possible bias towards a specific industry is possible.
- Correspondingly, it is problematic if a scheme is biased towards loss-making firms or incumbents, or if they reinforce the market power of the beneficiaries. The population of loss-making firms is defined by utilizing accounting data. Defining incumbents or enterprises with market power is based on a market analysis.

To conduct an adequate analysis of impact on competition and trade, the evaluation should identify when such effects may occur. One way is to identify whether firms covered by SkatteFUNN are active in export markets or whether imports are a real alternative to the SkatteFUNN firms' products. If so, the evaluation should investigate the extent to which the market is characterised by market dominance. If the dominant player is part of SkatteFUNN, it is highly possible that SkatteFUNN has a negative impact on competition and/or distorts trade.

If a SkatteFUNN-approved project increases the entity's productivity, it will benefit the business in terms of costs and therefore in the market place. Furthermore, it could improve existing product quality, although ordinary product development is not supported by the scheme. Firms who have the capacity for R&D could therefore gain competitive advantage over competitors who might not have this capacity. This provides an argument for differentiated deduction rates depending on the business' size. Differentiating ensures that SkatteFUNN is less beneficial for large firms than for SME. A reduction of competition in certain markets is viewed as a cost of the scheme, and must be weighed against the benefits. In Chapter 5.5, we suggest specific tools to identify situations where SkatteFUNN may enhance firms' dominant market power, which reduces competition and distorts trade.

Negative trade effects are interpreted as effects on trade that are disproportionate to the overall objective of the scheme. This can especially be the case if the scheme biased towards industries that mainly export to EU countries.

2.4 Methods: Finding an appropriate basis for comparison

Finding a reliable identification of effects is challenging. The Commission Staff Working Document carefully discusses alternative methods (European Commission, 2014). The main problem is the estimation of how the beneficiaries would have evolved without the effect of the scheme, i.e. the identification of the causal impact of the scheme. In order to identify causal effects, it is necessary to construct a counterfactual development, based on the development in comparable firm(s) or a control group. The working document specifies that an evaluation cannot rely on a simple comparison between beneficiaries and non-beneficiaries, but must take into account the

different characteristics of the two groups of firms, both those which can be observed and those which cannot. The quality of this control group is crucial for the strength of the evaluation.

The working document underlines that a specific problem emerges in terms of identifying a control group when non-beneficiaries themselves have decided to apply or not to apply for aid:

> *"For instance, if all firms are eligible (i.e. all firms who propose a project and apply for aid do receive some aid), then the firms who do not apply are likely to be those without projects. The firms' results may show that firms that did not receive aid performed worse in absolute and relative terms than those who did receive aid. This finding may however be entirely explained by the mere fact that the former group had no project to begin with, whereas the latter did, i.e. the management of the former group are lacking interest or creativity."*

Commission Staff Working Document, Common methodology for State aid evaluations

Randomising the process of selecting beneficiaries would have solved the selection bias. However, randomization is close to impossible for state aid schemes. In the case of SkatteFUNN, randomisation would not be the optimal selection method and would make SkatteFUNN less targeted; there is no economic argument for a random selection of beneficiaries for tax deduction on R&D investments. Since the purpose of the scheme is to stimulate R&D investments, the construction of the policy should allow for project planning in businesses. Receiving a cost reduction on random is therefore not ideal.

In recent decades, other methods of evaluating the policy impact from an ex-post perspective have been developed. These aim to use exogenous variations of the environment in which firms operate, to create situations that are close to experiments (commonly named quasi-experiments). The working document presents the most common methodologies used to assess policy impact and underlines the following:

> *"Differences-in-Differences, Regression Discontinuity Design, Instrumental Variables. These methodologies derive their validity from different assumptions and the best choice is normally driven by the context of the policy and the availability of data. (…) With the noticeable exception of randomised controlled treatments (…), there exists no technique superior to all the other ones in every aspect. The choice of a particular technique has to be guided by a careful analysis of the context of the measure and the available data."*

Commission Staff Working Document, Common methodology for State aid evaluations

In chapter 5, we elaborate on possible utilization of different methods in the coming evaluation, and in Section 5.1, we discuss the methods mentioned above.

2.5 Alternative schemes, proportionality and appropriateness

In most countries, there is a variety of instruments in place to stimulate increased R&D. The government produces R&D on its own, through universities and publicly backed research institutions, and enforces intellectual property rights and the rule of law. Furthermore, governmental competition authorities ensure that market power is not concentrated, which could reduce the incentive to invest in R&D. In addition, governments are actively promoting well-functioning capital markets.

The evaluation should assess the proportionality and appropriateness of the scheme. What is the cost of SkatteFUNN compared to the estimated impact? A crucial question in this regard is whether less aid or a different form of aid could attain the same impact. Hereunder, a direct subsidy is natural to consider as an alternative to SkatteFUNN. Could direct grants, instead of tax deductions, be more efficient in stimulating R&D investments and correct for potential market failures? A direct subsidy scheme would differ from SkatteFUNN, because the aid would require a more comprehensive process of approval, whereas SkatteFUNN is rights based. Assessing whether other instruments can result in the same achievement of the common goal is an objective of the evaluation, and the designed method should allow for such an analysis.

The impact of alternative instruments can be evaluated using similar methods as for the SkatteFUNN evaluation. It is therefore possible to include the effects of alternative instruments in the SkatteFUNN evaluation design. Thus, the evaluation may provide an assessment of the impact on the relevant indicators, for both SkatteFUNN and alternative schemes.

3. SkatteFUNN and its contribution to the common objectives

SkatteFUNN is a tax deduction scheme established in 2002. The objective is to stimulate investment in research and development (R&D) in the Norwegian business sector, cf. Innst. S. nr. 325 (2001) and Ot. prp. nr. 1 (2002). The scheme is rights based, regulated and provide all taxable enterprises in Norway with the opportunity to apply for tax deduction on their costs related to R&D projects. Exclusive taxation provisions for costs associated with R&D did not exist in Norway prior to 2002.

Since the emergence of endogenous growth theory in the 1980s, the belief that economic growth is endogenous and a consequence of an economic system spread widely.[1] This theory seeks to reveal the factors driving economic growth, other than labour and capital. The factors being innovation, investments in R&D, investments in new technologies and ICT, but also a strong focus on enhancing the level of human capital.

In addition to increasing the number of patents, investments in R&D facilitate enhanced human capital and innovation. Human capital differs from other capital investments because the value does not depreciate. Furthermore, increased human capital enhances firms' ability to absorb and implement externally produces R&D and new knowledge.

In 1997, the Norwegian R&D expenses' share of GDP was relatively low in relation to other countries, below the average in both EU, the OECD countries, and the Nordic countries, with only Iceland having a lower share.[2] It seemed likely that governmental intervention was necessary to increase the Norwegian R&D activity level. In the present, various policy schemes aimed at enhancing investments in R&D exist. SkatteFUNN is one of these.

3.1 Contribution to common objectives: Motivation for supporting private R&D

R&D, and in particular private R&D, is a central part of productivity growth in western economies (OECD Beyond the Hype, 2001; OECD Innovation and Growth, 2007, OECD The future of Productivity, 2015). The private economic return to R&D investments have long proved to exceed those of ordinary capital (Hall, Lerner, & Rosenberg, 2010).

[1] The origins of Endogenous Growth by Professor Paul Romer, published in Journal of Economic Perspectives (1994).

[2] The share of R&D is highly dependent on the industrial structure of the country; hence, countries who traditionally have large R&D intensive sectors will have a larger ratio. Therefore, these results are not to be solely relied on.

> *"Modern mainstream economic theory – whether neoclassical, endogenous or evolutionary – has recognized for some time now that technological progress and innovation are the main engines of economic growth."*

(Muldur, et al., 2006)

Despite the vast evidence on high private return, there are many reasons why companies under-investing in R&D, at least compared to what is socially optimal. Firstly, the broader economic effect of R&D investments exceed the private economic effects. Individuals and businesses aiming at increasing profitability though technological development, improved processes and new knowledge conduct investments in R&D. In addition to the gains experienced by those investing directly in R&D, these initiatives also have great external benefits for other businesses and the society overall. The external benefits, through productivity growth, increased production opportunities, and hence greater economic growth, are often difficult to measure precisely and is not included in the individual business' decision-making process. Because of the various positive externalities following investments in R&D, these investments conducted by the business sector will be less than what is socially optimal (Hervik, et al., 2000).

Secondly, R&D investments is subject to the classical free rider problem of public goods.[3] R&D investments are characterized by being risky and having high start-up costs, but relatively low marginal costs. Typically, these investments also face a low probability of success, but provide significant proceeds if succeeding. Furthermore, others commonly adopt the results of successful R&D projects relatively easily. This implies that businesses will experience great benefits if other businesses invest in R&D. Again, an argument for companies to not be first movers in investing in R&D, and thus underinvest compared to what is socially optimal.

Imperfect information is an additional market failure associated with investments in R&D. Investments, in every form, is characterized by uncertainty, but investments in R&D are associated with greater uncertainty than other investments (the Frascati manual, 2002). Furthermore, information related to the likelihood of successful R&D investments can be considered asymmetric, in the sense that the business investing in R&D may possess private information about the projects potential, market opportunities and their own abilities and effort. Hence, they possess superior knowledge about the probable outcome of the R&D investments. Therefore, it may be difficult for investors to assess their potential return, and they might be reluctant to finance these investments. In particular, small enterprises experience difficulty finding financing alternatives for their

[3] A public good is characterized as being non-rivalrous and non-excludable. Meaning that the usage by one entity does not precludes the usage by another entity, and that it is not possible to prevent others from utilizing the invention. In fact, some public goods, such as knowledge, will accumulates if everyone uses it. *"If you have an apple and I have an apple and we exchange apples then you and I will still each have one apple. But if you have an idea and I have an idea and we exchange these ideas, then each of us will have two ideas" – George Bernhard Shaw.*

R&D investments. This can impede the implementation of profitable R&D investments, profitable in terms of both the individual business and the economy.

The market itself does not solve the issues mentioned above. In order to mend these market failures, public support is a solution. Today, there is little disagreement about the desirability of subsidizing private R&D activities among researchers and policymakers. All OECD countries are currently spending significant amounts of public money on schemes intended to stimulate R&D activity, and the EU have launched their 8th framework programme (Horizon 2020) allocating a staggering € 70 billion for supporting R&D (and innovation) in years 2014-2020.

3.2 The basis for SkatteFUNN

The Hervik committee originally proposed the SkatteFUNN scheme in 2000. The primary objective of the committee was to evaluate and suggest appropriate measures to stimulate private investment in R&D.

The Hervik committee recommended additional governmental intervention to increase R&D activities in Norway. This argument was based on the various forms of market failures impeding the market's ability to reach the socially optimal level of R&D. There exists a vast amount of theoretical and empirical literature on market failures related to R&D investments, and there is little controversy associated with the necessity of governmental intervention.[4]

3.2.1 Stimulating SME with no or little R&D as well as R&D collaboration

SkatteFUNN applies to all sizes of enterprises, all industries and all types of business entities, which is contrary to other national schemes. However, the scheme differentiates between small and medium-sized enterprises (SME) and large enterprises. Large companies have the opportunity, through SkatteFUNN, to receive a tax deduction of up to 18% on the costs associated with R&D projects, whereas SME is entitled to a tax deduction of up to 20% on their R&D project costs. Entities that are not in a taxable position will receive the amount as cash grants. The deductions are calculated and implemented by the taxation authorities simultaneously with the tax assessment.

Previous evaluations of SkatteFUNN, the latest conducted by Statistics Norway (SN) in 2008, concludes that the scheme does have a positive effect on the receiving entities profitability and productivity (Cappelen, et al., 2008). The most significant effect of SkatteFUNN is amongst small entities. Small companies typically do find investments in R&D too risky and resource intensive, and have historically not been able to prioritize R&D investments without external incentives.

[4] The arguments are based on the Hervik committee's report (NOU); Ny giv for nyskaping – Vurdering av tiltak for økt FoU i næringslivet, 2000.

The implementation of SkatteFUNN provided such an incentive.[5] Almost half of the new projects supported by SkatteFUNN in 2014 were initiated by entities with less than 10 employees.

A major advantage of implementing a R&D tax deduction scheme is that it is neutral; enterprises can themselves decide which projects to invest in. SkatteFUNN incentivizes a wide range of social science projects, enhancing welfare and integration of research in the industry. The R&D projects promoted by SkatteFUNN can be within all disciplines, but must have the objective of creating new knowledge or new experiences in association with development or improvement of goods, services or processes.

The tax deduction basis can be divided into two; one part deals with the costs related to intramural R&D projects, whereas the other part is tied to the costs related to externally purchased R&D projects. The externally purchased projects are conducted by the Research Councils approved research institutions, and contributes to stimulating the disseminations of knowledge and ideas though enhancing collaboration between public and private organisations.

3.2.2 SkatteFUNN among other R&D enhancing instruments

SkatteFUNN is available to all. This is the main difference from other R&D enhancing schemes, where companies need to apply for subsidies or participate in projects and networks. The process involving application for R&D schemes is often a barrier for small and medium sized companies with little or no experience with these processes. This is a well-recognized issue. Throughout the past 10 years, the EU lead by the DG Research, had a specific aim of increasing SME participation in projects covered by the FP7. Specifically, the aim was that SME received 15 % of the Cooperation program's funding (European Commission, 2012).[6]

With a low threshold for receiving tax deduction through SkatteFUNN, the scheme can be a first step for companies into other programs. SkatteFUNN belongs to an independent department of the Research Council, under the innovation division. The scheme is funded by Ministry of Trade, Industry and Fisheries, and is operated in collaboration between Innovation Norway and the Norwegian Tax Administration. Innovation Norway plays a part in distributing knowledge about SkatteFUNN, in addition to assisting applicants. The diversity of actors involved in SkatteFUNN indicates that companies potentially are in contact with actors responsible for other R&D schemes.

