SPECIAL ISSUE ON THE ECONOMICS OF KNOWLEDGE SPILLOVERS: INTRODUCTION AND OVERVIEW

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ABSTRACT:

This paper summarises the contents of the special issue of the Brussels Economic Review on the economics of knowledge spillovers. The studies of this special issue lead to the following main findings. Knowledge spillovers arise through different channels and they are largely shaped by the structure of economic activities in a given region. Universities appear to be a main actor of science and technology generation and transfer. However, this source of scientific information does not appear to play an important role for the firms innovative activities. Furthermore, while universities are an important actor of firms innovative collaborative agreements, the fruits of these partnerships do not have a significant impact on firms' economic performance.

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KEYWORDS: Knowledge spillovers, Innovation, Industry-University S&T transfer and collaborations, Firm's economic performance.

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Ever since innovation was identified as an important driver of economic growth, policy makers have had a keen interest in understanding how the process of developing and integrating new knowledge in the innovation process leads to successful innovation. The prosperity of a country is expected to rise with the ability to access available new knowledge, which is relevant for the innovation process. Hence, it is important to stimulate the channels through which external technological information flows. The models of endogenous innovation-driven growth have placed the subject of knowledge spillovers at the forefront of research. Knowledge spillovers can be defined as the amount of knowledge that can not be appropriated by the economic agent who created it. While the imperfect appropriability of the outcomes of innovative activities has been acknowledged since a long time, numerous empirical studies have shown that spillovers do exist and are likely to be substantial.

In the literature, it is common to distinguish between different types of knowledge spillovers. Rent or market spillovers exist because innovations are rarely sold at prices that entirely reflect quality improvements. Pure knowledge spillovers refer to as the results (or part of it) of innovative activities generated by firms that can be obtained free of charge by other firms. Network spillovers take place when the expected value of an innovation is strongly dependent on the development of a set of related technologies. Finally, competitive spillovers occur when R&D activities of competitors have detrimental effects on firms’ R&D and economic performance. Knowledge spillovers can be transmitted through different channels. These externalities can be voluntary (through R&D cooperation for instance) or involuntary (freely available information), embodied (acquisition of new equipment, hiring of R&D personnel) or disembodied (licensing agreements, R&D subcontracting). The degree of knowledge transferability depends on different characteristics of the knowledge good (basic versus applied R&D, process versus product R&D, radical versus incremental innovation). Knowledge diffusion can be tacit (face-to-face interactions) or codified (scientific publications, patents). Transferability also depends on geographic (local, national, international) and cultural proximities (language) and on the technological absorptive capacity of the recipient. Finally, because of lags in the diffusion of knowledge, the effects of spillovers on economic growth and welfare are almost certainly not immediate.

The purpose of this special issue of The Brussels Economic Review, is to bring together, a group of papers that provides considerable insights into our understanding of knowledge spillovers, the diffusion of technology and their implications on innovation and economic activities. These papers undertake a generally common approach in that they all focus upon the assessment of knowledge spillovers and their impacts. They, however, are quite distinct in that each one addresses a different specific question and provides insights on a particular issue.

In the first paper in this special issue, “The Impact of Industrial Specialisation and Diversity on Innovation”, Lydia Greunz, concentrating on the European regional case, examines whether and how dynamic externalities are shaped by the composition of eco-
nomic activity within a particular geographical area. After a review of the empirical literature on intra-regional spillovers arising from specialisation and diversity and based on a derived model, the author constructs several measures aimed at capturing potential Jacobs as well as Marshall-Arrow-Romer (MAR) externalities. The latter arise when an increased concentration of a particular industry within a specific geographic region facilitates knowledge spillovers across firms. The former materialise as an appropriate agglomeration of different industries within an urban region, which fosters innovation due to the diversity of available knowledge sources. These measures are tested on an extended sample of 153 European regions at the two digit industry level (over the 1990-1998 period). The results, when sector and regional specific characteristics are controlled for, suggest that both kinds of externalities generate knowledge spillovers and positively influence the outcomes of innovation as measured by patenting. Furthermore, Jacobs externalities have a higher impact on knowledge creation as compared to MAR externalities in the context of "high density" regions, i.e. regions with a density of population exceeding 500 inhabitants per squared kilometer, as well as for high-tech industry sectors. In terms of policy implications, the focus should therefore be put on policy instruments that strengthen industrial diversity.

