



MONTHLY REVIEW OF ACADEMIC LITERATURE ON RESEARCH AND INNOVATION AS SOURCES OF GROWTH

Contact: DG RTD, Directorate A, A4, Diana Ognyanova, Tel. 69750, diana.ognyanova@ec.europa.eu

1. Technology and costs in international competitiveness: from countries and sectors to firms

Dosia G, Grazzi M, Moschella D (2015). Technology and costs in international competitiveness: From countries and sectors to firms. *Research Policy*. 44(10):1795-1814.

- This paper studies the distinct effects of technological and cost variables on firms' exports.
- It finds that technological variables (patents and investments) dominate over cost variables (labour costs).
- Results are reinforced when separating the short- and the long-run effects and still hold when employing Community Innovation Survey (CIS) data.
- The paper also provides evidence that exports of innovative firms decrease less in response to a real exchange rate appreciation.

This paper examines the microfoundations of the determinants of international competitiveness. It does so within the broader 'technology gap' perspective whereby wide technological and organizational differences ultimately shape the patterns of trade within sectors across countries and their dynamics. First, the paper takes stock of the incumbent evidence on the relation between cost-related and technological competition at country and sectoral level. The overall picture indeed suggests that the countries' sectoral market shares are mainly shaped by technological factors while cost advantages/disadvantages do not seem to play any significant role. However, within any sector, within any country, firms widely differ. The study attempts to empirically identify the underlying dynamics at the firm level using a large panel of Italian firms, over nearly two decades. Results show that also at micro level in most sectors investments and patents correlate positively both with the probability of being an exporter and with the capacity to acquire and to increase exports, whereas labour costs show a negative effect only in some sectors. The result is reinforced when separating the short- and long-run effects, highlighting the predominant impact of technological proxies and basically the irrelevance of wage costs.

2. Patent Boxes Design, Patents Location and Local R&D

Alstadsæter A, Barrios S, Nicodeme G, Skonieczna A M, Vezzani A (2015). Patent Boxes Design, Patents Location and Local R&D. *IPTS Working Papers on Corporate R&D and Innovation -6/2015*.

- The study finds that patent boxes have a considerable effect on attracting patents, mostly because of their favourable tax treatment, especially for high-quality patents.
- The size of the tax advantage offered by patent boxes is found to deter local innovative activities, whereas R&D development conditions tend to attenuate this adverse effect.
- On average, countries imposing such development conditions tend to grant a tax advantage that is slightly greater than optimal from a local R&D impact perspective.

Patent boxes have been heavily debated for their role in corporate tax competition. This paper uses firm-level data for the period 2000-2011 for the top 2,000 corporate research and development (R&D) investors worldwide to consider the determinants of patent registration across a large sample of countries. It disentangles the effects of corporate income taxation from the tax advantage of patent boxes. The study also exploits a new and original dataset on patent box features such as the conditionality on performing research in the country, and their scope. The study finds that patent boxes have a considerable effect on attracting patents, mostly because of their favourable tax treatment, especially for high-quality patents. Patent boxes with a large scope in terms of tax base definition also have stronger effects on the location of patents. The size of the tax advantage offered through patent box regimes is found to deter local innovative activities, whereas R&D development conditions tend to attenuate this adverse effect. The simulations in the study show that, on average, countries imposing such development conditions tend to grant a tax advantage that is slightly greater than optimal from a local R&D impact perspective.

3. The impact of R&D subsidies during the crisis

Hud M, Hussinger K (2015). The impact of R&D subsidies during the crisis. *Research Policy*. 44(10):1844-1855.

- The paper studies the impact of subsidies on R&D investments of SMEs in Germany during the most recent economic crisis.
- The subsidy receipt had an overall additionality effect on firms' R&D investments.
- A crowding out effect was found only in the crisis year 2009.
- The crowding out effect is not caused by Germany's countercyclical innovation policy, but rather due to the reluctant R&D investments of companies during the crisis.

This study investigates the impact of public R&D subsidies on R&D investments of small and medium-sized enterprises (SMEs) in Germany during the most recent economic crisis. The analysis is based on firm-level data of the Mannheim Innovation Panel (MIP) covering the period 2006–2010. While the paper finds an overall positive effect of R&D subsidies on SMEs' R&D investment behavior, a crowding out effect was found for the crisis year 2009. In 2010, when the German economy started to recover, the subsidy effect was found smaller than in the pre-crisis years, but positive and significant. Additional tests indicate that the temporary crowding out effect was caused by reluctant innovation investment behavior of the subsidy recipients rather than by Germany's countercyclical innovation policy during the crisis.

4. Tracking the internationalization of multinational corporate inventive activity: national and sectoral characteristics

Alkemade F, Heimeriks G, Schoen A, Villard L, Laurens P (2015). Tracking the internationalization of multinational corporate inventive activity: national and sectoral characteristics. *Research Policy* 44(9):1763-1772.