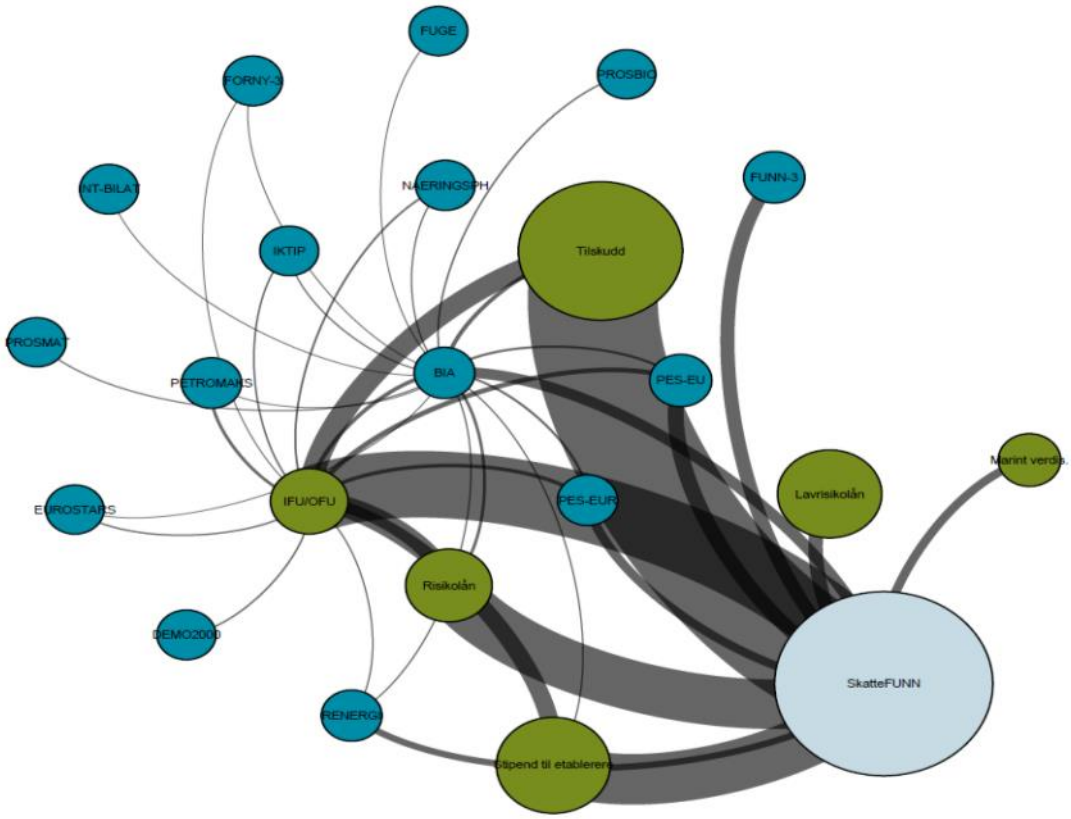
It is somewhat common that beneficiaries of SkatteFUNN are also receivers of other grants from Innovation Norway and The Research Council of Norway, see figure 3.1. This is an encouraging realisation of far more R&D projects than would have been the case without SkatteFUNN. The dark blue circles in figure 3.1, display the various schemes implemented by the Research Council,

[5] Click here to view an article about the evaluation in 2008

[6] See DG Research, progress report in SME Participation in the Seventh Framework Scheme for Research and Development.

whereas the green circles represent the schemes implemented by Innovation Norway. The light blue circle represents SkatteFUNN. The size of the circle illustrate how many enterprises are supported by that specific scheme, and the width of the connecting lines represent how many of the enterprises are receiving support by the schemes in both ends of the line. For example, it is required that all entities receiving support from IFU/OFU, is already approved by the SkatteFUNN scheme, hence the connecting line between the IFU/OFU line and SkatteFUNN is as wide as the IFU/OFU circle.

Figure 3.1 Overview of various R&D enhancing schemes, and the connection between these.



Source: Samfunnsøkomnomisk analyse's "Database of R&D and Innovation measures" aimed at companies

3.3 Adjustments to SkatteFUNN

The SkatteFUNN-scheme has been expanded in three rounds; 2009, 2014 and 2015. Each extension expanded the tax deduction base with the objective of further stimulating economically profitable R&D investments in private organisations. The adjustments must also be part of the evaluation, and incorporated in the methods, especially when utilizing the regression discontinuity design. Ex-ante and ex-post adjustment assessments would provide valuable information about the SkatteFUNN's impact.

The first extension, in 2009, was implemented by the Stoltenberg II-administration as a tool intended to dampen the effect of the Global Financial Crisis, cf. St.prp. nr.37. The extension meant an increase in the tax deduction base on internally completed R&D projects, from 4 to 5.5 million, and an expansion of the maximum sum of externally purchased R&D, from 8 to 11 million.

The 2009 extension was recommended in a broad evaluation of SkatteFUNN in 2008 completed by SN (Cappelen, et al., 2008). The objective of the evaluation was to evaluate whether the scheme did cause more R&D investments, whether these R&D investments provided increased return for the entities and what changes would occur within the entity as a consequence of the scheme.

In 2014, there was a further increase in the tax deduction base on internally completed R&D projects, this time from 5.5 to 8 million. The maximum sum for both internally completed and externally purchased R&D increased from 11 to 22 million.

In 2015 there was implemented another extension of the scheme. This extension involved an increase in costs related to internal R&D projects from 8 to 15 million, and an increase in the maximum sum of internally completed and externally purchased from 22 to 33 million. This extension in intended to, further, facilitate larger R&D projects, and thereby strengthen R&D in the business sector. In addition to stimulate larger R&D projects, the extension may also facilitate a more rapid completion of the projects.

4. The effects of SkatteFUNN in theory – the intervention logic

A profound and clear intervention logic is necessary for every evaluation. The intervention logic states the intervention, and it states the intervention target, both in terms of target group and problems to solve. In addition, the intervention logic states how the scheme is supposed to alter today's activities and through which channels. Finally, the intervention logic should define intermediate, shorter and longer-term effects.

With a thorough understanding of the intervention logic, the evaluator has a strong basis for completing the evaluation. The intervention logic will clarify the following:

- What are the main performance indicators?
- What are other variables, expected to have a causal relation with the performance indicators?
- Who can be expected to benefit from the intervention?
- How long is the time span from the intervention to expected effects?

After answering these issues, the evaluation can be conducted systematically with focus on isolating effects and causality. The following will outline the theoretical terms of how SkatteFUNN is expected to intervene with Norwegian companies.

4.1 Overall intervention logic of SkatteFUNN

We argue that an evaluation of SkatteFUNN must focus on both additionality and impact. Without additionality, the impact would have occurred independent of whether SkatteFUNN provided support or not. Without an impact, the additionality is unimportant. In order to identify the main performance indicators of both additionality and impact a thorough assessment linked to the intervention logic of SkatteFUNN is necessary.

4.1.1 Overall intervention

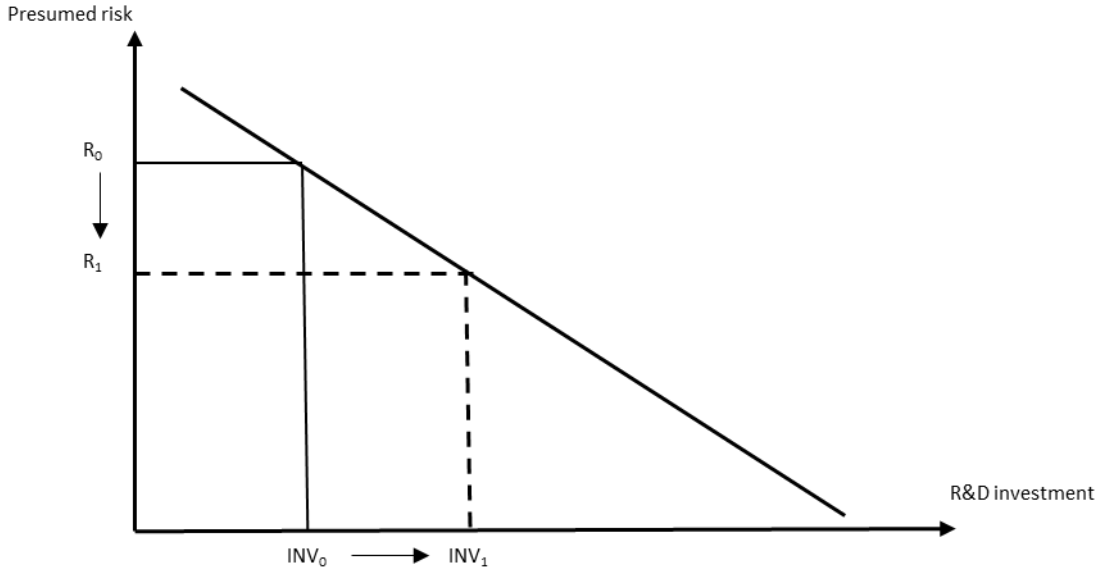
In general, public schemes are designed to overcome market failure. Market failure for instance being the lack of information to make optimal decisions regarding investments and resource allocation. Furthermore, research and development (R&D), knowledge and building knowledge capacity is featuring characteristics of a public good with external spillover effects. This potentially leads to undesirable investment decisions from an economic point of view, i.e. companies and businesses not investing sufficiently in R&D and knowledge building capacity compared with what is best for society.

The implementation of schemes reducing market failures, lowering the risk of R&D investments and exploit the fact that knowledge is a public good are present in all western countries. The objective is to stimulate private R&D and to change R&D behaviour in businesses. The effect of these schemes should be visible through increased patents and innovations, ultimately leading to increased economic growth.

Figure 4.1 provides a simplistic view of how SkatteFUNN is assumed to intervene in private Norwegian companies' R&D activity. The intervention mechanism is that a tax deduction on expenses related to R&D-investments is set to incentivise R&D investments. More precisely SkatteFUNN is aimed at lowering the realised cost of investment, and thereby stimulate to the initiation of R&D projects that otherwise would not have been initiated, or to increase investments in already undertaken R&D projects. This can be referred to as input additionality.

The intervention logic behind figure 4.1 is that the presumed risk attached to R&D investments is reduced as the cost of R&D investments are reduced. This could cause increase R&D investments, since projects, previously found too risky, are now considered acceptable. However, it also leads to a potential marginal increase in already initiated projects. Figure 4.1 builds on the assumption that companies are risk averse, implying a decrease in R&D investments with increasing risk. The figure shows that when lowering the initial cost of R&D, the presumed risk is also lowered. This in turn is leading to an increase in R&D investments.

Figure 4.1 Intervention logic of SkatteFUNN



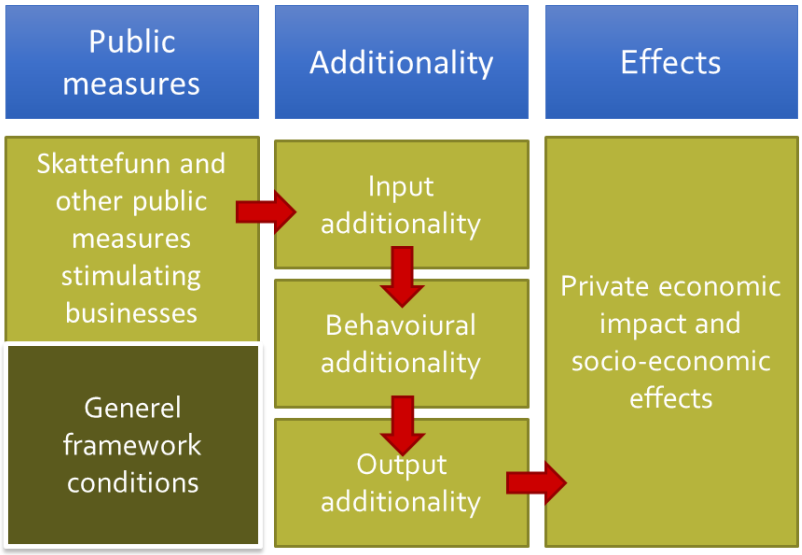
Source: Samfunnsøkonomisk analyse, 2015

Figure 4.2 display how SkatteFUNN can lead to input additionality. However, it is important to separate between measures of additionality and impact. The initial increase in R&D investments are potentially leading to a change in company behaviour, i.e. alternative allocation of internal resources related to R&D-activities. Companies might change from doing R&D from time-to-time, to having permanent R&D-activity. Furthermore, SkatteFUNN explicitly provide incentives

to stimulate buying R&D from public funded knowledge institutions. Thus, another expected change due to SkatteFUNN is a change in the level of R&D collaboration between companies and public funded research institutions.

Higher and more permanent investments in R&D and an increased purchased R&D from public funded research institutions is intended to increase innovation capacity, the number of patents and licenses. Thus, the changes caused by SkatteFUNN leads to more innovative companies in Norway. Finally, the increased innovation level is expected to increase economic growth.

Figure 4.2 Chain of effects from SkatteFUNN



Source: Samfunnsøkonomisk analyse, 2015

4.1.2 Explaining additionality

One of the main arguments for public intervention is additionality. In the case of SkatteFUNN, additionality is referring to activities or increased activities that would not have happened without public intervention. Even though a public scheme does have measurable effects on participating companies, it is not tantamount to economic effects. E.g. if a public scheme supports an already successful project in a company, the scheme will be successfully measured by private economic impact in the particular company. Yet, the overall economic effect is negative. The funding of the scheme stems from taxpayers, who experience a welfare loss. Furthermore, the alternative cost represent an economic loss because the funding could have been allocated to other alternatives, with higher impact.

The core of the problem is that all public funded schemes should stimulate activities that otherwise would not have taken place. This is, and must always be, the first criteria of evaluating a public scheme. The logic is quite simple; if the scheme does not stimulate additional activity, then the scheme does not address its common objective. Alternatively, the scheme's design might be of poor quality in terms of target group, incentives and intervention.

When a public scheme address activities or projects, one can approach the question of additionality as the relation between the return on investment and risk. This is so for every investment. Portfolio theory states that any rational actor will chose the projects or investments that maximise the return of investment at a given level of risk.

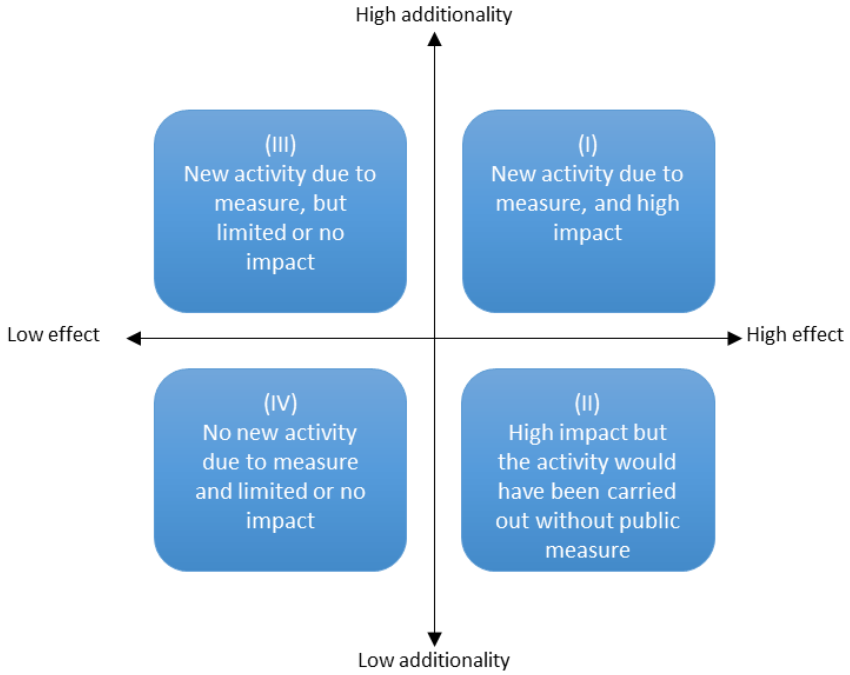
Different kinds of market failures, or even social aims diverging with private economic or commercial aims, cause a lack of investment. In addition, it is possible that society will have other measures for success and thus other measures and assessments of risks. The overall society will have a much broader portfolio of projects, and therefore be less vulnerable to unsystematic risk.

Determining impact of public schemes heavily relies on the level of additionality. This must be done as part of the impact assessment, where estimated effects are combined and compared with already known or estimated additionality. In that case, the impact assessment will be adjusted for additionality and thus account for policy aims. Adjustments will by no means be perfect, but it will increase the level of the impact assessment and relate it to the initial policy aims.

We can derive four archetypes of results of public schemes supporting private projects. The figure below present the four types of result, consisting of:

- Result I: Provides a high additionality and has a large effect. This scheme enable projects that would otherwise not have been initiated, due to market failure, and these projects have high effect.
- Result II: Provides high effect, but low or no additionality. The scheme support profitable projects, that would have been completed independent of the measure. These kind of projects have a negative economic impact on society overall, because the cost of resources allocated to a project with no additionality, could be allocated more efficiently.
- Result III: Provides high additionality, but low effect. The scheme support projects that, otherwise, would not have been initiated. However, because the project display no or limited effect, it is hard to justify public support.
- Result IV: The scheme supports projects with low or no additionality and effect. As such, the result of this scheme is a complete failure, and therefore the scheme is a waste of resources. It does not capture the target group and it does not support the aim of the target at all.

