

A note on data issues and econometric approaches in the evaluation of the Norwegian R&D tax incentive scheme - SkatteFUNN

Torbjørn Hægeland and Knut A. Kjesbu
Statistics Norway

June 20, 2005

Data issues

Evaluation of various aspects of the SkatteFUNN scheme requires an extensive information base. In building this database, Statistics Norway (SN) will combine databases established for other purposes together with surveys carried out to obtain data on specific aspects of the SkatteFUNN scheme not covered by existing data sources.

The “core” databases in the evaluation are the micro information behind various statistics produced by SN, as well as databases assembled by the Research Council of Norway (RCN) (most importantly the SkatteFUNN database). To study the effects of a tax incentive scheme for R&D, one needs a fairly long time horizon because the total economic effects of R&D cannot be expected to be visible in the short run. The data should cover a sufficiently long period both prior to and after the launching of the scheme. What should be regarded as “sufficiently long” can in principle not be established *ex ante*. In practice, one has to make a compromise based on the availability historical data, the cost of gathering new data, and the time horizon for the evaluation project.

The panel database in which to evaluate SkatteFUNN consists for time being of data from about 18000 establishments with data back to 1993. This will be continuously updated throughout the project. All establishments which are found in SN’s R&D statistics and/or which have submitted applications to SkatteFUNN during this period are represented in the database. This database contains detailed establishment information on R&D activity, inputs and outputs, employees (including education) as well as information from establishment accounts. It has been taken into consideration that enterprises

may change structure over time, such that only enterprises defined as comparable are included. Therefore a change in R&D activity for an enterprise will be based upon real change and not structural change in the enterprise (i.e. mergers and acquisitions).

The most important data source to the panel database is RCN's SkatteFUNN database. This is a comprehensive data source which pr. May 2005 consists of about 12000 projects. Several establishments and R&D institutions may participate in a project. The content of the database derives from a web application in which data have been added from the applicant and from RCN and Innovation Norway. Quarterly these data are transmitted to SN where it is transformed into the right format for further use, quality checked and checked for consistency versus other data sources. SN and RCN have a constant dialogue where errors, misunderstandings and inaccuracies found in the data are discussed. Subjects that are taken into consideration are problems of technical art like unit errors (1 vs 1000), characters in numerical fields and data transmission problems, and more generic problems like contradictions between modules, non-real identification numbers and accrual principles. The SkatteFUNN database has been under continuous development, which means that the oldest projects are of poorest data quality.

The SkatteFUNN base contains all relevant information from firms' applications for tax exemption, such as description of the project etc, from the processing of the application in RCN, and from the firms' reports after the completion of the supported R&D project. This source of information is of vital importance for evaluation purposes, particularly when combined with information from administrative sources.

In addition to statistics mentioned above the panel database also includes data of real tax exemptions from SkatteFUNN collected from Skatteetaten (tax authorities). This is important in order to see how many of the projects which are completed.

The SkatteFUNN tax incentive for R&D is new in Norway. Future R&D surveys will take this new measure into account, by adding questions related to the SkatteFUNN scheme. This is done mainly to provide data for official statistics, but the information will be useful also for evaluation purposes.

Not all aspects of the SkatteFUNN scheme may be evaluated by using existing data sources. We will therefore carry out specific surveys covering behavioural additionality and administrative aspects of the scheme.

Perhaps the major data problem in the evaluation of the SkatteFUNN scheme is that a disproportionately large share of the R&D projects supported by the SkatteFUNN scheme is carried

out by small firms, e.g. firms with less than five or ten employees. Historically, these firms are not covered by the R&D surveys; hence we do not have any direct and independent information of the R&D activity of these firms prior to the launching of the SkatteFUNN scheme. We therefore have to rely on other sources to try to indirectly identify changes in R&D activity among these firms.

Econometric approaches

In some sense, the most important part of the evaluation project is answering the question of whether the SkatteFUNN scheme has resulted in increased R&D activity in firms. There are of course other important aspects of the scheme, but the success of the scheme critically depends on the effect it has on the R&D activity. In this short note, the emphasis is therefore put on how we study input additionality and "results" from R&D, and what we may expect to find. These are the "econometric-intensive" parts of the evaluation. When making our final judgments, we will hold our findings from the econometric analyses up against findings from other parts of the evaluation project, where we make use of more qualitative information. A description of these parts of the project is beyond the scope of this note.

