

R&D, Industry Dynamics and Public Policy –Revised proposal

1. Relevance

Our project covers most of the issues listed in the program, although it is organized somewhat differently than “Economics and Business Perspectives”. The first part of the project covers the dynamics of industry, R&D and the decisions of firms to innovate (first part of first bullet point) and sectoral differences (second bullet point).

The second part of the project covers optimal R&D policy, including immaterial capital and public policy (last part of first bullet point), and includes policy design in an endogenous growth context (third bullet point). Moreover, the second part of the project also covers topics under “An Innovation Theoretic Perspective”, for example, spillovers and spread of knowledge (first bullet point), as well as the efficiency of different types of R&D instruments (second bullet point).

2. Aspects relating to the research project

2.1 Background and status of knowledge

R&D and industry dynamics. Industry dynamics, including creation and growth of new, more efficient firms, and reallocation of resources (particularly labor) from old, inefficient firms to new firms with better technology are often considered to be the engine of capitalism, the dynamo in the economy that ensures growth and prosperity. Research and development is in many cases key in this process of creative destruction (Schumpeter 1942). This process does not always run smoothly, however. A key property of a flexible dynamic economy is that technological progress is achieved and implemented without too many resources being lost along the way, implying that the process of creative destruction is more creative than destructive.

Industry dynamics. There exists a large literature on R&D and industry dynamics. A survey of the empirical literature is given in Bartelsman and Doms (2000). Most of the empirical studies utilize the Longitudinal Research Database. This database includes information on R&D spending and company characteristics, mainly sales and th

ment nor search frictions in the labor market.
ntive to invest in human capital is studied
the theory of on-the-job search and turnover
agos (2006). Moen and Rosen (2006) show
e contracts, and that multiple equilibrium may
al literature on turnover, the work by Davis,
gross worker flows (measured as changes in
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Entrepreneurship. The origin of entrepreneurs and the importance of R&D have attracted considerable attention in the literature. Standard references in the recent literature include Gompers et al (2005), Agarwal et al (2004), and Klepper and Sleeper (2005). A problem that hampers the literature on entrepreneurship is that entrepreneurs are defined as self-employed, an assumption first introduced in Hamilton (2000). With our data set, we

employees. This allows us to trace the interrelated event histories of workers and firms, and to study the relationship between firm creation, R&D and industry dynamics in detail – and opens up for major advances in our understanding of R&D and firm dynamics.

Optimal R&D policy. There are reasons to believe that R&D, innovation and entrepreneurship create externalities through spillovers depending on absorptive capacity, through information spillovers between workers, and through the tax system. These externalities create a gap between the private and social returns to innovations. In most countries, therefore, the government actively supports R&D.

The importance of R&D spillovers is emphasized both in the IO literature and the macroeconomic literature. Central contributions in the IO literature include Nordhaus (1969), Spencer and Brander (1983) and Spence (1984). Aspremont and Jacquemin (1988) identified the implication of R&D spillovers for economic efficiency and subsidies under different market structures. Seminal contributions in R&D-based endogenous growth theory are given in Romer (1990), Aghion and Howitt (1992) and Grossmann and Helpman (1994).

Importantly, from Statistics Norway we will include the R&D database (around 17,000 firms), from the Industry Database (investment data, etc.) and, finally, from the Patent Registers (all patents registered in Norway in the period 1995-2005 and identification of the patent holders).

2.3.2 R&D and industry dynamics

The database will be sufficiently rich to facilitate descriptive as well as causal analyses of R&D investments, industry dynamics and the role of worker flows, with much better data on firm characteristics and worker histories than in Longitudinal Research Database. Identification of empirical regularities in the data may give impetus to theoretical findings whose empirical relevance may in turn be rigorously tested on the basis of structural or reduced form econometric models. A key concern in our empirical analysis is that correlations do not always reflect causation. Causality can sometimes be recovered, however, by taking advantage of exogenous shocks/reforms present in the data or by imposing theoretically justified restrictions on structural models.

Industry dynamics include the evolution of firms over their life cycle, in which R&D is given a key role in many studies. Klette and Kortum (2004) construct a dynamic growth model of R&D and firm dynamics to explain a set of stylized facts regarding R&D. We plan to test some of the assumptions and implications of the Klette-Kortum model such as, for instance, that R&D is a prerequisite for growth. To the extent that we find empirical regularities that the Klette-Kortum model cannot account for, we plan to modify the model so as to incorporate these findings and analyze the implications.

In the Klette-Kortum model, the labor market is assumed to be frictionless, and no importance is attached to *worker flows*. Worker flows affect the incentives for investing in R&D, as well as the ultimate social value of such endeavors. Worker mobility is a source of spillover from

The determinants of R&D investments

- Characterize firms and sectors that invest heavily in R&D in terms of factors such as profitability, size, employee composition, market position, degree of competition and regulation.
- Investigate the relationship between R&D investments, the firms' international competition, and the degree of foreign ownership.
- Examine the presence of external effects between firms in the same sector or in the same geographic area.
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behaviour among firms than others. In some industries capacity constraints play a major role, resulting in equilibrium prices well above marginal costs. In other industries, competition is softened by product differentiation. Moreover, industries vary in the extent of spillovers from R&D activities, and in the extent of complementarities between the various firms' R&D investments. Because of these variations across industries, it may be necessary for government to have a R&D policy that incorporates flexible instruments. Whereas a standard R&D subsidy may be useful as a basis for the government's policy, it may need to be complemented in some industries with other instruments. This rationalizes why R&D activities in the real world are stimulated in various ways.

In Norway, R&D is supported in several ways, including direct support from the Research Council after an application process (*ex ante* support), tax credits for R&D expenses or matching grants, state-owned venture capital funding and, finally, funding of research and education at universities and non-commercial research institutions. A key issue in this part of the project is therefore to *identify the optimal mix of R&D instruments*.

Private information

R&D politics in practice are generally hampered by severe informational problems (see e.g. Katz

R&D in a Small Open Economy
The defining models in endogenous

(http://www.bi.no/templates/omSkolested_41466.aspx). The objective of this center is to carry out applied research and analysis in industrial economics broadly defined, of which R&D and industry dynamics is an integral part. At the Frisch centre, applied and empirical economics research in industrial organization and labor economics is the major activity. A core competence is empirical analysis using large data sets, and the project will broaden the scope of their already rich database.

A key idea of the project is to merge not only the two established datasets, but to exploit the synergies arising from the cooperation between two research environments that have each specialized on different segments of the market economy; the Economics and Financial Economics Department of the Norwegian School of Management, with their expertise in industrial economics, labor economics and firm-level accounting data, and the Ragnar Frisch Centre for Economic Research, with its experience in the empirical analysis of individual event histories and expertise in micro-econometric analysis. The merged dataset will be located at the Frisch Centre, where large investments already have been made in reliable security systems and storage capacity, and where access to supercomputing facilities is ensured.

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