Figure 4.3 Success of public schemes, coherence between additionality and effect



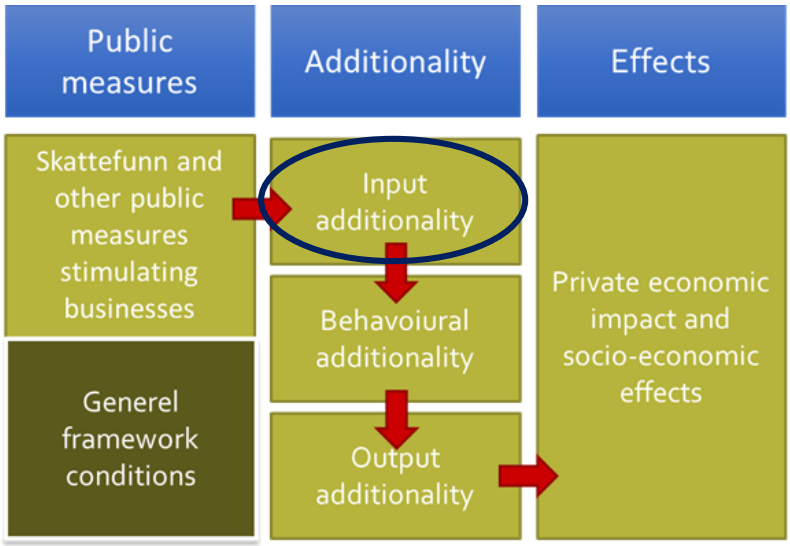
Source: Samfunnsøkonomisk analyse, 2015

4.2 Effects of stimulating R&D

Schemes stimulating R&D aims at additional R&D activity. This being increased investments in R&D, both internally and in combination with other public schemes. This investment include an increased number of researchers employed in the supported companies. In turn, the increased activity is expected to cause an increase in the number of new patents registered and in the number of innovative companies. Therefore, increasing the private value added, and have an impact on the overall economy.

Following the intervention logic from SkatteFUNN, earlier in this chapter we deduct potential indicators measuring additionality and effects of SkatteFUNN. Primary indicators measuring the impact of SkatteFUNN can by divided by the steps in which SkatteFUNN is intended to intervene. The initial effects of SkatteFUNN is stimulating the input additionality.

Figure 4.4 Input additionality from SkatteFUNN



Source: Samfunnsøkonomisk analyse, 2015

4.2.1 Input additionality

The main target for SkatteFUNN is to stimulate private R&D activity. Thus, measures of input additionality will be of high importance in an evaluation. To a certain extent the success of SkatteFUNN is decided by whether or not it leads to additional R&D activities. If SkatteFUNN does not lead to any additional R&D activity, the scheme is a failure with no economic impact and a waste of public resources.

There are several ways of measuring input additionality. The Commission Staff Working Document, puts forward additional research, development and innovation (RDI) activity as a direct impact of the aid (2014). This is further specified to cover "additional RDI expenditure undertaken by supported companies". Focusing on additional RDI expenditure is an obvious indicator, and it has been central in other evaluations of R&D tax deduction schemes in Norway, UK, Netherland and France (European Commission, 2014).

Another relevant indicator is R&D employment. This is also an indicator put forward by the European commission (2014). However, they define the indicator as "number of new researchers employed in the supported companies". What exactly the term "researchers" mean is not clear. It could mean employees with a PhD. On the other hand, not all R&D employees are defined to be people with PhD's as they are measured and defined by the Frascati Manual (OECD, 2002). R&D-employees are defined as people, who allocate some or all of their working hours to R&D activities and they are not defined by level of education, in the Frascati Manual.

A third indicator worth mentioning is continuous R&D investments. In the evaluation of SkatteFUNN by Statistics Norway (SN), it is stated that R&D investments under given conditions are

quite stable (2008). This actually contradicts with a Nordic report based on micro level R&D statistics (Christensen, Frosch, Boysen, Mark, & Knudsen, 2014). In this report, implementation of a set of imputation rules were necessary in order to construct panel data across four Nordic countries, indicating that R&D investments may not be as stable as claimed.

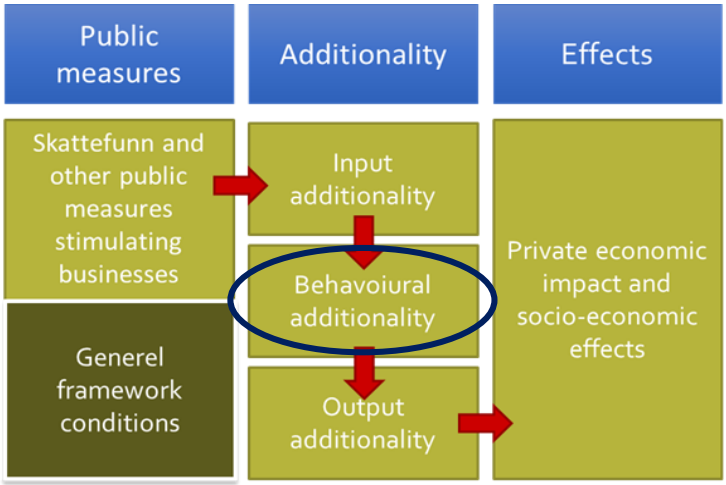
Continuous R&D investments is a proxy for building R&D capacity. Building R&D capacity enhance the company absorption capacity, which in turn increase the ability to gain, process and commercialize new knowledge (Cohen & Levinthal, 1990). Graversen & Mark (2003) shows that companies with permanent R&D activities significantly increases the probability of participating in R&D collaboration, indicating that these companies are more attractive as R&D collaboration partners. In addition, a Danish study points out that companies initiating a collaboration with public knowledge institutions increases their productivity by a yearly average of 9 percent (Frosch, Christensen, & Mark, 2011). Thus, we recommend continuous R&D investments as an important indicator for input additionality.

A fourth indicator is the number of companies investing in R&D. Increasing R&D activity does not only imply increasing R&D investments for those already investing in R&D. The additional activity also stems from those deciding to begin investing in R&D. A higher share of R&D performing companies does not only increase the probability of increasing the number of innovative companies, it also increases the number of potential R&D-collaboration partners (van Geenhuizen, Trzmielak, Gibson, & Urbaniak, 2008).

4.2.2 Behavioural additionality

Stimulating R&D activities also imply altering the way you conduct R&D activities, i.e. a change in behaviour. This can be in terms of R&D activity type; whether the R&D activities are matched and geared by other public funding, or whether the R&D activities are conducted jointly with others. These are all potential changes in the way companies commonly conduct their R&D activities, and can be viewed as behavioural changes.

Figure 4.5 Behavioural additionality from SkatteFUNN



Source: Samfunnsøkonomisk analyse, 2015

A central target for SkatteFUNN is to stimulate R&D collaboration between companies and public funded knowledge institutions. This is seen as a way of transferring knowledge and capacity from public funded knowledge institutions to companies, and thus into the market. SkatteFUNN provide incentives for stimulating increased R&D collaboration, because R&D bought from knowledge institutions has a higher tax deduction limit. Thus, we recommend R&D collaboration as an indicator. In addition to R&D collaboration, we suggest to use R&D bought from public funded knowledge institutions as an indicator. Although, as Mark et al. (2011) shows, there are no private economic effects of buying R&D.

The Commission also points out private R&D investments matching public support as a relevant indicator. SkatteFUNN must analysed as an addition to other schemes in the Norwegian and European R&D support system. If SkatteFUNN can stimulate to increased usage of other support schemes and participation in national and international projects, this is a strength of SkatteFUNN.

A third indicator is the nature of the R&D activities. The Frascati manual divides R&D activities into three categories: Basic research, applied research and experimental development. The distinction between the three is defined as:

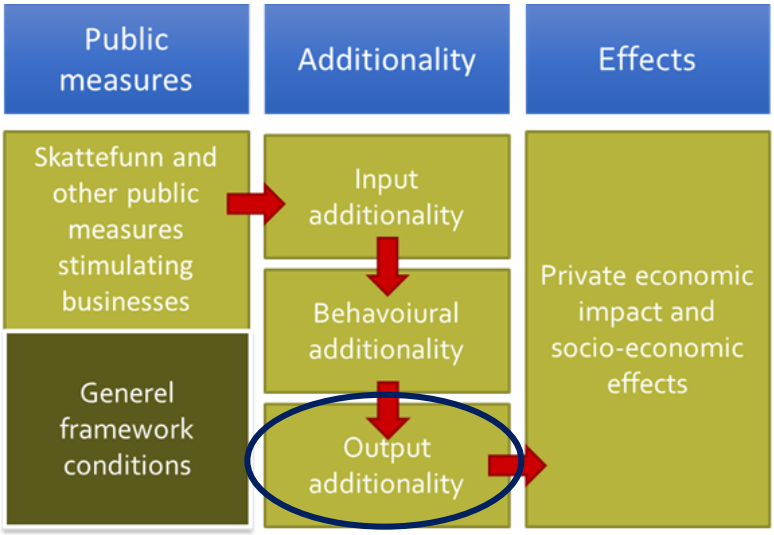
> *"**Basic research** is experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundation of phenomena and observable facts, without any particular application or use in view. **Applied research** is also original investigation undertaken in order to acquire new knowledge. It is, however, directed primarily towards a specific practical aim or objective. **Experimental development** is systematic work, drawing on existing knowledge gained from research and/or practical experience, which is directed to producing new materials, products or devices, to installing new processes, systems and services, or to improving substantially those already produced or installed."*

Frascati Manual (2002): Proposed Standard Practice for Surveys on Research and Experimental Development, OECD, 2002.

4.2.3 Output additionality

Increased R&D activities is expected to increase the level of innovation in the companies. Innovations can be a way of turning R&D investments into something relevant for the market. Furthermore, it is an important source of capitalizing on R&D investments and an output measure of SkatteFUNN.

Figure 4.6 Output additionality from SkatteFUNN



Source: Samfunnsøkonomisk analyse, 2015

According to ESA, the number of enterprises supported to introduce new products or services to the markets is a direct impact of research, development and innovation aid. To elaborate and specify on the result indicator we suggest focusing on innovations. That being either product innovation or process innovation. According to the Oslo Manual, product and process innovation can be defined as:

> *"A **product innovation** is the introduction of a good or service that is new or significantly improved with respect to its characteristics or intended uses. This includes significant improvements in technical specifications, components and materials, incorporated software, user friendliness or other functional characteristics."*
>
> *"A **process innovation** is the implementation of a new or significantly improved production or delivery method. This includes significant changes in techniques, equipment and/or software."*

OSLO MANUAL: GUIDELINES FOR COLLECTING AND INTERPRETING INNOVATION DATA (OECD, 2005)

The increase in innovation does not say much about the magnitude of the innovation or the number of innovations introduced. A way of further elaborating on the innovation is to focus on the novelty of the innovation. Schumpeter (1934) argues that innovations can be divided into two overall categories. The *"incremental innovation"* which can be seen as a continuously advance in the process of change. Whereas *"radical innovation"* creates major disruptive changes.

One way of further elaborate on the novelty of innovation is by dividing the innovations into three categories. If the innovation is new to the company or new to the market of the company, then the innovation is viewed as incremental. Whereas, if the innovation is brand new on the

global market, i.e. the novelty goes beyond the company and its existing market, then the innovation is labelled a radical innovation.

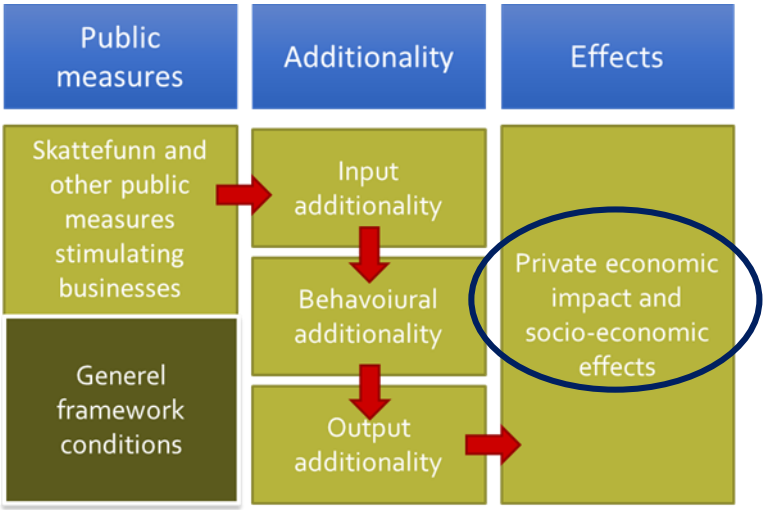
Another indicator of the magnitude of innovations is to focus on the proportion of revenue that stems from innovation and, how much of the revenue stems from innovation that are new to the world, new to the market or new to the company. The rest of the revenue stems from products or services that are not thought of as innovations.

Furthermore, ESA suggest patents as a possible indicator on output activities. Patenting is one way of protecting research-based innovation. However, patents are not viewed as the most applied way of protecting innovation (OECD, 2003). The OECD report find that copyrights and industrial design are commonly used as intellectual property rights, and are more widespread than patens. Never the less, patents can be an indicator of output from R&D activities.

4.2.4 Effect indicators

The ultimate reason for focusing on increased R&D is to improve company performance. Increasing performance covers the ability to provide a market with new products or services allowing the company to demand a higher mark-up price or gaining new markets. It also covers the ability to reduce costs of production by exploiting various input factors more efficiently. An evaluation of SkatteFUNN must have the ambition to measure the impact on company performance. Furthermore, the argument for using public funding to support private R&D must be that the support lead to economic effects.

Figure 4.7 Chain of effects from SkatteFUNN



Source: Samfunnsøkonomisk analyse, 2015

There are several ways of measuring the private economic impact. A stated increased performance can be caused by a better position in the market or a more efficient use of input factors. In order to illustrate this, it can be fruitful to take a closer look at the standard Cobb-Douglas productivity function:

$$Y = AL^{\beta}K^{\alpha}$$

The productivity function consists of the following; Y is the total production value (value added) for the company. L is the labour input, K is capital input, α and β are output elasticities[7] of capital and labour relative to total production.

If a company introduces new products or services, and the market respond positively, Y will increase even without changes in L or K. On the other hand, if a company improves its internal processes, leading to a more efficient use of input from labour and capital, then the company can withhold the level of Y with a lower level of L and K. Both changes will cause an increase in productivity.

There are several ways of measuring productivity. The most common measure is labour productivity. Labour productivity measures the difference between growth in production and labour input. Its major advantage is the simplicity; it is easy to measure and to interpret. Yet, labour productivity is only a partial productivity measure and only reflects the joint influence from other inputs. E.g., it neglects the specific input from improved technology. Furthermore, the term is often misinterpreted as improvements of productivity of the single employee (OECD, 2001).

In order to measure productivity gains from leaps in technology it is advised to use total factor productivity (TFP). TFP measures the difference between productivity growth and growth in all measureable input factors. Thus, TFP is a measure for how efficient each unit (company, sector or nation) converts various input factors into production.