Higher Education institutions, in particular universities, are playing an increasingly important role in economic growth through innovation and knowledge generation and technology transfer. The valorisation of academic knowledge can take several forms from scientific publications, consulting activities, creation of spin-offs to patent applications. In "Insight into the Patenting Performance of Belgian Universities", Eleftherios Sapsalis and Bruno van Pottelsberghe provide an in-depth analysis of the evolution of Belgian applications by six Belgian universities over the 1985-2001 period. Thanks to the information contained in the patent documents, the authors also analyse the potential value of patenting, the institutional sources of the knowledge, the international patenting strategy and the type of co-assignee. With the KUL being by far the most productive Belgian university, the results indicate a catching-up process in patenting by all universities, both in terms of quantity and quality. For the authors, three main factors can be advanced to explain the boom in universities patenting activities during the 90s': a change, as in other countries, of the regulation as regards the intellectual property rights associated with publicly financed research projects carried out at universities, the technological revolution in ICT, biotechnology and nano-technologies, and finally a higher propensity to patent academic inventions.

Given the importance of regional spillovers arising from both industry specialisation and diversity and the growing role played by universities in terms of knowledge generation and valorisation, it is of particular interest to analyse the extent to which and the diffusion mechanisms through which these new ideas can benefit to firms innovative activities. Indeed, in order to generate new goods and services, firms in general do not rely on internal research capabilities only. Other strategies such as collaborative research agreements or the use of external sources of information can also significantly contribute to the firm development of innovation.
In "Industry-University S&T Transfers: What Can We Learn From Belgian CIS-2 Data?", Henri Capron and Michele Cincera, based on the second Community Innovation Survey data for Belgium, examine the main firms and industry’s characteristics that explain different sources of information firms use to develop their innovative activities (informal knowledge spillovers) as well as the formation of R&D collaborative agreements with different types of partners (formal knowledge spillovers). In particular, the authors investigate the role played by universities as a provider of technological information and as a main partner in R&D collaboration. The main findings, which corroborate the conclusions of previous studies in this literature, indicate that firms’ size, the provision of public support for innovation and patenting activities are the main determinants conducive to firms-university R&D partnerships and firms’ use of university based scientific information. Another result of the study is that at the Belgian aggregate level, university do not appear to be the most important source of information for firms’ innovation activities. However in terms of collaborative agreements, universities are the second main actor with whom enterprises collaborate.

Like the previous paper, Stéphanie Monjon and Patrick Waelbroeck in "The Nature of Innovation and the Origin of Technological Spillovers", also use data from CIS-2, but for France. Based on a sequential econometric model, the authors investigate the impact of several types of information spillovers on the decision to innovate. They also test the extent to which the importance of these different information sources differ according to the degree of novelty of innovations. The results give clue that innovation rely on a large number of information sources external to the innovative firm. Other firms of the group, customers, patent publications, suppliers of raw materials and components as well as shows and exhibition appear to be valuable sources of information for firms introducing radical innovations on their market while firms that improve existing technologies rely more particularly on information coming from competitors. Scientific and technological information from universities and other public research institutes do not appear to be particularly relevant.

Finally, in the last paper, "Productivity Growth, R&D and the Role of International Collaborative Agreements: Some Evidence for Belgian Manufacturing Companies", Michele Cincera, Lieselot Kempen, Bruno van Pottelsberghe, Reinilde Veugelers and Carolina Villegas Sanchez, using the classical productivity growth framework, examine the contribution of R&D cooperation with different partners on firms’ productivity performance. The econometric analysis is based on a representative sample of 599 Belgian manufacturing firms over the period 1995-1999. The results, which are corrected for possible sample selection bias, suggest a strong and significant impact of international R&D cooperation on firms’ productivity growth. In particular cooperation with foreign customers, suppliers or other firms, which reflects more applied international R&D co-operative activities, significantly improve firms’ performance. On the other hand, cooperation with national partners has a negative impact and cooperation, both national and international, with universities and other public research institutions, which reflects more basic oriented R&D activities, is not significant. This result can be
explained by the fact that the impact of basic R&D may take a longer time to show up in firms' economic performance. The authors also try to assess the role of R&D cooperation as a channel for knowledge spillovers. Yet, the proxy used for measuring the available stock of external know-how, which foreign cooperation would give access to, do not provide conclusive evidence of that hypothesis.

The following papers included in this special issue of the Brussels Economic Review are edited versions of a selected number of papers from those presented at a workshop held in September 13th at Université Libre de Bruxelles and sponsored by the International Network on Innovation Research (INIR)¹.

¹ The workshop programme is available at: http://homepages.ulb.ac.be/~mcincera/INIR2003/MAIN.HTML