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The input to the integration exercise of calibration of micro-economic effects

Pierre Mohnen

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SEVENTH FRAMEWORK PROGRAMME

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Final report

(Deliverable D7.3)

Pierre Mohnen

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Abstract

This report specifies the major results from the micro and the macro parts of the SIMPATIC project, the calibration that has been used in the macro part and the importance of the incorporation of spillover effects.

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The micro part

The SIMPATIC team responsible for the micro studies proposes a structural model that analyses the impact of R&D subsidies on private R&D and that allows to perform counterfactual analyses. The model includes four actors: the R&D performer, the experts evaluating the R&D subsidies, the government ultimately in charge of granting or not R&D subsidies and the financial intermediaries financing part of the projects. There are four estimating equations in the model: the decision by firms to do R&D or not, the decision for them to apply for R&D subsidies, the decision by the government to grant R&D subsidy on the basis of the quality of the proposals as evaluated by the experts, and the amount of R&D that will be performed based on the expected R&D subsidies. Decisions to apply for R&D subsidies and the ensuing amount of R&D that will be performed are made based on the expected costs of applying, the expected evaluation of the quality of the projects and the expected subsidy rate that will be granted by government. The evaluation of the impact of R&D subsidies is done not on ex-post data but on ex-ante anticipated data contained in the grant proposals.

The model has been estimated with advanced econometric techniques for data from 5 regions/countries: Finland, Flanders, Germany, the Netherlands and Spain. One difficulty is that the subsidy programs offered in the various countries are quite different from each other: in the Netherlands for instance there are only targeted grants and in Spain only cheap loans. At this stage reasonable values have been obtained for 3 regions/countries: Flanders,

Germany and Finland.

Calibrations for the macro part

The ideal would be to use the estimates from the micro approach to calibrate the macro simulations. What are the parameters from the micro part that could be used for the macro-level analysis? First, there is the marginal effect of R&D subsidies on R&D participation and on the amount of R&D for firms that decide to invest in R&D. Second, there is the marginal effect on welfare, which includes the private profit and the spillover effects. What do the results show? The results from the micro analysis show that there is a lot of heterogeneity between firms and also between countries reflecting different institutional environments. The optimal policy is really country specific. There is no "one-size-fits-all" optimal solution. Few firms are enticed to apply for R&D subsidies because of the high costs of applying for R&D subsidies. Welfare gains are modest. The big challenge seems to bring more firms to do R&D.

The micro analysis suggests that there is a lot of heterogeneity at the micro level and that many firms do not do R&D and will hence not be affected by R&D subsidies. There is hardly a typical effect that could be used in the macro model. The second difficulty is that the micro analysis is based on project data and should be interpreted in terms of project responses and not firm responses, let alone macro responses.

The macro part

The macro modeling part of SIMPATIC consists in two parts, one part uses the General Equilibrium Model GEM E3 and the second part uses the Econometric macro sectoral NEMESIS model.

The first part, using the GEM E3 model, focuses on energy and innovation. The second part, based on the NEMESIS model, focuses on innovation policies in general. One of the main developments done in the SIMPATIC framework is the integration of three innovation components: R&D, ICT and other intangibles. Each one produces spillovers that are constructed using patent citations where patents are assigned to industries according to industry of manufacture (IOM) for R&D and according to sector of use (SOU) for ICT and the other intangibles, on both the sending and the receiving end of the patent flows (Belderbos and Mohnen, D7.1, 2013). The effects of product and process innovations and the three innovation components and the elasticities of R&D, ICT and other intangibles to their user cost are calibrated based on estimates available in the literature. For R&D an extensive literature exists already (See Handbook of economics of innovation, Hall and Rosenberg, 2010).

However, with the introduction of the new innovation inputs that are ICT and OI, the calibration of the innovation function becomes more complex for two reasons. The first reason comes from the weakness of the empirical literature about the impact of ICT and Intangible investments in general at the macro-sectoral level. On the one hand, several studies explore their impact in a pure accounting framework without consideration of indirect effects such as externalities and, on the other hand, other studies assess the effects of the network externalities or the impact of intangibles and ICT only at a firm level. The second reason relies on the interactions existing between these innovation

inputs. Here again the most relevant studies are placed in a microeconomic framework (Kretschmer, 2012 [23], Brynjolfsson et al. 2002, Brynjolfsson and Hitt 2000) and studies at macro and sectoral level only begin (Corrado et al., 2014 [8] and Corrado et al., 2014 [9]).

The macro analysis comes to two major conclusions: first, that R&D is an important contribution to growth and competitiveness and secondly, that R&D support should be complemented with investments in ICT and intangibles because of the complementarity between R&D, ICT and other intangibles.

Importance of taking spillovers into account

One important link between an analysis conducted at the micro level and one conducted at the macro level is the incorporation of R&D spillovers. R&D subsidies, R&D tax incentives or public R&D projects yield immediate returns on the immediate beneficiaries, but these individual effects can magnified by spillover or externality effects. Those can be positive as when new markets get created, new opportunities to make profits, so called rent spillovers, or are firms learn from the experience of, or the knowledge accumulated by, other firms, so called knowledge spillovers. They can also be negative, as when new products supersede old products, making them obsolete, outdated.

Spillovers can occur at various levels: between research units in a large company, between firms within an industry, between firms across industries, within as well as between regions and countries.

Spillovers can occur via various channels: through trade, foreign direct investment, networks, collaborations, fares and conferences, publications and other codifications of knowledge. Given the multitude of ways spillovers

materialize, it is difficult to measure spillovers using a particular transmission vehicle, unless these various channels operate simultaneously.

In the end the SIMPATIC team has decided to measure intersectoral and international R&D spillovers using patent citations for various reasons. Patent data with patent citations are available for many countries. They are classified in detailed technology classes, allowing for instance to distinguish “green” and “dirty” patents. They capture both rent and knowledge spillovers, knowledge spillovers to the extent that they correspond to new ideas and rent spillovers to the extent that we can dissociate for each patent an industry of manufacture and an industry of use. A given patent can have multiple users as well as multiple owners. Information on the citing patent can be used to identify sectors of use while information on the cited patent can be used to identify sectors of origin. In this way spillovers can be extended to service industries. Finally some experience with these patent flow matrices had been built up earlier by the macro team in the NEMESIS project.

When spillovers are included in the micro analysis by magnifying the social return by the spillover effects on other sectors in the economy and other countries of the set of EU countries, the welfare effect increases to reach a 10% markup over private returns.

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