Whether to use labour productivity or TFP is debatable. Often TFP is proclaimed the preferred measure, but labour productivity is the measure implemented because it is easier to obtain in data. Empirical studies show a high correlation between the two measures. SN finds that the correlation is above 0.9, across 50 sectors and between the years 1972 and 2014. SN conclude that, since labour productivity is easier to measure, to calculate and to communicate, there are advances without major drawbacks in choosing labour productivity, instead of TFP, as a productivity measure (Halvorsen, et al., 2015).

Another indicator on the private economic impact is return on investment. Return on investment can be measured through various output measures. We suggest that the evaluation of SkatteFUNN follow international research and focus on productivity as an output measure. As discussed above, productivity can include both labour productivity and TFP (Hall, Mairesse, Mohnen, 2009; DASTI, 2013).

Return on investment analysis also allows for conducting marginal return on investment. This allows for analysis of the effect of investing one additional kroner or increase the investments by 1

[7] Elasticities is the relative measure between input and output, e.g. if the elasticity of labour is 0.75 then a 1 pct. Increase in the labour input will lead to a 0.75 pct. Increase in Y.

per cent. This is of particular interest if the evaluation should answer questions regarding the possible effects of decreasing or increasing subsidies to SkatteFUNN.

In order to account for economic effects there are various possible ways of measuring external effects or spillover effects. In principle all indicators based on the intervention logic of SkatteFUNN is eligible. To point out the economic effects can focus on additional and time lagged increase in R&D investments in non-beneficiaries, increased R&D collaboration, increased innovation and increased productivity.

Furthermore, it can be argued that any positive private economic impact for the beneficiaries will lead to derived and ripple effects in the economy. These effects can be seen as consequences of increased economic activity in certain sectors and geographical areas due to SkatteFUNN. The positive economic effects impacts from SkatteFUNN stems from i.e. increased employment, increased income, increased tax revenue and increased national demand, see Mark et.al. (2010).

In order to delimit the analysis we will suggest not including a full analysis of economic effects. Skattefunn is aimed at increasing private R&D for the benefit of companies, and that must be the main target. If the evaluator is able to identify additional and private economic effects, then it will most likely also have positive effects on society.

4.3 Complex transmission mechanisms and time lags

Measuring the effects of SkatteFUNN is complex because the scheme aims at increasing R&D investments. Whereas measuring the impact on R&D investments can be relative straight forward, the question on additionality complicates the impact assessment. Our exposition of various effects due to the intervention logic states more complicated impacts. There is no straight line between increased investments in R&D, increased innovation and private economic effects. The link is much more complex with various transmission mechanisms, e.g. where investments lead to patents, which again stimulates R&D investments in order to develop the innovation, which may or may not be a success in the market. Another dimension that complicate the impact assessment is time lags from changes in R&D investment or behavioural changes to measurable impact.

4.3.1 Who will benefit from the R&D investments

With the complex transmission mechanism and knowledge being a non-rivalry good, the impact from SkatteFUNN is not solely isolated to the beneficiaries.

Spillover effects will occur among closely related companies. That being relations formed by participation in joint markets, but also relations formed by geographic proximity. Furthermore, spillovers occur in the general society. OECD has summarised empirical studies from recent years and state that the spillover effects from being within the same sector or geographical proximity

increases the return on R&D investments from 20-30 per cent to 30-40 per cent. In addition, OECD concludes that if spillover effects are set to include the whole of the economy, the potential effects measured as return on investment increases to estimated 50-100 per cent.

In order to assess the full impact of SkatteFUNN, the evaluator can investigate thoroughly who will benefit from the scheme and a potential increase in private R&D investments. However, we will not recommend this as part of the evaluation because it will increase the evaluation cost drastically. Instead, it can be argued that identifying impacts of Skattefunn will most likely be a minimum estimate because spillover effects from enhancing the knowledge base and ripple effects from increased economic activity will benefit non-beneficiaries. This can be supported by the comprehensive literature in the area.

4.3.2 When to expect an impact

Another central element is when to expect an impact from the scheme. The effect of SkatteFUNN, and other schemes, can hardly be measured by discrete variables. The potential effects will be evident gradually. However, the intervention logic does provide some simplistic insights to order of effects. It is, for example, hard to argue for productivity gains from SkatteFUNN, if there are no effects on R&D investments.

The various impact measures have different potential time lags. Initially additional R&D investments will potentially occur already the same year as the tax deduction are implemented. Furthermore, a change in behaviour may also occur the same year, but the full effect will most likely not be evident during this year. In particular, changes in behaviour will change over the first years.

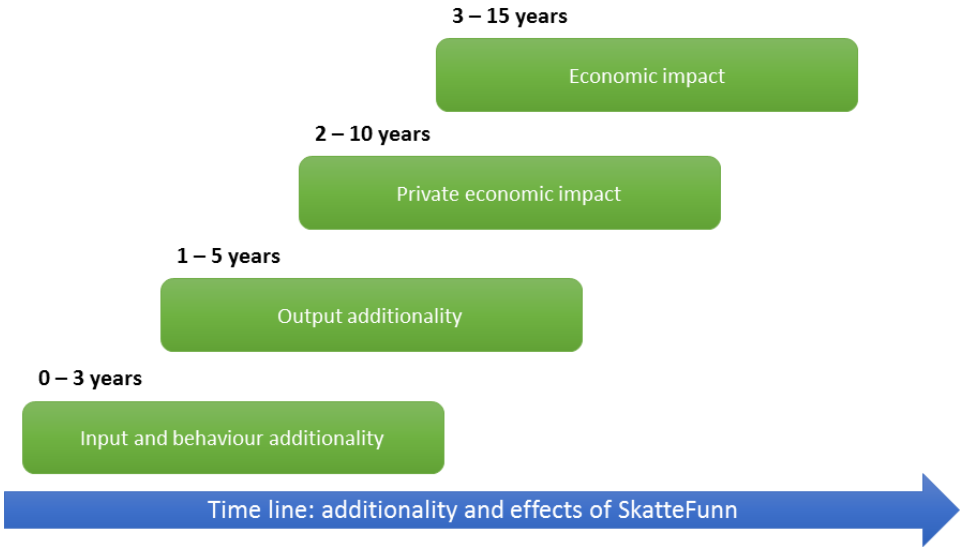
On the other hand, various aspects of innovations, patents and licensing are most likely not evident the same year as the tax deduction were implemented. Innovations and particular patents will first become visible in data in the years after the tax deduction, due to their application process. It is likely that that the full effect on innovation and patents will be evident years after the initial tax deduction.

There will typically be a time lag between the initial R&D investment and the potential effect on company productivity. The time lag will vary depending on the type of R&D investment involved. Moreover, it is difficult to isolate the effects of R&D investments on a specific time from the effects of accumulated knowledge through previous R&D investments (Rouvinen, 2002).

Finally, the broader economic impact from increased R&D investments will not be evident before the private economic impacts. The time span for broader economic impact is even longer than the private economic impact. This is both due to the ripple effects from increased economic activity derived from the private economic impact, but also to the impact of inventions or innovations in society and spillover effects to other companies.

Figure 4.8 gives an illustrative example of when various effects may occur. The example is not conclusive in any way, but still provides a useful illustration of the steps in which the evaluator can expect effects to occur.

Figure 4.8 Time line for expected effects of Skattefunn



Source: Samfunnsøkonomisk analyse, 2015

4.4 Relevant performance indicators

Based on the previous chapters, we recommend the following indicators as central for the impact assessment. The indicators include both measures of additional activity and effects. To sum up from the intervention logic, we have described how the impact assessment of SkatteFUNN needs to focus on both additionality and impact. The table below include the recommended indicators divided by the various types of additionality and impact that were argued during our exposition of SkatteFUNN's intervention logic.

Table 4.1 Listing relevant performance indicators.

Input additionality	Behavioural additionality	Output additionality	Private economic effects	Other economic effects
• Additional R&D investments	• R&D collaboration • Buy R&D	• Patents	• Labour productivity	• Changes in R&D activity in closely related sectors
• More companies invest in R&D	• Matching public R&D support	• Innovation activity	• Total factor productivity	• Changes in R&D activity due to geographical proximity
• Continuous R&D investments	• Division of basic and applied research as well as experimental development	• Novelty of innovations	• Return on investment	• Increased economic activity due to increased private economic effects
• R&D employment		• Share of revenue from innovation		

Source: Samfunnsøkonomisk analyse, 2015

5. Evaluating SkatteFUNN in practice

In this chapter, we will review and discuss potential evaluation methods for the SkatteFUNN scheme, with particular emphasis on the criteria thoroughly debated in the Commission Staff Working Document (European Commission, 2014), which were discussed in Section 2.

We do this in several stages. First, in Section 5.1, we address the possible methods for identifying the direct effects. The suggested methods are in line with the guidelines from the European Commission Staff working paper on evaluation of state aid, but other possible econometric models are also presented (2014). Then, in Section 5.2, we describe the indicators needed, the corresponding data and the cost of data for conducting such an impact assessment. Section 5.3 presents ways of addressing proportionality, appropriateness and the effects of alternative schemes. In section 5.4 focus we on the analysing the question of misuse of SkatteFUNN. Whereas section 5.5 present possible ways of analysing distortive effects

It is also important that the evaluation include a thorough literature review related to the externalities of R&D investments in general, and the impact of various schemes implemented to correct for the marked failures hindering R&D investments. This would provide a more solid insight into how R&D investments influences the overall society, and how SkatteFUNN incentivise further R&D investments in relation to other forms of governmental intervention. There exist a vast amount of literature on this topic, in particularly international literature.

5.1 Econometric modelling

The choice of econometric method depends on the policy evaluated and on the available data. The impact of SkatteFUNN on the economy is divided into direct and indirect impacts. The indirect impact could for instance be spillover effects on other firms (e.g. positive spillover from R&D or the crowding out of investment by other competing firms) or displacement effects (e.g. shifts in economic activity from one region to another).

Understanding the magnitude of the direct impact is crucial to assess the level of efficiency and effectiveness of a public scheme. For example, the absence of additional investment in R&D by aid beneficiaries is indicating failure of the policy, unless very convincing arguments can be made about the existence of large and beneficial indirect effects. The contrary is also true: even if the evaluation find positive direct impact of SkatteFUNN, the question remains whether there may be negative indirect effects that offset or even outweigh these.

Assessing the impact of a scheme consist of two key parts. First, we wish to identify indicators that are robust measures of the outcome in question. Second, an impact assessment must be able to answer the question of causality. As the European Commission's the State Aid evaluation guideline asserts, this is not a trivial task. The main problem is to estimate how the beneficiaries would have evolved without the effect of the scheme.

In the following, we will present possible ways of conducting the impact assessment in practice. This will include how to set up models that can address the question of causality. Furthermore, we will outline suggestions for indicators needed to implement the impact assessment in accordance with the ESA guidelines.

The ESA outlines two overall approaches to setting up models for impact assessments. The first is to conduct randomized experiments. This approach is favourable because there are no selection effect, and thus no selection bias either, since the beneficiaries are selected randomly. However, it is difficult to argue for random selection of beneficiaries approved by the SkatteFUNN scheme. This is also confirmed by ESA, that this method may be difficult to implement in practice, in particular for large existing schemes. As such, we conclude that conducting a randomized experiment is nugatory, but we will provide a more detailed description below.

The second approach outlined by ESA for conducting impact assessment is quasi-experimental. The quasi-experimental method provides the possibility of setting up models that estimate the counterfactual situation. By utilizing the quasi-experimental design, we are able to use existing sources of exogenous variation in order to identify causality. The quality of the evaluation will crucially depend on how convincingly the models can establish exogeneity of the control group. The ESA points at three different methodologies for completing quasi-experiments; difference-in-difference, instrumental variables and regression discontinuity design. We describe them further in this chapter.

5.1.1 Randomized experiments

If the beneficiaries of the scheme were selected at random, it is possible to conclude that the difference in outcomes is caused by the scheme. Implying no systematic difference between the enterprises receiving support from the scheme and those not receiving support, except from the support.

The causal impact of a scheme is measured as the difference between the outcome with support from the scheme, and the outcome without support of the scheme. The complication is that beneficiaries of a scheme is rarely selected at random. Furthermore, the same firm is not able to observe both outcomes, hence, we do not observe the outcome that would have been without the support of the scheme, for those receiving aid. It is likely other factors separating firms who received aid, and who did not, than just the aid.

Ideally, the evaluation would make sure that no confounding factors affected the estimated impact of SkatteFUNN. It is, however, impossible to perform this evaluation as a random experiment, and therefore impossible to exclude the possibility of confounding factors. Therefore, the analysis will be of a quasi-experimental design.

5.1.2 Quasi-experiments

The quasi-experimental approach is commonly utilized when evaluating the impact of policy from an ex-post perspective. Selection of this method is often due to the impossibility of performing a randomized experiment. Quasi-experiments include the establishment of a group of companies not receiving aid, who are as similar as possible to the group of enterprises receiving aid, ideally in all aspects expect from the aid. This group is called the control group, whereas the group of companies that did receive aid is the treatment group. It is necessary to control for the observable differences between these groups, and bear in mind that firms who receive support typically differ in various characteristics from those who did not. By analysing the difference between the control group and the treatment group, it is possible to evaluate the impact of the scheme. It is crucial for the validity of the evaluation that the quality of the control group is high, and that systematic differences between the beneficiaries of the scheme and the firms in the control group are controlled for, and thus does not bias the result.

Ensuring a high quality of the control group is the most significant challenge to overcome within the quasi-experimental framework. Furthermore, because SkatteFUNN is a general rights based scheme, it is highly challenging to establish a control group. The control group should ideally include firms who would have wanted to utilize the scheme, but were refused. However, this scheme will approve anyone who meet their requirements. Hence, this control group would be suboptimal because those refused would not be similar to those approved. Therefore, a better strategy would be to use the firms who would be approved by SkatteFUNN, but did not apply (possibly, because they were unaware of this opportunity) as a control group. However, this performance would also be difficult to conduct in practice.

The paragraphs below will outline the most common methods utilized to evaluate policy impact in a quasi-experimental framework. We will present our recommended approach in chapter 6.

Matching techniques

Matching is a useful method to create the treatment and control groups utilized in the quasi-experimental framework (e.g. in a difference-in-difference model). Matching is a common method of pre-processing data to improve causal inferences. In evaluating the impact of a treatment by comparing, those treated with those not treated, matching techniques are found efficient. The objective of matching is to mimic randomization, and hence reduce the possibility of bias, by establishing a group of treated entities that is comparable on all observed variables to a group of non-treated entities.

The process involves pairing every treated entity with a similar, but non-treated entity. In the case of SkatteFUNN, it would mean pairing each company receiving aid, with another company or a group of companies that is highly similar, but did not receive aid. It is a nonparametric method of pre-processing data in order to control for some, or all, of the potentially confounding

influence of pre-treatment control variables. This is conducted by reducing the imbalance between the treatment and control group. Lowering the imbalance reduces the model dependence and bias (King and Nielsen, 2015).

Matching is a useful way to control for observables in the context of a valid empirical strategy. The observables used for matching can be company characteristics or the estimated probability to receive aid. Furthermore, the procedure motivates more sophisticated discussions of unobservable variables that might be correlated with the causal variable.

After completing the matching process, any analytical method can be applied to estimate the causal effects of the treatment. In other words, the treatment and control groups established by matching techniques can be utilized in other methods within the quasi-experimental framework. For example, by utilizing the groups created by matching, the quality of the result from using the difference-in-difference approach is increased.

Below two of the most common matching methods will be briefly explained.