- This paper offers a comprehensive overview of national and sectoral patterns of R&D internationalization by multinational corporations for the years 1993–2005.
- It introduces a unique database, the Corporate Invention Board (CIB), which combines data from the PATSTAT and the ORBIS databases on the 2289 companies with the largest R&D investments.
- The results show heterogeneity in sectoral and national patterns of internationalization.
- Asian countries are on average less internationalized than expected, whereas the European countries and Canada are more internationalized.

This study introduces a unique database, the Corporate Invention Board (CIB). The CIB combines patent data from the PATSTAT database with financial data from the ORBIS database on the 2289 companies with the largest R&D investments. The paper offers a comprehensive overview of national and sectoral patterns of R&D internationalization by multinational corporations in the period 1993–2005. The results show heterogeneity in sectoral and national patterns of internationalization. These

patterns have remained relatively stable over the 1993–2005 period. China is among the least internationalized countries and European countries, especially the UK and the Netherlands, are among the most internationalized countries. The largest countries in terms of patent production, such as Germany and the US, have internationalization profiles that can be very well predicted based upon their sectoral composition. Other country profiles, however, diverge significantly from the prediction based on sectoral profile. Asian countries are on average less internationalized than would be expected, whereas the European countries and Canada are more internationalized. The paper finds that while national level indicators explain a large part of the variance observed in the ability of countries to attract R&D from foreign multinationals, there are significant differences between sectors and this has large implications for the design of foreign R&D and innovation policies.

5. Just-in-time patents and the development of standards

Byeongwoo K, Bekkers R (2015). Just-in-time patents and the development of standards. *Research Policy*. 44(10):1948-1961.

- Patents essential to technical standards have become very valuable assets.
- This paper demonstrates how companies use a strategy the authors call 'just-in-time patenting'.
- It matches patent data with inventors' presence at standards meetings.
- The paper demonstrates how firms drive patents with low technical merit into standards.

Modern technical standards often include large numbers of patented technologies that are required to implement those standards. These "standard-essential patents" are very valuable assets, and firms that do not own such patents need to spend billions of dollars purchasing them. Whereas large numbers of standard-essential patents are often taken for granted, this study focuses on the process by which companies obtain such patents. Analyzing original data of a large standardization process, the paper demonstrates how many companies use a strategy the authors call "just-in-time patenting": They apply for patents of low technical merit just before a standardization meeting, and then send the patents' inventors to the meeting to negotiate this patented technology into the standard. The findings of the study have several implications for standard-setting organizations, patent offices, and policymakers, as the inclusion of just-in-time patents may reduce competition and market entry, increase prices, and unnecessarily complicate the technological content of standards.

6. Excellence and growth dynamics: A comparative study of the Matthew effect

Langfeldt L, Benner M, Sivertsen G, Kristiansen E H, Aksnes D W, Borlaug S B, Hansen H F, Kallerud E, Pelkonen A (2015). Excellence and growth dynamics: A comparative study of the Matthew effect. *Science and Public Policy*. 42(5):661-675.

- Based on empirical studies of Centres of excellence (CoE) in four Nordic countries, this paper examines how the resources provided by CoE schemes (generous long-term funding, prestige and visibility) add to the success and growth dynamics of the CoE.
- The data indicate a modified Matthew effect with ceilings and limits avoiding excessive accumulation of resources.
- The study finds that CoE enable more interdisciplinary collaboration and risk-taking and enhance international recruitment.

In the past two decades, centres of excellence (CoE) and other 'research excellence initiatives' likely to increase the cumulative advantages and stratification of science, have been implemented in many countries. Based on empirical studies of CoE in four Nordic countries, this paper examines how the resources provided by CoE schemes (generous long-term funding, prestige and visibility) add to the success and growth dynamics of the CoE. The data indicate a modified Matthew effect with ceilings and limits avoiding excessive accumulation of resources. Important impacts of the CoE are found, in

particular in terms of enabling more interdisciplinary collaboration and risk-taking and enhancing international recruitment to the research areas involved. However, in contrast to what might be expected, the CoE grant seem to add less to the relative citation rate of those already performing at the highest level, than for those performing at lower level prior to the CoE grant.

7. Does involvement in patenting jeopardize one's academic footprint? An analysis of patent-paper pairs in biotechnology

Magerman T, Van Looy B, Debackere K (2015). Does involvement in patenting jeopardize one's academic footprint? An analysis of patent-paper pairs in biotechnology. *Research Policy* 44(9):1702-1713

- The study explores whether the involvement in patenting hampers the dissemination of published research.
- It finds no negative effect on forward citations for publications that are subject to a patent.
- Moreover, it finds a far higher lifespan H-index for authors involved in patenting activities.

