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University–industry linkages in the UK: What are the factors underlying the variety of interactions with industry?

P. D'Este [a,b,*], P. Patel [b]

[a] *Cranfield School of Management, Cranfield University, Bedford MK43 0AL, UK*
[b] *Science and Technology Policy Research (SPRU), The Freeman Centre, University of Sussex, Brighton BN1 9QE, UK*

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Abstract

This paper examines the different channels through which academic researchers interact with industry and the factors that influence the researchers' engagement in a variety of interactions. This study is based on a large scale survey of UK academic researchers. The results show that university researchers interact with industry using a wide variety of channels, and engage more frequently in the majority of the channels examined – such as *consultancy & contract research, joint research, or training* – as compared to patenting or spin-out activities. In explaining the variety and frequency of interactions, we find that individual characteristics of researchers have a stronger impact than the characteristics of their departments or universities. Finally, we argue that by paying greater attention to the broad range of knowledge transfer mechanisms (in addition to patenting and spin-outs), policy initiatives could contribute to building the researchers' skills necessary to integrate the worlds of scientific research and application.

Keywords: University–industry interactions; Variety; Academic researchers; Integration skills

1. Introduction

Universities play a crucial role in society as producers and transmitters of knowledge. In recent years the discussion about whether universities can encompass a third mission of economic development, in addition to research and teaching, has received greater attention (Mansfield, 1995; Branscomb et al., 1999; Etzkowitz and Leydesdorff, 2000; Leydesdorff and Meyer, 2003). Many scholars have argued that within the remit of the third mission university–industry research collaborations are extremely important mechanisms for generating technological spillovers. Such collaborations contribute positively to address innovation market failures and help realise the full social returns of R&D investments (Martin and Scott, 2000; Siegel and Zervos, 2002). Moreover, there is a burgeoning empirical literature showing an increasing level of academic commercial activities, such as patenting and licensing, and generation of spin-out companies (Shane, 2004; Friedman and Silberman, 2003; Thursby and Kemp, 2002; Zucker et al., 1998). This has been accompanied by an increase in research joint ventures (Hall et al., 2001) and joint scientific publications (Calvert and Patel, 2003). At the same time many governments have introduced an increasing range of policies encouraging the involvement of universities in technology transfer.

* Corresponding author at: Science and Technology Policy Research (SPRU), The Freeman Centre, University of Sussex, Brighton BN1 9QE, UK. Tel.: +44 1273877964; fax: +44 1273685865.
E-mail addresses: p.d-este-cukierman@sussex.ac.uk (P. D'Este), P.R.Patel@sussex.ac.uk (P. Patel).

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Despite this growing interest among academics and policy makers there are a number of gaps in the understanding of university-industry linkages. This paper aims to investigate two such gaps. The first is related to the variety of channels through which knowledge transfer occurs. Much of the literature on university–industry technology transfer has centred on the academic capacity to generate and exploit intellectual property rights (IPR) via patent ownership agreements, academic spin-offs and income streams from licences and royalties (Shane, 2004; Friedman and Silberman, 2003; Jensen et al., 2003; Link et al., 2003). In addition, many policy initiatives are aimed at encouraging university researchers to engage in patenting, licensing and creating new companies. However, systematic analysis of other forms of knowledge transfer, such as joint research projects, consultancy and training, has been largely neglected. The purpose of this paper is to focus on this wider variety of channels through which university researchers interact with industry.

The second neglected issue in the literature is related to the factors underlying the interactions of academic researchers with industry. Existing research shows that the distribution of science–technology interactions among academic researchers is highly skewed, with a few researchers engaged in a large number of interactions (Balconi et al., 2004; Agrawal and Henderson, 2002). However, we know little about the distinctive role of individual characteristics versus institutional characteristics (i.e. the institutional affiliation of university researchers) in explaining such heterogeneity of behaviour.

The paper is organised as follows. Section 2 sets out the conceptual framework highlighting why variety of interactions matters within the context of knowledge transfer between university and industry. Section 3 sets out the main research questions addressed in the paper and examines the main factors underlying the engagement of academic staff with industry, through a review of the literature. A description of the data used in the analysis is contained in Section 4, and Sections 5 and 6 present the main empirical results. Section 7 presents our conclusions.

2. Why variety of university–industry interactions matters

2.1. Emphasising variety rather than focusing solely on patenting and spin-offs

Many earlier studies of knowledge transfer have concentrated on patenting, licensing and formation of start-up companies as the main contributions of universities to technology diffusion. However, as several authors have noted, university–industry links embrace a much broader spectrum of activities than commercialisation of IPR (Agrawal and Henderson, 2002; Mowery and Sampat, 2005; Cohen et al., 2002; Mansfield and Lee, 1996; Schartinger et al., 2001). In particular, Cohen et al. (2002), using data from the Carnegie Mellon Survey of R&D performing firms in the US, highlighted that for most industries patents and licences were of lesser importance as channels for conveying public research than publications, conferences, informal interactions and consulting. In addition, Schartinger et al. (2001) and Roessner (1993) showed that patenting and licensing account for a small proportion of public–private interactions when compared to other formal arrangements such as contract research or joint research agreements. Agrawal and Henderson (2002), using data on academics in departments of mechanical and electrical engineering at MIT, confirm these findings, showing that patents account for only around 10% of all knowledge transfer activities.[1]

Thus there is abundant empirical evidence to suggest that the process of knowledge transfer between university and industry occurs through multiple channels such as personnel mobility, informal contacts, consulting relationships and joint research projects, and that patenting and spin-offs play a comparatively small part in this process (Faulkner and Senker, 1995; Arundel and Geuna, 2004; Sequeira and Martin, 1997). This is partly because only a minority of university–industry interactions are motivated by the prospect of directly realised commercial products. As Mansfield and Lee (1996) argue, academic R&D supported by industry seldom yields specific inventions or products. Such R&D is generally aimed at getting up-to-date knowledge, obtaining access to students and faculty, and finding solutions to specific problems.

Moreover, as Howell et al. (1998), Meyer-Krahmer and Schmock (1998) and D'Este et al. (2005) showed, university researchers choose to interact with industry for a diverse set of reasons. These include access to additional research income, applicability of research, access to industry skills and facilities, and keeping abreast of industry problems. It is unlikely that any single form of

[1] Many authors have noted the inherent risks involved in concentrating on IPR commercialisation and formation of spin-offs, given the highly skewed nature of licensing income, with only a very small proportion of inventions yielding commercial success (Lee, 1996; Lerner, 2005). Moreover increasing university patenting and licensing may pose serious challenges to the culture of open science within academia (Mowery and Sampat, 2005).