Propensity Score Matching

The propensity score matching (PSM) method is the most common matching method (Rosenbaum and Rubin, 1983; Austin, 2011; Wells et al, 2013). It involves fixing the treated sample size ex ante, and then attempt to reduce the imbalance between the treatment and control group, resulting from the treatment.

This method also employs a predicted probability of an entity belonging to either the control or the treatment group to establish the groups. This method has the advantage of balancing the groups on a large number of explanatory variables, without losing a significant amount of observations. The first treated entity is matched by the most similar entity from the control group; the rest of the entities will be matched by their most similar entities from the control group, which has not already been matched, until all treated units have matches. It is also common to remove matched pair with larger distance than a preselected limit.

A disadvantage with this method is that there might be unobserved variables affecting the probability of entity affiliation, but cannot be accounted for in the matching procedure.

Coarsened Exact Matching

The coarsened exact matching (CEM) method invert the process. This method involves fixing the imbalance between the treatment and the control group ex ante, and then attempting to lose as few treated entities as possible ex post. The pre-selected level of imbalance is based on intuitive substantive information. The researcher selects certain characteristics of the sample ex ante, and in the matching process, all entities not satisfying this description are excluded (Iacus, King, & Porro, 2011).

Several recent studies favour CEM over PSM (Wells et al., 2013; Iacus et al., 2013). Advantages these studies point to includes that increasing balance on one variable cannot increase the imbalance on another in CEM, whereas this can happen in PSM. Furthermore, it is an easier method to implement and it is less sensitive to measurement error.

Difference in Difference

In order to evaluate the causal effect of the scheme it is necessary to combine the analysis of differences between the treatment and the control group, with a comparison over time. This approach is named Difference in Difference (D-i-D) because one considers the *difference* in performance between the two groups of firms in *different* periods of time. The pre-existing differences are to be identified, and would not be due to the scheme. When the pre-existing trend is identified, any observed difference in performance between these two groups in the period after implementation of the scheme is explained by the scheme. More precisely, one compares the difference in outcomes between the firms receiving support from the scheme, and the control group, before and after the support is received, and then attributes the change in the difference between the two groups to the scheme.

One crucial assumption for the validity of the result is that the difference between the treatment and control group is stable overt time. Any external shock should have the same impact on both groups. It is of high importance that underlying trends, also known as the parallel trend assumption, are identified and managed.

There is in principle two ways of managing underlying trends. One is to include explanatory variables that explain trend differences in a linear regression. Another approach is to use matching procedures to define the population under the assumption that if beneficiaries and non-beneficiaries are alike they will also be subject to the same influential factors. This is enhancing the fact that matching techniques are useful for establishing internal validity of the estimation because selection of a proper control group is essential. The D-i-D approach is a technical method, whose result is crucially dependant on the selection of an appropriate control group.

Instrumental variables

The method of instrumental variables is used to estimate causal relationships within the quasi-experimental framework. A linear regression estimates the magnitude of association, rather than the direction of causation, which is necessary for policy evaluation. The instrumental variable approach allows for a consistent OLS estimation even when the regression is facing the endogeneity problem, i.e. when the explanatory variables are correlated with the error term. In the presence of reversed causation or omitted variables, an instrument can be utilized to secure validity. The instrument should not be an explanatory variable in the regression, but should be correlated with endogenous explanatory variables.

There are two main requirements to consider when selecting the appropriate instrumental variable:

1. The instrument must be correlated with the endogenous explanatory variable
2. The instrument cannot be correlated with the error term

No test exists of the validity of exactly identifying instrument variables, thus one has to be very careful in choosing the variable. Therefore, one will need good economic arguments to assess the validity of the evaluation. Furthermore, the issue of weak instruments needs to be addressed. That is the case where instrumental variables are weakly correlated with the indicator of being a beneficiary or not, which will lead to imprecise estimates. In addition, there may be a temptation to use more instrumental variables or even to create a vector of instruments, but again caution is needed in evaluating the instrument variable since many weak instruments do not add up to a solid instrument vector.

Regression disconuity design

Regression discontinuity design (RDD) typically involves both the differences-in-differences and instrumental variables method, but hinges on a trait of the policy under evaluation, namely that the assignment is based on whether agents are above or below a (or several) threshold value(s).

The benefit of RDD is that, locally, around the threshold, the agents are likely to be highly similar. Hence, RDD is a local difference-in-difference measure, where local signifies that the estimation is primarily valid around the threshold, not necessarily across the whole sample. Moving away from the threshold implies greater differences between the compared groups (treated and control).

In the case of SkatteFUNN, the threshold value could for example be the maximum deduction basis allowed under the scheme. Those with R&D expenditures above this threshold value are not affected at the margin. For them, SkatteFUNN is simply a cost reduction with no incentive to invest more since the cost of a marginal increase in investment is unaffected by the existence of SkatteFUNN. However, businesses with lower R&D expenditures than the threshold value will be incentivised to increase their expenditures because this is, with SkatteFUNN, less costly at the margin. They can marginally increase their investment, with reduced costs because of the scheme up until the cost of the investment reaches the threshold. A large investment generally means that the firm is either large or R&D intensive, or both, whereas a small investment generally means the firm is small or not a R&D intensive firm, or both. Thus, including observations further away from the threshold can potentially increase the selection bias. The drawback of the RDD method is therefore that large datasets are required to ensure that the number of observations close to the threshold is sufficient.

5.1.3 Ordinary Least Squares (OLS)

OLS is a method of estimating the unknown parameters in a linear regression model that minimize the differences between the observables and predictions. In the case of SkatteFUNN, it would be possible to utilize this method as one alternative to estimate the additionality of the scheme. In

the previous evaluation of SkatteFUNN a simple regression model where revenues and R&D subsidies explained entities investments in R&D. Furthermore, this regression included a dummy variable to incorporate macro- and microeconomic shocks, entity characteristics affecting the level of R&D investment and controls for whether entities are beneficiaries of the SkatteFUNN scheme.

The most common method to distinguish between the treatment and control group is by linear regression. Utilizing the OLS framework provides the opportunity of including more control variables, and hence increasing the quality of comparison between the treatment and control group. A linear relationship between the effect of the scheme, i.e. increased R&D investments, and other characteristics of the firm (i.e. aid, size, industry, age) is then assumed.

The 2008 evaluation of SkatteFUNN also utilized this framework to answer problems such as impact differences between the short and the long-run, or whether specific entity characteristics could be associated with the degree of additionality.

The table below summarises the pros and cons for choice of models.

Table 5.1: Pros and cons of different evaluation methods

Model	Pros	Cons
Randomised experiments	The best way of establishing a proper control group and hence, key to obtaining valid estimates of the scheme's causal impact.	Not feasible with large existing schemes such as the SkatteFUNN scheme.
Difference-in-Differences	Intuitive and easy to manage. Flexible with regard to design. In order to evaluate a causal effect of any scheme this method is very useful because it evaluates the between the treatment and the control group, with a comparison over time.	The parallel trend assumption is crucial and every model needs to address this by including observable variables. This method also has a tendency to overestimate the statistical significance of the results.
Instrumental variables	Well-known way of addressing causality and handling selection bias between beneficiaries and non-beneficiaries.	Difficult to identify proper instrument variables. Furthermore, we cannot test whether or not we have identified good instruments. To justify the instruments validity, it is necessary to prove that it is correlated with the endogenous independent variable, but not with the residual term.
Regression discontinuity design	Easy to implement and works well with the SkatteFUNN scheme because there is an upper threshold for tax deduction. This is also the main empirical method that was used in the previous evaluation of SkatteFUNN.	The major drawback of using this method is that it can only evaluate the impact of the scheme for the entities close to the threshold. The need to address observations that are far from the threshold, both among beneficiaries and non-beneficiaries, will not be considered. Therefore, the firms who began their investments in R&D due to SkatteFUNN will not be included. I.e. those who went from zero in R&D expenditures, to some level greater than zero.

OLS	This method is common, easy and flexible. It is possible to include more control variables, and hence increase the quality of comparison between the treatment and control group by utilizing this framework. It is also possible to identify the difference in impact across time and the relation between entity characteristics and additionality.	The major drawback of this method is the assumption of linearity, which might not be the case in reality. Furthermore, this method minimize the sum of squared errors, and is sensitive to extreme values, who will have a disproportionally large impact on the results.

Source: Samfunnsøkonomisk analyse, 2015

5.1.4 Return on Investment

The return on investment in R&D cannot be estimated in the same manner as the rest of the indicators. This is firstly because the return has to be modelled as a function of the accumulation of research capital. Secondly, because one has to control for other investments that matter for value added in businesses. Thus, our suggested method follows the preceding SkatteFUNN evaluation by Statistics Norway (Cappelen, et al., 2008).

At the same time, the evaluation must deal with the complex transmission mechanisms from investment in R&D and further into knowledge capital, before ending up as value added. Regarding this point, the evaluation will need to deal with a long time horizon from investment to return[8], the question of causality and the challenge of the valuation of knowledge capital as a public good.

In the feasibility study, we will examine the possibilities of being able to apply methods and models to estimate the return on investment, as pointed to in the international research literature. The literature[9] favours an approach made up of the following steps:

1. Calculation of R&D capital. This is because knowledge will accumulate over time.
2. The use of an expanded Cobb-Douglas production function to estimate elasticities between R&D capital and value added.
3. Calculate the return on research investment, starting from actual investments and value added.

Point 1 follows, among others, Hall et al. (2009) and the so called “perpetual inventory method”:

[8] See Petri Rouvinin (2002): R&D-productivity dynamics: Causality lags and dry holes.
[9] See Graversen and Mark (2005): The impact of research and development on productivity and employment (Forskning og udviklingsarbejdes påvirkning af produktivitet og beskæftigelse),
Hall, Mairesse and Mohnen (2009): Measuring the Returns to R&D,
Bjørner and Mackenhauer (2011): Estimation of spill-over effects from energy research and other private research (Estimation af spillover-effekter af energiforskning og anden privat forskning),
Christensen, Frosch, Boysen, Mark and Knudsen (2013): Economic Impacts of Business Investments in R&D in the Nordic Countries – a micro economic analysis

$$R_{i,t} = (1-\delta)R_{i,t-1} + IR_{i,t}$$

Where $R_{i,t}$ is research capital in business *i* at time t and $R_{i,t-1}$ is the value of accumulated research investments the preceding year. $IR_{i,t}$ is this year's investments in R&D. δ is the depreciation rate, often set equal to 15 percent in the literature. Graversen and Mark (2005) has tested the significance of different depreciation rates and concluded that changing this value only has a minor effect.

The Cobb-Douglas production function is defined in accordance with the literature. In our case, we imagine the following formula:

$$ln\left(\frac{Y_{i,t}}{FTE_{i,t}}\right) = \varrho_n + \lambda_t + \alpha ln\left(\frac{C_{i,t-1}}{FTE_{i,t}}\right) + \beta ln\left(FTE_{i,t}\right) + \gamma ln\left(\frac{R_{i,t-1}}{FTE_{i,t}}\right) + \sigma ln\left(\bar{X}_{i,t-x}\right) + \varepsilon_{i,t}$$

Where $Y_{i,t}$ measures value added in business *i*, at time t. $FTE_{i,t}$ is the number of full time employed in business *i*, at time t. ϱ_n and λ_t are dummy variables that capture, respectively, industrial and time trends. $C_{i,t-1}$ is invested capital in the preceding period. $R_{i,t-1}$ is the measure of research capital, presented above. $\bar{X}_{i,t-x}$ is a vector of other possible characteristics, for example education level, which Statistics Norway included in the production function in their evaluation of SkatteFUNN (Cappelen, et al., 2008).

As a last step, the return is estimated. Again, we follow the literature and the previous Statistics Norway calculations. When estimating the return, the estimated elasticity between research capital and value added is used. Thus, we can estimate the return on the invested research capital, measured as return on investing marginally more in R&D capital. For this reason, the measure is often called "the marginal return on R&D investment":

$$\rho = \gamma * \frac{Y}{R_{t-1}} - \delta$$

Where ρ is the net return on investments in research capital. $\frac{Y}{R_{t-1}}$ is the median of value added relative to research capital in the preceding period, while γ is the elasticity between value added and research capital in the preceding period. δ is the depreciation rate of research capital, which is set equal to 15 percent, as mentioned above.

In the feasibility study, we will examine the possibility of conducting the analysis described above. The analysis requires time series data on a variety of variables, for example the yearly R&D investments in businesses. Another important variable is the number of workers employed in R&D, as one risks double counting in the models above: R&D employees will both be in each business' number of full time employees, and as part of the business' R&D investments. This has to be accounted for.

5.2 Identifying indicators, data sources and their costs

Identifying the causal impact of SkatteFUNN is the main objective of the evaluation. These effects concern the additional effects from change in input, behaviour or output due to the intervention and the broader economic impact. As described in Chapter 4, several indicators can measure the various aspects of additionality and effects.

In this section, we will present these indicators. In addition, we introduce variables that are relevant either as control variables or as ways of specifying the analyses, e.g. firm size in order to analyse the difference in impact between small and large companies. The section focuses on three central elements:

1. Identify and list the performance indicators
2. Listing potential control variables
3. The estimated cost of relevant data

5.2.1 Performance indicators

Through our review of the intervention logic of SkatteFUNN we identified various ways that SkatteFUNN intervene with Norwegian companies. In the following, we present indicators measuring the various interventions.

Input additionality

- **Additional R&D investments**. Has SkatteFUNN enabled the initiation of more projects than there would have been without the existence of the scheme? This indicator regards the fundamental objective of SkatteFUNN, and is measured using micro level data. This is a counterfactual analysis, conducted using econometric methods.
- **More companies invest in R&D**. Has the share of firms investing in R&D increased since the introduction of SkatteFUNN, and has this share further increased as SkatteFUNN has been made more generous? The indicator measures the proportion of businesses investing in R&D. One can choose to focus on a disaggregated level, i.e. industry or regional level, or on an aggregated level. It is desirable to have a higher proportion of businesses investing in R&D, since this will potentially increase total R&D investments in the economy.
- **Continuous R&D investments**. Are businesses supported by SkatteFUNN continuing their R&D investments, or are they “one-timers”? The indicator measures the proportion of businesses supported by SkatteFUNN that initiates new R&D projects at later stages.
- **R&D employment**. This indicator measures the proportion of employees who are involved in R&D. This can be measured as the proportion with higher education, measured in full-time equivalents. R&D personnel can be researchers, technicians and other supporting staff. More R&D employment is beneficial because it implies more R&D investments in businesses.

Behavioural additionality

The term "behavioural additionality" regards behavioural change in businesses resulting from a government intervention. Changed behaviour in businesses concerning technological development, is arguably an important long-term determinant of the level of R&D and innovation in industries.[10] This is behavioural additionality. The following indicators are relevant:

- **R&D collaboration/ buying extramural R&D**. Are supported businesses cooperating more with approved research institutions? A measure of the cooperation between SkatteFUNN supported businesses and approved R&D institutions. This indicator is relevant because more contact between businesses and R&D institutions implies that businesses have projects that generate results that are interesting for R&D institutions. These so called "university-industry interactions" increase the flow of knowledge, augmenting the potential positive externalities of R&D. Collaboration with approved research institutions might also increase the chance of project success.
- **Matching public R&D support**. Is SkatteFUNN a "gateway policy", i.e. does it lead to increased use of other public support schemes? Governmental aid schemes are put in place for businesses to use, and if SkatteFUNN leads to more use of other schemes, then this is a desirable behavioural effect.
- **Division of basic and applied research as well as experimental research**, see 4.2.2 for definitions. To gain a deeper understanding of SkatteFUNN's effects, one can divide R&D projects into these categories. This indicator regards the nature of the R&D activities, and is measured through a questionnaire survey. The survey should ask business representatives to divide their projects into these categories, while also stating whether the project had positive effects for other participants in the market. This is interesting in itself, but also as a rough measure of potential positive externalities.