In this part of the evaluation we aim at quantifying how much extra R&D that is generated by the support the firm receives through the SkatteFUNN scheme. We will look at the "direct" additionality, but also analyse if there is an "indirect" additionality effect in the sense that an increased level of R&D investments increase firms' R&D competence, thereby increasing the profitability of future R&D project. As an integrated part of the input additionality analysis, it is also necessary to look at whether the implementation of the tax incentive has altered the relation between reported and actual R&D investments.

To answer the fundamental question whether the SkatteFUNN scheme has led to an increase in R&D activity over and above the tax subsidy itself implies a counterfactual analysis. We must compare the actual level of R&D investments with the level of investment that would have been realized if the SkatteFUNN scheme had not been implemented.

Ideally, such a question should be answered by carrying out a controlled experiment, randomly dividing the population of firms into two groups, and give one group access to the SkatteFUNN scheme. However, SkatteFUNN is a more or less general scheme. The challenge in a non-experimental setting, without a formal control group, is to deduct from historical data, what the

situation would have been if the tax incentive scheme had not been launched. In the evaluation we will address this issue by using several different approaches.

The conceptually simplest approach is to carry out a "before-and-after-study", i.e. to look at changes in total R&D investments under the assumption that the changes can be attributed to the implementation of the scheme. This approach can be refined, and the estimates improved, by estimating a model that predicts R&D investments from firm-specific variables, business cycle indicators etc, thereby controlling for other factors than the tax incentive that are relevant for the level of R&D investments.

Another approach is to utilise discontinuities built into the scheme itself to generate "quasi-experiments" that can be analysed by so-called difference-in-difference methodologies. The first year the SkatteFUNN scheme was in place, it was restricted to small and medium firms, based on criteria wrt. number of employees and size of revenue. Assuming that firms around the border of the size restriction are comparable, and that it is in a sense random whether they were eligible for tax subsidies or not, this discontinuity creates a quasi-experiment, and we may study the effect of SkatteFUNN by comparing changes in R&D investment for firms just above and just below the threshold. The weakness of this approach is that it cannot tell us much about the effect for firms that are considerably smaller and larger. For evaluation purposes, it is also a limitation that this discontinuity was in place only in one year. Another "built-in" discontinuity is that the tax exemption is limited to investments up to a certain level. This implies that firms that already had R&D investments over and above this level, is not given any direct incentive by SkatteFUNN to increase their R&D investments.

We also want to study if the input additionality effect is different for R&D projects that involves cooperation with R&D institutes, and also whether it varies with characteristics of the firm, such as industry, region, previous R&D activity, education level of the employees etc.

In addition to analysing whether SkatteFUNN generates more R&D, we also want to analyse to what extent increased R&D investments in firms results in increased innovation, productivity, employment, survival rates profitability etc.

In principle, the effects of SkatteFUNN come in three stages. First, the scheme must lead to more R&D in firms (see above). Second, this increased R&D must lead to an increased pace of innovation. Third, this increased pace of innovation must lead to increased profitability etc. A successful scheme therefore requires more than a large input additionality.

The direct effect of the extra R&D investment in a firm is in principle easy to identify by regression analyses of the relation between R&D and different "success indicators" at the firm level, cf. above. The methodological framework for such a study is already established in the international literature, and one can utilise the exogenous variation in R&D investments generated by SkatteFUNN. As an integrated part of this analysis we will also try to estimate the private returns to R&D investments

SkatteFUNN represents a subsidy that makes the price of an R&D investment faced by a firm lower than the actual cost. This implies that R&D projects may be carried out even if the private return is low. Subsidising R&D may be justified if there are market failures and positive externalities to R&D. Empirical data as well as economic theory suggest that such externalities exist and may be substantial. However, the lower the private return, the larger the externalities have to be for the investment to be socially profitable, thereby justifying the subsidy. Such indirect effects are however hard to identify.

In general, the input additionality effect is the easiest (or least difficult) to identify. Results, both on the firm level and possibly outside the firm, are harder to identify. These effects also come with substantial and unknown lags. We therefore expect to be able to give the most definitive answers with respect to input additionality.