This study explores the question whether involvement in patenting hampers the dissemination of a scientist's published research. To this end, a detailed, large-scale citation analysis of patent-paper pairs in biotechnology is conducted. Those pairs signal the occurrence of research resulting simultaneously in scientific publications and patent applications. Patent-paper pairs are detected using text-mining algorithms applied on a large dataset. Starting from a dataset consisting of 948,432 scientific publications and 88,248 EPO and USPTO patent documents, 584 patent-paper pairs are identified. The forward citation patterns of these patent-paper pairs are then matched and compared to biotechnology publications without an equivalent patent. Publications linked to a patent receive more citations than publications without a patent link (after taking into account the necessary controls). In addition, by comparing H-indexes, the findings of the study reveal that the authors involved in such pairs develop a larger scientific footprint than comparable colleagues refraining from patent activity. The study concludes that involvement in patenting does not hamper the dissemination of published research in the field of biotechnology.

8. Persistence of various types of innovation analyzed and explained

Tavassoli S, Karlsson C (2015). Persistence of various types of innovation analyzed and explained. *Research Policy*. 44(10): 1887-1901.

- The study analyzes the persistency in innovation behavior of firms, using a panel of Community Innovation Survey in Sweden, which spans over a decade.
- It distinguishes between product, process, organizational, and marketing innovations.
- There is a variation in the degree of persistency among the four types of innovation.
- Product Innovation shows the strongest persistency among all four types of innovation.
- Marketing Innovation shows the least persistency.

This paper analyzes the persistency in innovation behavior of firms. Using five waves of the Community Innovation Survey in Sweden, the study has traced the innovative behavior of firms over a ten-year period, i.e., between 2002 and 2012. The paper distinguishes between four types of innovations: process, product, marketing, and organizational innovations. First, using transition probability matrix, it found evidence of (unconditional) state dependence in all types of innovation, with product innovators having the strongest persistent behavior. Second, using a dynamic probit model, the paper found evidence of "true" state dependency among all types of innovations, except marketing innovators. Once again, the strongest persistency was found for product innovators.

9. Market failure in the diffusion of consumer-developed innovations: Patterns in Finland

De Jong J P J, von Hippel E, Gault F, Kuusisto J, Raasch C (2015). Market failure in the diffusion of consumer-developed innovations: Patterns in Finland. *Research Policy*. 44(10):1856-1865.

- The study finds that the scope of innovation by consumers for their own use is substantial, but only a fraction diffuse beyond the originators.
- Value that others may gain can often not be internalized by consumer-developers, who therefore do not invest effort in supporting diffusion.
- The paper documents a novel type of market failure by showing that more valuable innovations are not more likely to diffuse 'for free' than less valuable ones.

Empirical studies have shown that millions of individual users develop new products and services to serve their own needs. The economic impact of this phenomenon increases if and as adopters in addition to the initial innovators also gain benefits from those user-developed innovations. The paper argues that the diffusion of user-developed innovations is negatively affected by a new type of market failure: value that others may gain from a user-developed product can often be an externality to consumer-developers. As a result, consumer innovators may not invest in supporting diffusion to the extent that would be socially optimal. Based on a large sample of consumers in Finland, the authors explore the extent to which innovations developed by individual users are deemed of potential value to others, and the extent to which they diffuse as a function of perceived general value. The empirical analysis supports the hypothesis that market failures affect the diffusion of user innovations developed by consumers. Implications and remedies are discussed.

10. Technology and people: The great job-creating machine

Stewart I, De D, Cole A (2015). *Technology and people: The great job-creating machine*. Deloitte. <http://www2.deloitte.com/content/dam/Deloitte/uk/Documents/finance/deloitte-uk-technology-and-people.pdf>

- The study, based on census data for England and Wales between 1871 and 2011, found that technology has created more jobs than it has destroyed.
- The authors argue that during the last 200 years when a machine replaces a human, the result, paradoxically, is faster growth and rising employment.
- Declining employment in agriculture and manufacturing is being more than offset by rapid growth in the caring, creative, technology and business services sectors.
- Rapid advances in technology mean that education, training and the distribution of income are likely to be central to the political debate for many years to come.

This study looks at the impact of technology on employment in England and Wales between 1871 and 2011 and found that technology has created more jobs than it has destroyed. The authors argue that technological change is the prerequisite for improving welfare. Until the eighteenth century the organisation of work was largely fixed and the material condition of the masses was miserable. It was the change of the industrial revolution, the application of steam power to production, urbanisation and the rise of manufacturing that brought improvements in material conditions and life expectancy for working people. Technology has transformed productivity and living standards, and in the process, created new employment in new sectors. The authors argue that during the last 200 years when a machine replaces a human, the result, paradoxically, is faster growth and, in time, rising employment. The authors found that in the UK employment has more than doubled in the last one and a half century. The work of the future, according to the study, is likely to be varied and have a bigger share of social interaction and empathy, thought, creativity and skill. The authors point to two central policy challenges. If the pace of adoption of technology is accelerating, society will need to prepare for higher levels of technological unemployment. And the way in which change increasingly rewards high-level education and skills suggests that income inequality may yet widen. Rapid advances in technology mean that education, training and income distribution are likely to be central to the political debate.