Output additionality

The primary focus of the evaluation is to investigate whether R&D investments increase because of the scheme. However, once R&D investments are completed, it should lead to increased innovation, production and profitability in businesses. This can be framed as output additionality. The following indicators are relevant:

- **The number of new patents registered**, as well as the effect of R&D investment on different types of innovations: new products and process innovation. These innovations can be new to the market or new to the business. An econometric analysis into the probability of patenting or innovating is possible, as well as a descriptive analysis. Doing both will enable the evaluator to measure the issue of self-selection. If the descriptive analysis

[10] OECD (2006): Government R&D Funding and Company Behaviour - Measuring Behavioural Additionality. Paris: OECD; Directorate for science, technology and industry, Committee for scientific and technological policy
Buisseret, T. J., Cameron, H. M., and L. Georghiou (1995): What Difference Does It Make - Additionality in the Public Support of R&D in Large Firms. International Journal of Technology Management, 10(4-6), 587-600
Terttu Luukkonen (2000): Additionality of EU framework schemes. Research Policy, 29 (6), 711-724

shows SkatteFUNN supported businesses are more innovative, but the econometric analysis indicate no such results, then self-selection explains the difference in results.

- **Innovative companies,** this much-used indicator state whether companies introduces new products or services to the market, if they implement new processes and if they change the way they approach the markets and are how they are organised. The indicator only state whether or not the companies are innovative in any way and not how innovative they are.
- **Share of revenue from innovation**. This indicator measures to what degree types of innovations have contributed to revenue. These innovations can be new to the market or the business. Statistical data of sales from product innovations can be used as indicator.

Private economic effects

- **Return on investment**, i.e. the financial return on SkatteFUNN supported projects. This indicator is measured as described in part 5.1.4. This is relevant because R&D investments should lead to private return, in most cases, in order for there to be a social return. Therefore, this is a lower bound measure of the social return on SkatteFUNN projects. If there are no positive externalities, then private and social return can be considered equal.
- Time series comparison **of labour productivity** and **total factor productivity** in enterprises approved by SkatteFUNN, and enterprises not approved. The productivity within a sector or region in relation to their SkatteFUNN approved R&D investments. If firms increase their R&D effort, a labour intensive activity, an increase in labour input for a given production or a drop in production for a given labour input should be visible. However, when the project is completed, productivity gains can be measured. Labour productivity is measured as volume of output per full time equivalent of labour input. The latter reflect the hours spent, the effort and the level of skills of the workforce. Total factor productivity is productivity not pertaining to inputs. This variable accounts for the change in output, not caused by changes in labour and capital. Therefore, it cannot be measured directly, but instead as a residual.

5.2.2 Control and key ID variables

Control variables are crucial for the impact assessment. They can be imposed directly into the D-i-D model as covariates explaining variance in performance between beneficiaries and non-beneficiaries. Alternatively, they can be used to delimit population and define control groups.

An alternative use of control variables is to elaborate further on additionality and effects. To give a few examples, a further division of the data will lead to new and relevant analysis. This includes:

- Is the additionality larger in small or large firms? One would expect the former, as large firms tend to have larger R&D projects, and are therefore, not incentivised to the same

degree as firms with smaller projects. This is because SkatteFUNN has an upper limit for the R&D-project's expenses allowing for a tax deduction, above which there is no incentive to further increase the project size, because this does not reduce costs further through SkatteFUNN.

- Is the additionality larger in some regions than others, urban or rural?
- What is the additionality related to education: is it larger in firms with low- or high-educated workers? This is approximately the same as inquiring about additionality in R&D intensive versus R&D non-intensive businesses.

Control variables

The examples mentioned above actively use of control variables to give a more in depth analysis of SkatteFUNN. The control variables applied in the examples above include company size, geographical location and a distinction between companies with either high or low shares of highly educated employees. In addition, export activity is a relevant control variable, as being exposed to international competition might imply greater pressure to invest in R&D.

Several of the control variables from our performance indicators will be reused. This induces an interpretation problem when using performance variables as control and is something the evaluator must take into account. In addition, characteristics of the companies' R&D activities are relevant, in order to deal with selection bias and isolate the effect of SkatteFUNN in the evaluation. This includes, bearing in mind that some of the performance indicators also are relevant:

- Whether a company invested actively in R&D before entering SkatteFUNN, and in general whether a company is investing in R&D continually
- Participation in other R&D and innovation schemes
- R&D project size
- Intramural or extramural R&D
- Type of R&D project: basic, applied or experimental

Data on key ID that can link individuals, companies, SkatteFUNN and other schemes

The final point here refers to data that enables the researcher to link data between the various levels of interest. In the following, we present data used to identify and link the various levels:

- **Serial number for individuals**. This is available across the different divisions at Statistics Norway (SN) that will link individual information to companies. The data are available if the individual has a Norwegian personal identification number, since they are derived from this number.
- **Serial number for companies**. This is available across the different divisions at SN, allowing us to gather and link information from various data sources at SN, to one specific company. The data are available if the company has a Norwegian organisation number.

- **Participation in SkatteFUNN**: This should be linked with other statistics by the company's serial number. This ensures a linkage between SkatteFUNN and other relevant statistics.
- **Participation in other schemes**: This should also be linked with other statistics by the company's serial number. This ensures a unique linkage between participation in other schemes and other relevant statistics. The data should be available with the responsible authorities.

5.2.3 Data, sources and costs

Data on the performance indicators from 5.2.1 can be obtained from the following sources, which must be combined in order to address all the performance indicators:

- SN's R&D survey - Covers all businesses with more than 50 employees and a stratified sample for those with 10-50 employees. This survey was only done every second year 1993-2003 (i.e. 1993, 1995, …, 2003), but annually from then on, the latest available covering year 2014.
- The Norwegian Tax Administration's tax registry - Contains information about paid taxes, deductions and subsidies received. SkatteFUNN deductions and R&D expenses are included.
- Accounting statistics – Joint-stock companies in Norway are obliged to publish accounts annually. This includes book values, revenues and costs, among other things.
- Structural statistics – SN's industrial activities statistics which includes information about production, input factors and investments at the firm level. The data is gathered as part of the tax return, and can therefore be linked with accounts statistics.
- Research Council of Norway - Since the introduction of SkatteFUNN, the Research Council of Norway has collected R&D information on SkatteFUNN applicants. This database is dominated by small firms. There is also the same type of data (project and customer databases) regarding the other scheme's the Research Council of Norway administers.
- Innovation Norway – Administration of project and customer databases for the aid schemes .
- SN's section for industry and R&D statistics – Amongst other things they receive statistics on patenting from the Norwegian Industrial Property Office.
- SN's National Education Database – Education statistics from primary to tertiary education at the individual level.
- The Norwegian Labour and Welfare Administration's AA registry – A database on employers and employees in Norway.

Table 5.1. Matching performance indicators with data sources

Performance indicators	Data sources
Additional R&D investments	- SN's R&D survey - The Research Council of Norway's SkatteFUNN database - The Norwegian Tax Administration's tax registry
More companies invest in R&D	- SN's R&D survey - The Research Council of Norway's SkatteFUNN database - The Norwegian Tax Administration's tax registry
Continuous R&D investments	- SN's R&D survey

	- The Research Council of Norway's SkatteFUNN database - The Norwegian Tax Administration's tax registry
R&D employment	- SN's R&D survey - The Research Council of Norway's SkatteFUNN database - The Norwegian Tax Administration's tax registry - The Norwegian Labour and Welfare Administration's Aa registry - SN's National Education Database
R&D collaboration/ buying extramural R&D	- SN's R&D survey - The Research Council of Norway's SkatteFUNN database - The Norwegian Tax Administration's tax registry
Matching public R&D support	- SN's R&D survey - The Research Council of Norway's SkatteFUNN database - The Norwegian Tax Administration's tax registry - Innovation Norway's user database
Division of basic and applied research as well as experimental research	- New survey data as part of the evaluation
New patents	- SN's section for industry and R&D statistics
Innovation activity	- SN's R&D survey - The Research Council of Norway's SkatteFUNN database
Novelty of innovation	- SN's R&D survey - The Research Council of Norway's SkatteFUNN database
Share of revenue from innovation	- SN's section for industry and R&D statistics
Return on investment	- SN's R&D survey - The Research Council of Norway's SkatteFUNN database - The Norwegian Tax Administration's tax registry - The Norwegian Labour and Welfare Administration's Aa registry - SN's section for industry and R&D statistics
Labour productivity	- SN's R&D survey - The Research Council of Norway's SkatteFUNN database - The Norwegian Tax Administration's tax registry - The Norwegian Labour and Welfare Administration's Aa registry - SN's section for industry and R&D statistics
Total factor productivity	- SN's R&D survey - The Research Council of Norway's SkatteFUNN database - The Norwegian Tax Administration's tax registry - The Norwegian Labour and Welfare Administration's Aa registry - SN's section for industry and R&D statistics
Analysing misuse of SkatteFUNN	- SN's R&D survey - The Norwegian Tax Administration's tax registry - The Research Council of Norway's SkatteFUNN database - The Norwegian Labour and Welfare Administration's Aa registry - Accounting statistics from SN or other accounting data-bases

Source: Samfunnsøkonomisk analyse, 2015

It is our view that the evaluation would gain from using SN's expertise on compiling the relevant data, and should acquire an updated version of the database used in the previous evaluation,

conducted by SN. This database is a combination of data from, primarily, (i) SN: The R&D survey, accounting statistics and structural statistics, (ii) the Research Council of Norway's SkatteFUNN database and (iii) the Norwegian Tax Administration's tax registry. The future evaluation is thus recommended to update this database, described by Kjesbu (Kjesbu, 2006). This is a service purchasable from SN.

Cost of data

The cost of data is based on the cost structure of SN. The researcher needs to access several registers at multiple departments at SN. Further, the researcher will need data covering a long time period. These are two costly determinants. Finally, it is vital that the researcher obtains a research contract for the evaluation in order for SN to accept the use of these microdata.

It has not been possible to obtain an estimate of the data costs from SN. Hence, we need to conduct our own assessment of the cost of data. We know that we will need data from at least 6 different departments at SN. All these registers need to be harmonised. Further, we see that there is an issue regarding the long time period. Here we want information from years before 2002, likely from 1998 if possible. The typical cost of data at SN is defined by the following three points:

- Coordination and clarification of data order, including administration.
- Achieve approval from SN and the Norwegian Data Protection Authority to exploit data
- Preparation of data, archiving and documentation.

Previously data should be approved from the relevant data owners. A process that were somewhat complex since it potentially involved a broad range of data owners. Now this process has to a large extent been internalised by SN. This should improve casework time. On the other hand it might increase the cost. Previously the approvals were given for free from data owners. Since the initiative was implemented in October 2015 we have yet to see whether SN will be counting man hours in approval of data. If they do, this will further add to the costs of data from SN.

In terms of this project, we would estimate the cost of data at SN to be as shown below. The cost is calculated based on the expected number of hours that personnel at SN expect to use, and using SN own price list. Here we use the cost of "group 2"personnel, i.e. researchers, counsellors and project managers[11]:

Task for Statistics Norway	Expected time spent	Price
Coordination and clarification of data, including administration.	105	NOK: 134 000
Approval of data	75	NOK: 66 375
Preparation of data, archiving and documentation.	193	NOK: 170 805
Total cost excl. VAT		NOK: 330 105
VAT		NOK: 82 526
Total costs		NOK: 412 631

Source: Samfunnsøkonomisk analyse, 2015

[11] See http://www.ssb.no/omssb/tjenester-og-verktoy/statistikk-paa-oppdrag/prising-av-oppdrag

5.3 Proportionality and appropriateness

One central part of the assessment is the question of the proportionality and appropriateness of the scheme. Several central questions are to be answered here. At first are the cost of the scheme proportional with the effects? Another central question here is whether the desired aim of the scheme could have been achieved at a lower cost by using other schemes. A third central question is whether SkatteFUNN stimulates participation in other schemes and thus how the coherence between SkatteFUNN and other schemes are.

5.3.1 How much additional R&D

The question on proportionality can be examined by the ratio between tax deduction and additional R&D investments. At first the econometric models have to identify whether or not there are in fact a significant additionality. If the models conclude with positive additionality then it is meaningful to assess how much the support from SkatteFUNN have generated in additional R&D per krone spend.

As a point of reference one can think of the R&D project worth 100 NOK that are entitled to SkatteFUNN, but would not have been carried out in the absence of SkatteFUNN. If the project is implemented 100 per cent because of SkatteFUNN then the additionality per SkatteFUNN-krone can be calculated as:

- The R&D project turns from 0 to 100 NOK in R&D investments.
- The Tax deduction is set to 20 per cent then the support from SkatteFUNN is 20 NOK.
- Thus, the additionality per SkatteFUNN-krone is 5. In most public funded schemes an additionality of more than 1 is considered a success.

The above mentioned calculation are relatively easily implemented, yet the results are sensitive to the results from assessing the additionality. As SSB (2008) state in their impact assessment of SkatteFUNN, the result is considerably insecurity. Their results range from 1.3 to 2.90 in additional R&D-investment per SkatteFUNN-krone.

5.3.2 Identifying effects from alternative schemes

A central question here is could the same effects have been obtained with less aid or a different form of aid? One way of identifying the effects of alternative instruments is by including information on participation in other schemes.

In the econometric models, one can include participation in other schemes as control variables. Hence, we use the information on participation in other schemes to explain variance in the chosen performance indicator. When the evaluation includes participation in other schemes as a control variable, it is possible to both eliminate the effects from the schemes in evaluating

SkatteFUNN and to evaluate the effect of other schemes on the performance indicators. If the evaluation still finds effects from SkatteFUNN, these will be effects controlled for the effects that other schemes have. Such an approach will include the following steps:

1. State whether there are any effects of SkatteFUNN without controlling for the impact of other schemes.
2. If SkatteFUNN proves to have an impact, then include information regarding allocation of resources from other schemes. This information should be presented either as a dummy variable or as a measure in absolute figures in order to control for the magnitude of additional public funding.
3. Assess whether or not the inclusion of additional information implies differences in the effects of SkatteFUNN.

5.3.3 Coherence between SkatteFUNN and other schemes

SkatteFUNN is in principle available to all. Moreover, the process of applying is simple and not restricted to anything except from that the investments must be classified as R&D. This is somewhat contrary to other R&D and innovation schemes, where applicants must qualify through detailed application forms. As showed with figure 3.1 in chapter 3 SkatteFUNN is the largest scheme, measured by number of beneficiaries. Furthermore, it is evident from the figure that SkatteFUNN is linked to many other schemes.

In assessing the appropriateness of SkatteFUNN, the evaluator must also consider SkatteFUNN's ability to bring companies into to R&D system. One important focus of SkatteFUNN is the ability to make small and medium companies start investing in R&D. In addition, the focus of bringing small and medium sized companies into national and international R&D systems.

