

On the role of input and output spillovers when R&D projects are risky

Nils Hauenschild*

*University of Hamburg, Institute for Statistics and Econometrics, Von-Melle-Park 5,
20146 Hamburg, Germany*

Received 2 May 2002; received in revised form 23 September 2002; accepted 3 December 2002

Abstract

This paper analyzes the impact of input and output spillovers on the expected effective cost reductions in a two-stage model of R&D where all R&D projects are risky. It is shown that, relative to the deterministic case, output spillovers tend to reduce expected cost reductions whereas input spillovers tend to increase investment in R&D and hence expected cost reductions. In particular, the relations between cost reductions in the presence of input and output spillovers known from deterministic models may be reversed under certain parameter constellations.

© 2003 Elsevier B.V. All rights reserved.

JEL classification: D43; L13; O31

Keywords: Research and development; Spillovers; Uncertainty

1. Introduction

During the last decade, research and development (henceforth R&D) has been one of the major fields of interest in both theoretical and applied industrial economics. Although there had been some previous studies on this subject, e.g. by Ruff (1969) and Spence (1984), most of the recent (theoretical) research was

*Tel.: +49-40-42838-3539; fax: +49-40-42838-6326.

E-mail address: hauen@econ.uni-hamburg.de (N. Hauenschild).

inspired by the seminal work of d'Aspremont and Jacquemin (1988) who analyzed the R&D activities of oligopolistic firms within the framework of a two-stage game.¹ One of the main features of their model (henceforth referred to as the AJ model) is the presence of output spillovers which means that part of the information about a firm's completed R&D project leaks out costlessly to its competitors who are thus able to benefit from cost reductions resulting from the successful R&D as well. A related line of research is essentially based on work by Kamien et al. (1992) whose model (henceforth the KMZ model) is formally rather similar to the AJ model but which assumes input instead of output spillovers. Here, leakages of information occur at the research stage and prior to the discovery of a new technology which does not become available to the rival firms. Despite this formal similarity, the models yield rather different results with respect to R&D performance as the AJ model implies systematically higher cost reductions through R&D than the KMZ model unless there are no spillovers.² This surprising and important distinction between the two popular models has only recently been pointed out by Amir (2000).

An important common element of almost all studies building upon one variant or another of the AJ and the KMZ model is that the success of the respective R&D projects is not at stake, i.e., any firm that engages in R&D will innovate with certainty and is also perfectly informed about the extent of the associated cost reduction. In order to analyze the effects of uncertainty with respect to the success of R&D projects one usually turns to stochastic models of racing games, e.g. in the spirit of Loury (1979), Lee and Wilde (1980), Reinganum (1982), and Beath et al. (1988). There, however, uncertainty refers to the time until one of the firms innovates and all other R&D projects are cancelled once the first innovation occurs. It is not possible that all firms innovate or that all projects fail. Moreover, with the notable exception of Martin (2002), the role of input and output spillovers which is central to the AJ and the KMZ models is not discussed in further detail. Unlike the racing game models, the approaches taken by Choi (1993) and Combs (1993) are conceptually closer to the AJ and the KMZ model, although they still differ in various important aspects. In particular, the product market competition in the second stage of the game is not modelled explicitly.

In this paper we consider simple stochastic versions of the original AJ and KMZ models and analyze how uncertainty with respect to the success of R&D projects influences technological performance in the sense of expected effective cost reductions. The main insight to be brought out in this analysis is that input and output spillovers cause important additional effects that are not present in a deterministic environment, and which influence technological performance in very

¹ A comprehensive survey of this line of research is provided by De Bondt (1997).

² The original models also differ in their degree of generality because d'Aspremont and Jacquemin (1988) assume linear cost and demand functions whereas Kamien et al. (1992) allow for general functional forms. However, the AJ model has been extended to this case by Suzumura (1992).

متن کامل مقاله

دریافت فوری ←

ISIArticles

مرجع مقالات تخصصی ایران

- ✓ امکان دانلود نسخه تمام متن مقالات انگلیسی
- ✓ امکان دانلود نسخه ترجمه شده مقالات
- ✓ پذیرش سفارش ترجمه تخصصی
- ✓ امکان جستجو در آرشیو جامعی از صدها موضوع و هزاران مقاله
- ✓ امکان دانلود رایگان ۲ صفحه اول هر مقاله
- ✓ امکان پرداخت اینترنتی با کلیه کارت های عضو شتاب
- ✓ دانلود فوری مقاله پس از پرداخت آنلاین
- ✓ پشتیبانی کامل خرید با بهره مندی از سیستم هوشمند رهگیری سفارشات