In order to evaluate the coherence between SkatteFUNN and other schemes the evaluator should utilize databases of the various R&D and innovation schemes in Norway. By tracing companies through participation, the evaluator is able to state which scheme act as an entrance into the R&D system for companies. What type of scheme is it? Where do they go afterward, do they leave or enter a more advanced schemes? How often is SkatteFUNN the first scheme? Alternatively, is SkatteFUNN a scheme that is utilized in addition to and concurrently with other schemes?

5.3.4 SkatteFUNN compared to international tax deduction schemes

In order to gain further insight into the impact of a tax deduction scheme, such as SkatteFUNN, it would be rewarding to conduct an international comparison. However, the quality of data will vary greatly between countries and the actual evaluation across countries would be highly resource intensive.

Therefore, it might be sufficient to conduct a thorough international literature review, on other nation's evaluations, or draw upon others' international comparisons. This would give insight into what is good practice in other countries and the heterogeneity between nations. Furthermore, it could provide inspiration to own evaluation, and strengthen the foundation for potential adjustment suggestions that SkatteFUNN could adapt.

There is a vast availability of such studies. An example of an international comparison study is the European Commission's comparison (2014). This report includes a specific comparison of ten countries where the tax deduction scheme target SMB, similarly to SkatteFUNN. Furthermore, the report creates an index that rank the different nations' schemes. The French tax deduction scheme aimed at young innovative enterprises is ranked number 1 out of 20. The generic SkatteFUNN scheme ranks second.

If the evaluator does find it profitable to conduct an international evaluation in order to provide a high quality comparison with other countries, it would be possible to do so with, at least, Denmark, Sweden and Finland. These countries do have access to microdata-.

5.4 Avoiding misuse of the scheme

Companies will adjust their accounting policy to maximise their bottom line. This is well known and documented with companies adjusting their accounting within the frame of the law in order to pay as little taxes as possible. One of the main questions related to evaluating SkatteFUNN, is the question of potential fraud. Fraud being adjusting expenses in companies in either register the expenses as R&D related, though they are not, or to overvalue expenses related R&D-activities. This is an important question because:

- Obviously a more or less deliberate upscaling will in some cases be fraudulent. In other cases, it will simply be a matter of misunderstandings. In any case, this will lead to an undesirable use of public funding.
- In terms of the evaluation, an upscaling will lead to a clear overestimation of the impact.

SkatteFUNN is a privilege available to all companies. This also includes subsidies to loss making companies. Companies without any revenue, and thus no tax expenses, will receive funding corresponding the deductive value of stated R&D expenses. In other words, the incentive for companies to overvalue their expenses are quite clear. Therefore, there is a need for investigating the potential misuse of SkatteFUNN. We suggest the following approaches:

- Analyse the control mechanisms, what are they? Are they sufficient to identify and avoid misuse?
- Analyse the basis for tax deduction, is the tax deduction proportional to other economic levels? Does the figure seem reasonable compared to other economic measures of the companies?

- Interviews with relevant agents (in particular the research council and the taxation authority), what is the relevant agent's perception on the degree of misuse?

5.4.1 Feasibility of Control mechanisms

At first, it would be reasonable to check if the control mechanisms are good. In addition, if they are able to catch potential misuse. In order to do so the individual audit of each application must be able to catch potential fraud. Auditors and tax authorities conduct the individual audit.

In practise, controlling the deduction is both difficult and resource demanding. R&D expenditure is not uniform. The expenditure is individually linked to each investment and can be very different across projects, sector, company size and other characteristics of both company and project. Further, the information provided by companies in terms of cost, man hour allocated and hourly wages cannot be controlled by an independent third party.

There are no standardised requirements or formulas in terms of stating hours or other costs. This makes the audit resource demanding, difficult and in certain cases even impossible. The last evaluation of SkatteFUNN stated two of three auditors that they did not have adequate information to audit the costs related to R&D. Further 80 pct. of the auditors stated that they did not have sufficient information to check the listed man hours allocated for R&D project.

The above underlines the difficulties in running full control of a scheme open to all, with the premise of rapid, smooth and simple administrative processing.

5.4.2 Proportionality of tax deduction – fair or overvalued

Alternative to run full control is to ex post analyse the proportionality of tax deduction. With proportionality, we mean comparing the stated level of cost eligible for deduction with other account information. In during so it is possible to get an overall indication on the level of misuse and in turn identify selected groups of companies who could be investigated further by auditors. We will suggest that the evaluator complete interviews with the administrative agents to get their views on potential misuse.

There is no rule of thumb as to the costs or resources allocated to R&D projects. As such, we do not have any threshold to which we can evaluate the proportionality of the listed expenses. Yet there are other measures that can be used:

- Every year Statistics Norway (SN) collect statistics on private R&D. With access to micro level data, it is possible to match beneficiaries in SkatteFUNN with those in the R&D statistic to see if the listed information is consistent.
- By comparing the information from SkatteFUNN with standard accounting information, it is also possible to state if there are a proportional level between the two.

Comparing SkatteFUNN and R&D statistics

Comparing SkatteFUNN with the yearly R&D statistics from SN opens for a broad range of comparison. Yet, it is important to state that the R&D statistic only covers a representative selection of Norwegian companies, though all companies with at least 50 employees are fully covered. For companies with less than 50 employees a representative draw of approximately 35 pct. of all companies is completed. In some sectors the representative draw is lower, often between 10 to 15 pct., in particular in sector with known low level of R&D. E.g. in construction no companies with less than 20 employees are included simply because this sector have almost none R&D activity at all.

The obvious comparison is to directly compare listed R&D expenses in SkatteFUNN with corresponding information in the R&D statistics. Discrepancy between the two is an indicator of irregularities. Another way is to compare R&D expenses in SkatteFUNN with the average R&D expenses of a group of approximate identical Norwegian companies.

Another relevant indicator for comparing is the statement of man-hour. Again, it is feasible to compare either directly company by company or between the beneficiary and an average based on the R&D statistics. Finally, it is possible to compare the cost of one R&D man-hour in SkatteFUNN with one R&D man-hour in the R&D-statistics. The latter should be done only for companies with the same characteristics since the costs of R&D projects will vary across markets and likely also by company size.

Finally, it is possible to use the R&D statistics to compare the relative allocation of man-hour to R&D compared to number of employees. In previous studies of SkatteFUNN (SSB, 2008) it is stated the average R&D active company without SkatteFUNN on average allocate 130-170 man-hours to R&D per employee. This is compared to an average allocation of 300 man-hours to R&D per employee of beneficiaries of SkatteFUNN. Suggestion an overrated listing of man-hours allocated for R&D-projects in SkatteFUNN.

Comparing SkatteFUNN to general accounting data

Accounting will provide sound information on economic fundaments of the companies. In addition to compile information on R&D statistics this will provide us with valuable overall information, i.e. information on level on balance sheet, on the level of capital and operating margins.

R&D-investments are included in the balance sheet in line with other immaterial investments. As such they potentially will be included in accounting information related to companies. In addition, it is possible to compare the listed R&D expenses in SkatteFUNN with the balance sheet information. Another possible comparison is comparing the listed R&D expenses in SkatteFUNN with the overall level of capital in the beneficiaries.

ESA does state that supporting loss making firms is a possible negative effect on competition in terms of state aid. By exploiting historical accounting data, it is possible to state whether Skatte-FUNN is high among loss making firms or even firms going bankrupt.

Methods for comparing

It can be difficult to assess whether potential differences between beneficiaries and other companies are at a fair level. Therefor we suggest various methods for comparison:

- Firstly, comparing average means will give some indication. By either comparing single beneficiaries to an average mean or comparing average means from beneficiaries and non-beneficiaries provides initial information.
- Second the evaluator can compare the more extreme values. By comparing quantiles or deciles of beneficiaries with non-beneficiaries with provide additional detail information and indication of disproportionality and thus potential misuse.
- As a third approach it is possible to exploit various econometric modelling to decide whether or not there are significant differences. The models can vary in complexity and in cover both simple t-tests, OLS-regressions and quantile regressions.

Quantile regression is an extension of the classical OLS. OLS models lets a response variable Y be explained by a number of explanatory variables. OLS produces an aggregated value summarising the correlation between Y and X. Quantile regression in turn describes the correlation between Y and X, but at a certain point in the distribution of Y, e.g. in the middle where the point will be the median. Note that even though this is considered a point measure quantile regression compile the total amount of information. In the median there are an equal number of observations on both sides of the point of estimation. An important difference to OLS is that quantile regression estimate the correlation by minimising the sum of weighted deviations. OLS measures the average correlations by minimizing the squared sum of deviations.

5.4.3 Does misuse hamper the impact assessment

The short answer to that is yes, at least potentially. As such we do recommend a strong focus on the potential level of misuse of SkatteFUNN in order to assess whether or not it will affect the evaluation. One should bear in mind that analysing disproportionality is mainly evident for smaller companies. In reality for larger companies, the deduction of R&D will only cover a smaller level of their total R&D investments making fraud easier to camouflage in larger companies.

5.5 Identifying distortive effects on competition and trade

SkatteFUNN lowers R&D costs for the supported firms. If those receiving aid have a strong degree of market power, then it is conceivable that SkatteFUNN indirectly helps these firms maintain or strengthen their market power through lower costs in R&D investment which may lead to increased product quality or better production processes. This is an issue of domestic competition. There is also the possibility that SkatteFUNN indirectly aids exporting or import competing businesses in increasing their production, thereby affecting trade markets. This is an issue of both international competition and trade. The estimation methods mentioned earlier are able to show results of SkatteFUNN for various result indicators at the industry and firm level. By matching these results with market knowledge regarding which industries export or compete with import products and the degree of market concentration, it is possible to ascertain the effect of SkatteFUNN on competition and trade.

5.5.1 Domestic competition

If there is a bias towards a specific industry or loss-making firms, then these are negative indirect effects of SkatteFUNN. These points are mentioned in the Commission Staff Working Document. The scheme is supposed to cover all industries and sectors. Hence, a bias towards a sector is unwanted. If SkatteFUNN is used as a means of survival or prevention of exit for unprofitable businesses, then this is an unwanted consequence. It is not the objective of SkatteFUNN to affect the industrial structure, and funding firms who are not profitable is not economically optimal and could potentially be a sign of misuse of the scheme, if firms benefit from a generous public scheme to keep their business afloat.

A bias towards a specific industry can be measured directly, whilst a bias towards loss-making firms can be measured through accounting data. There could also be a bias toward incumbents or firms with a high degree of market power. This will have to be measured through market analysis. On the other hand, lowering the costs to R&D might lower entry costs, at least in R&D intensive industries, thereby increasing competition in these markets.

When detecting market power, it is likely the large businesses, i.e. not SMEs, who are the interesting agents for this part of the evaluation. There is therefore the issue of determining the threshold value for size. Since SkatteFUNN differentiates between SMEs and large businesses as part of its scheme (different deduction rate and basis), it is logical to use SkatteFUNN's definitions.

There are several methods for measuring a firms' market power or the level of market concentration. The Herfindahl-Hirschman Index (HHI) measures the degree of market concentration as the sum of market shares squared (usually scaled up with a factor of 10 000), which means large firms are weighted more than small firms:

$$HHI = 10\,000 * \sum_{i=1}^{N} s_i^2$$

Where s_i is the market share of firm *i*. For example, if there are six market competitors where one has a 50 percent share, and the rest are equally distributed, then the HHI is 3000. The Norwegian competition authorities make the following inference for different threshold values of the HHI, based on recommendations from the European commission regarding horizontal mergers (European Commission, 2004):

- HHI < 1000 Weak market concentration
- 1000 < HHI < 2000 Moderate market concentration
- HHI > 2000 Strong market concentration

Note that strong market concentration does not necessarily imply there's something wrong. The result must be interpreted based on other knowledge of the market in question. If businesses are involved in several markets (in terms of product and geography) with a varying market share, then this complicates the analysis. However, as long as all the markets in question are accounted for, e.g. those who compete with businesses in the EU, this HHI problem is not an issue.

The HHI requires knowledge of all the firms' market shares, which is quite demanding. A simpler approach is the C_m index, the sum of the market shares of the *m* largest firms. However, there is then the issue of deciding what *m* is appropriate. Combining this and the HHI leads to an approximation for the cases where there are some large firms and many small firms where finding market shares can be demanding. Small market shares have a small impact on the HHI, hence calculating the HHI for the *m* largest firms can be sufficient. Market share is often defined as "revenue market share", meaning company share of total revenue in a market.

Foncel, Ivaldi and Khimich (Foncel, Ivaldi, & Khimich, 2013) assesses the accuracy and validity of the HHI. They find that the index can be misleading regarding mark-ups and competition, especially when defining market boundaries is difficult. The HHI is likely a noisy indicator of competition, it is not clear cut and must be applied with discretion, but can still be used as a screening device.

There are other measures that can be used, indicative of competition. Altogether, with the HHI, they can give an idea of the competition levels in the relevant industries:

- The asymmetry of firm size, measured as the difference in size between the largest and the second largest firms. The theoretical literature indicates a positive relation between asymmetry and the difficulty of collusion, i.e. the more asymmetric, the more difficult it is to collude (see for example (Davidson & Deneckere, Horizontal Mergers and Collusive Behaviour, 1984), (Davidson & Deneckere, Excess Capacity and Collusion, 1990), (Lambson, 1994).

- Entry and exit measures. High entry costs or barriers means it is likely that competition is low. Fixed costs is an important indicator for this and a measure could be capital intensity, that is capital as a share of labour input. A simple, but effective, approach is to calculate entry and exit rates in given industries and see how this relates to who received SkatteFUNN support.

The measures and indicators mentioned above are indirect approaches to measuring the effect of SkatteFUNN on competition, all drawn from the industrial organisation literature. A more direct approach, based on Bresnahan and Reis (Bresnahan & Reis, 1991), is to measure the effects of entry in concentrated markets. This method builds on simple oligopolistic models and they analyse markets for five industries, consisting of monopolies, duopolies and oligopolies. By establishing the relationship between the number of firms in a market, market size and competition, they find that competitive conduct varies with number of firms and that as soon as the participants increase from 3-5 firms, the next entrant has little effect on conduct. They also estimate entry thresholds for these markets: how large must the market be in order to sustain the second, third, fourth firm etc.

If SkatteFUNN is biased towards specific industries or markets and we expect the scheme to affect competition, then we might observe different entry thresholds in those supported and those not supported. Such effects, if found, have direct implications for competition levels. The indirect measures (HHI etc.) might lead us to patterns in relation to SkatteFUNN support, but extending the analysis with this direct approach will help in making sense of the indirect results and further strengthen any conclusion.

5.5.2 International competition

Identifying which industries and firms are exposed to international competition is the first step when looking into SkatteFUNN's effects on international competition. Many sectors compete both domestically and internationally, and it is not obvious whether a sector can be considered sheltered or (internationally) competitive.

The evaluation will have to decide on a threshold value for the share of international competition in a sector, above which it is appropriate to look for distortive effects from SkatteFUNN on international competition and trade. This could for example be some percentage of exported value relative to total production or, for import competing businesses, percentage of goods or services supplied by foreign businesses in the market. Using these definitions, the threshold value can be the same regardless of whether one is looking at exports or import competition. In evaluating domestic competition, one might be able to learn more about the different industries and markets and hence, be able to identify the relevant sectors in which to examine the international competitive situation.

The method and indicators mentioned in 5.5.1 are also valid for assessing the scheme's indirect effects on international competition, given that the industries exposed to international competition have been identified:

- Conduct a market competition screening project using the Herfindahl-Hirschman index to measure market concentration, measure the asymmetry of firm size and calculate entry and exit measures such as fixed costs and entry and exit rates.
- Employ Bresnahan and Reis' (1991) method to measure entry thresholds in concentrated markets. If these are not significantly different in the relevant markets, then SkatteFUNN cannot be said to have distortive effects on competition.

5.5.3 Trade

As mentioned, a potential indirect effect of SkatteFUNN is an effect on trade, more specifically whether the scheme indirectly helps exporting or import competing businesses increase their production. It is not enough, however, to measure increased production. One need also to identify whether this is due to the cost advantage introduced by SkatteFUNN.

An approach to this identification issue is firstly to look at exports at the industry level, as a share of Norwegian production. This way, one can control for business cycle effects. Secondly, if any patterns are found, case-by-case studies of the industries in question should be done. If no such effects are found, then it is not very likely that SkatteFUNN has a distortive effect on trade.

6. Our recommendation for evaluation methods

On the basis on earlier chapters, we have established a recommended procedure for evaluating SkatteFUNN. In this chapter, we will provide an outline and the arguments for our recommended evaluation methodologies. Along with our recommendation we recommend a thorough literature review concerning both the intervention logic, the direct and indirect effects of SkatteFUNN and to compare SkatteFUNN to other equal schemes in other countries

6.1 Difference-in-difference estimation

When evaluating the isolated impact of a scheme such as SkatteFUNN there are several important methodological issues that must be addressed. These problems arise because the evaluation cannot be done as a random experiment, rather it must be conducted as a quasi-experiment.

As outlined in section 5.1, it is crucial for the validity of the evaluation to select the best possible control group. The previous evaluation of SkatteFUNN exploited a discontinuity in the scheme to define a valid control group. The control group were entities who had invested more than 4 million in intramural R&D or 8 million in total R&D (intramural plus extramural), in at least one year prior to the introduction of SkatteFUNN. These threshold values (4 and 8 million) have since been changed, but this is arguably a suitable control group because R&D investments of above these threshold values do not increase the tax deduction. Hence, the incentive to invest more is not caused by SkatteFUNN. The treated are those incentivised to increase their R&D investment on the margin, while the controls are those who are not.

This regression discontinuity design is a way of addressing the systematic difference between the typical SME beneficiaries of SkatteFUNN, and larger entities with significant R&D investments. Using this method in a difference-in-difference framework, thus comparing the groups on each side of the deduction limit before and after implementation of SkatteFUNN, or a change in the threshold values, provides insight into how SkatteFUNN influenced R&D investments by comparing the growth of R&D investments in the two groups.

Due to the implemented extensions of the scheme, it is possible to perform the exact same method as the previous evaluation, but for three different thresholds. Furthermore, the availability of data has significantly improved, relatively to the data available for the previous evaluation, and therefore it would be possible to have a narrower band around the threshold values. The narrower the band, the more similar one can assume that the entities on each side are (so called balanced groups), and hence, the stronger the internal validity of the method.

A drawback, when comparing entities on each side of the threshold in the regression discontinuity design, is that those entities who have never invested in R&D before the implementation (or

change) of SkatteFUNN will not be included. Hence, this approach will not evaluate the impact of SkatteFUNN on entities who have started investing in R&D due to the scheme.

Therefore, it might be relevant to find other possible control groups, which can be utilized in the difference-in-difference framework. In the case of SkatteFUNN, the firms who do not receive support might be firms who applied for support, but were denied it, firms who chose not to apply, or firms unaware of the opportunity to apply. It is reasonable to assume that the anticipated outcome for supported firms differ from the expected outcome for those who chose not to apply for the scheme. This argument is based on the assumption that because SkatteFUNN is a rights-based scheme, it is possible that the firms choosing not to apply do not have any R&D projects. Furthermore, it is reasonable to assume that the firms without any R&D projects will perform comparatively worse than firms who do have R&D projects over time, independent of whether they are supported by SkatteFUNN or not. If this is the case, the firms receiving aid are not comparable with those knowingly not applying for aid. The firms in the control group should not be non-recipients of aid due to unobserved factors influencing the outcome.

It is also possible that the firms who chose not to apply did perform R&D investments or displayed characteristics implying that they should be investing in R&D, but did not apply because they did not prioritize the process of applying.

Neither of these theories can be excluded, and it would be impossible to establish a group of entities who are equal to the beneficiaries of SkatteFUNN, but did not apply because they were unaware of this opportunity. Therefore, we find that the best approach for selecting a control group would be to use a set of characteristics that capture the nature of SkatteFUNN beneficiaries. The characteristics could for instance be the size of the company, the number of employees with masters and PhD degrees, industry, and level of R&D expenditure. Furthermore, whether the firm is an exporter or not, could be an indicator of the competitive environment in which the firm operates. It is reasonable to assume that an exporting firm is facing stronger pressures to invest in R&D projects. It is important that the firms in the control group is either investing in R&D projects, or possess the characteristics that would imply that they should be investing in R&D.

The data required for completing this part of the evaluation are accounted for in chapter 5.2.3.

6.2 Estimating the return on R&D investment

Our recommendation for estimating the return on SkatteFUNN supported R&D investments follows international literature. There is a broad consensus that the methodology concerning estimating return on R&D investment includes the following steps[12]:

1. Calculation of R&D capital. This is because knowledge will accumulate over time.

[12] The steps are presented in depth in chapter 5.1.4.

2. The use of an expanded Cobb-Douglas production function to estimate elasticities between R&D capital and value added.
3. Calculate the return on research investment, starting from actual investments and value added.

The models and data needed for completing the three steps are well described in the literature. Yet as for step 2 there are some distinctions between model specifications. This is partly driven by the researcher's access to data and partly driven by what explanatory variables the researcher wants to control for. We will not give any specific recommendations as to what explanatory variables to include in the augmented production function.

The data required for completing estimations of return on investments follows the data used for completing analysis of additionality. As such, we do not foresee any additional data costs in completing this part of the analysis.

6.3 Proportionality and appropriateness, Identifying effects of alternative schemes

Our recommendation for assessing proportionality and appropriateness includes several elements. First, there is the question of proportionality. Is the cost of SkatteFUNN proportional with the effects? Another central question here is whether the desired aim of the scheme could have been achieved at a lower cost by using other schemes.

Whether the cost of SkatteFUNN is proportional with the effects is assessed by comparing the additional R&D investments with the tax deduction. The level of additional R&D investments is obtained from the analysis of input additionality. Whereas the information regarding tax deduction is obtained from the Norwegian tax administration's tax registry. By simple comparison the evaluator will calculate a fraction of additional investments over costs, i.e. tax deductions.

It can be somewhat difficult to answer whether the desired effect(s) of the scheme could have been achieved at a lower cost by using other schemes. Yet in order to assess this we recommend including information on participation in other schemes. Using this information, one can explain the variance in the chosen performance indicator. A more detailed description is found in chapter 5.2.

Regarding appropriateness, the coherence of SkatteFUNN and other schemes are of great importance. We recommend a thorough analysis of the links between SkatteFUNN and other schemes. In order to conduct such an analysis, the evaluator must access information on companies' participation in other schemes, when they start to participate and in what schemes.

Our recommendation also includes an international literature review. The literature review should include a comparison of various relevant nation's tax deduction schemes, with the objective of gaining insight into what can be justified as best practice. This would address the issues of both proportionality and appropriateness.

The data required for the questions regarding proportionality and appropriateness will to a large extent build on Statistics Norway's micro level data used in analysing additionality. In addition, the evaluator must access a thorough database on companies' participation in other schemes.

6.4 Avoiding misuse of the scheme

In assessing whether beneficiaries are taking advantage of SkatteFUNN we listed different approaches in chapter 5.4. We will recommend that the evaluator utilize data used in the other parts of the evaluation to assess disproportionality between stated information from the beneficiaries and information regarding the R&D activities and other accounting information. Furthermore, we recommend that in depth interviews with relevant agents are conducted. In particular, interviews with the research council and the taxation authority on their perception of the degree of misuse would be high value, in order to gain further insight into the issue of misuse.

The models used for carrying out the assessment includes, ranging from simple comparisons to more sophisticated:

- Comparing variable means between beneficiaries and non-beneficiaries.
- Comparing variable deciles or quantiles between beneficiaries and non-beneficiaries
- Using various econometric models to test significance in differences including t-tests, OLS regression and quantile regression.

The choice of model to apply depends on the allocation of resources, quantile regression potentially being more costly than simple t-tests. We will not recommend one model above another since the extra cost of conducting quantile regression, a more complicated model, might not equal the gain. Yet, we will recommend that the evaluator runs tests to assess the significance of potential differences, and thus potential misuse, of SkatteFUNN.

Another way of assessing potential misuse is to do more in depth control of stated information from SkatteFUNN applicants. We will not recommend to use this approach since it is highly resource demanding. Further, it can be almost impossible to check whether companies are stating the right information. This is particularly the case for larger companies where internal resources can be allocated and redistributed on a continual basis. With the threshold values of SkatteFUNN increasing in the years 2009, 2014 and 2015, the incentive for larger companies to apply also increased. This will further complicate control with the beneficiaries.

In turn an assessment of the control mechanism of SkatteFUNN might be feasible, but will be more in line with an overall structural evaluation of SkatteFUNN. A structural evaluation will focus on the administrative processes, user satisfaction and how SkatteFUNN is organised. Though relevant, this kind of assessment is not part of the ESA recommendations for state aid evaluation.

The data required for this element is highly based on data from other parts of the assessment. This includes data on R&D activities as well as accounting data. Thus, we will not expect additional data costs for this part of the analysis.

6.5 Identifying distortive effects on competition and trade

Based on part 5.5, we propose to focus on the following steps in the evaluation of distortive effects on domestic competition:

1. Assess which markets are affected by the SkatteFUNN scheme.
2. Establish whether this constitutes a bias towards specific industries.
3. Investigate accounting data for whether there is a bias toward loss-making firms.
4. Using various methods and measures drawn from the industrial organisation literature, evaluate the competition level in these markets.
5. Based on point 4, do case-by-case studies to identify whether or not the SkatteFUNN aid is supporting the firms with a high degree of market power in these markets, and as such might be detrimental to competition.

Regarding the effect on international competition, steps 1, 4 and 5 should be carried out for those markets exposed to international competition. This leads to evaluating the effect of SkatteFUNN on trade. Looking at exports as a share of either local or industry production might reveal patterns regarding SkatteFUNN supported businesses. The next step would be to conduct case studies for the businesses in question, in order to identify whether the aid was instrumental in increasing production.

All points, except number 3, will have to utilise micro level data. Accounting data will also be important when conducting market analysis. Here, distinguishing each market will be a challenge, but this is essential in order to measure market competition levels and market power. Structural data on exports and imports as well as other factors should complement the analysis. See parts 6.1 and 6.6. for more on data use and needs.

The use of SkatteFUNN is dominated by SMEs, partly as a result of favourable rates for SMEs. As mentioned in part 5.5, it is likely large companies that are in a position of market power. Thus, the evaluators will have to assess how much weight to put on this part of the evaluation, both considering the likelihood of finding significant or interesting results and the cost.

6.6 Data, duration and work requirements and costs

6.6.1 Cost and time spent obtaining data from Statistics Norway and other sources

The cost of data is based on the cost structure of SN. The researcher needs to access several registers at multiple sections. Further, the researcher will need harmonised data covering a long time period. These are two costly determinants. Finally, it is vital that the researcher obtains a research contract for the evaluation in order for SN to accept the use of these micro-data.

We know that one will need data from at least 6 different departments at SN. All these registers need to be harmonised. Further, we see that there is an issue regarding the long time period. Here we want information from years before 2002, likely from 1998 if possible. The typical cost of data at SN is defined by the following three points:

- Coordination and clarification of data order, including administration.
- Achieve approval from SN and the Norwegian Data Protection Authority to exploit data.
- Preparation of data, archiving and documentation.

The cost related to acquiring data from SN is provided in the table below.

Task for Statistics Norway	Expected time spent	Price
Coordination and clarification of data, including administration.	105	NOK: 134 000
Approval of data	75	NOK: 66 375
Preparation of data, archiving and documentation.	193	NOK: 170 805
Total cost excl. VAT		NOK: 330 105
VAT		NOK: 82 526
Total costs		NOK: 412 631

Source: Samfunnsøkonomisk analyse, 2015

In addition to costs allocated towards SN we estimate that the evaluator will use 100 hours of work when ordering data from Statistics Norway. This includes collecting necessary approvals, specifying a detailed order form, dialogue and re-specifications, and most probably meetings with SN.

In addition, we estimate 200 hours of work for the evaluator related to organising the data and collecting data from open sources and from various government bodies (SkatteFUNN and other instruments).

6.6.2 Cost and duration of preparing intervention logic and establish evaluation models

It is also important that the evaluator thoroughly establish an analytical and logical approach before conducting the estimation. This includes a theoretical analysis similar to that performed in Chapter 4, but in a much more explicit form. In addition, the evaluator should decide on the econometric specification in detail during this stage. It is advisable to do this before ordering data. We estimate the use of 250 hours of work for this part of the evaluation.

6.6.3 Cost and duration of conducting the analysis

Conducting the analysis consists of resources allocated for:

- The actual estimation, setting up the models and interpretation of the results. This includes estimation of all parts of the evaluation.
- Carry out a detailed documentation of the results.
- Project management.

For the actual estimation, documentation and organisation of the project, we estimate a total of 1,150 hours of work.

Table 2 summarises the duration of the various stages, the hours of work needed and their costs measured in 2015 prices/wages. In total, we estimate the use of 1,700 hours of work. At an hourly rate of NOK 1,400, and adding the costs of ordering data from Statistics Norway, the total cost of evaluating the SkatteFUNN scheme is estimated at NOK 2,710,000 exclusive of VAT, or NOK 3,387,500 inclusive of VAT.

The proposed timeline is based on the estimated duration of each stage of the evaluation process, where each stage builds successively on the work from the previous stage. Further the timeline is based on a tentative timeline outlined by the Ministry of Finance. The total evaluation period stretches over two years. Hence, there is a need for communication between the principal, the evaluator and other expert groups during the period. In the timeline, we have taken into account that the evaluator presents preliminary findings in meetings, seminars, workshops or milestone reports. In particular, we recommend arranging a seminar during the first quarter of 2018, where the evaluator presents the results from the D-i-D estimation and where methodological issues are discussed with other expert groups.

Table 6.2: Estimated time, tentative timeline, hours of work and costs for evaluating SkatteFUNN scheme using suggested methodology

	Period	Hours of work	Costs excl. VAT based on NOK 1400* per hour
Establishing the analytical and logical approach, including an extensive literature review	May 2016 – Dec. 2016	250	350,000
Ordering and collecting data	Sep. 2016 – Jan. 2017	100	Data: 330,000 Work: 140,000
Preparing necessary databases	May 2016 – Nov. 2016	200	280,000
Estimation and interpretation	Jan. 2017 – Dec. 2017	750	1,050,000
Documentation	Nov. 2017 – Feb. 2018	250	350,000
Meetings, coordination and administration	Oct. 2015 – Feb. 2018	150	210,000
Total		**1,700**	**2,710,000**

*Measured in 2015 prices/wages Source: Samfunnsøkonomisk analyse, 2015

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Samfunnsøkonomisk analyse
Rapport nr. 23-2015

Samfunnsøkonomisk analyse har særskilt fokus på samfunnsøkonomiske problemstillinger i skjæringspunktet mellom næringers og samfunnets interesser, mellom makroøkonomiske utviklingstrekk og markeders respons, mellom individ og samfunn og i tilknytning til samfunnets institusjoner.

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