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User–producer relations, innovation and the evolution of market structures under alternative contractual regimes

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ABSTRACT

In this paper we examine the effects that user-producer interactions have on innovation and the dynamics of market structure of two vertically related industries under alternative contractual regimes. The existence of advantages stemming from users-producers relationships introduces a dynamic "matching" problem between firms characterized by heterogeneous capabilities and imperfect information who act in a continuously changing environment but are however able to improve their products also through interactive and interdependent learning processes. Our results highlight the subtle trade-offs and dynamic interdependencies that arise in these contexts. In particular, we show that: (a) a trade-off is present between the exploitation of past experience and the exploration of new suppliers; (b) externalities are present, even if the advantages arising from interactions do not spill over to other firms; (c) imperfect information and agents heterogeneity are crucial factors in determining the consequences of alternative contractual arrangements on industry dynamics; (d) vertical interdependencies propagate the effects of specific firms' decisions across industries and over time, so that the resulting dynamics is characterized by interacting path-dependent processes.

1. Introduction

In this paper we examine the effects that user–producer interactions have on innovation and the dynamics of market structure of two vertically related industries under alternative contractual regimes. User–producer relationships have been a key theme in the economics of innovation ever since the seminal contribution by Lundvall (1992): user–producer relationships may generate interactive learning, improvements in products and processes and innovation. Yet, despite the widely recognized importance of user–producer interactions as an important source of innovation, very little attention has been paid to the analysis of how the existence of technological advantages arising from tight interactions among suppliers and producers influences the co-evolution of innovation and market structure. The empirical literature has focused mainly on the attempt at identifying how and at what conditions user–producer relations may foster innovation at the level of individual firm, region and country, without considering in any detail the consequences on the dynamics of concentration: if anything, the discussion has been mainly framed in terms of the relative advantages of establishing tight relations among suppliers and customers as opposed to vertical integration or other forms of governance of the innovative process. In a more theoretical perspective, while a few models (Ciarli et al., 2008; Windrum et al., 2009) have studied the effects of vertical specialization and outsourcing on firms performance and innovation, no formal model has yet been produced so far which explicitly focuses on the effects of close interactions between users and producers and the patterns of industry evolution.

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In a previous paper (Malerba and Orsenigo, 2008), we began to explore how users–producers interactions affect innovation and the dynamics of market structure in industry evolution. In this paper we extend the analysis by examining how the benefits of user–producers interactions influence the rates of innovation and the evolution of market structure in the two related industries under alternative contractual arrangements. We do not address the issue of why specific contractual forms are used: more generally, we do not enter the realm of contract theory. Nor do we consider here the possibility that firms may vertically integrate. More modestly, as an initial step, we simply compare the dynamic effects of different contractual forms regulating market transactions, namely the length and the exclusivity of the contracts.

The choice for a highly simplified analysis is supported by the consideration that even in this extremely stylized setting, the model generates a rather complex behaviour. In fact, the existence of advantages stemming from users–producers relationships introduces a dynamic "matching" problem between firms characterized by heterogeneous capabilities and imperfect information who act in a continuously changing environment but are however able to improve their products also through interactive and interdependent learning processes. Our results highlight the subtle trade-offs and dynamic interdependencies that arise in these contexts. In particular, we show that:

a. a trade-off is present between the exploitation of past experience and the exploration of new suppliers;
b. externalities are present, even if the advantages arising from interactions do not spill over to other firms;
c. imperfect information and agents heterogeneity are crucial factors in determining the consequences of alternative contractual arrangements on industry dynamics;
d. vertical interdependencies propagate the effects of specific firms' decisions across industries and over time, so that the resulting dynamics is characterized by interacting path-dependent processes.

It has to be emphasized that the model presented here is not "history-friendly", i.e. it does not aim at qualitatively examining the main causal factors and processes that could explain the evolution of a particular industry (Malerba et al., 1999, 2008; Malerba and Orsenigo, 2002). This exercise originates indeed from a "history-friendly" model (Malerba et al., 2008), but it has not the ambition to reproduce the main stylized features of any particular industry. As much as we are convinced that history friendly models are an extremely useful and methodologically sound research tool, they are not necessarily the only acceptable modeling strategy. We believe that they are complementary with other more traditional styles. Here we develop a history friendly model in a more abstract way for two reasons. First, we are interested in investigating and probing a more general phenomenon that might apply to a variety of industries, very much along the lines of Malerba et al. (2007). Second, in a complementary perspective, we feel the need of beginning to elucidate some more abstract theoretical issues which could then guide us towards the construction of models of industries where user–producer relations play a particularly important role.

The paper is organized as follows. In the next section we discuss the empirical and theoretical background of the paper. In Section 3 we begin to examine the complex issues that the consideration of user–producer relations introduces in the dynamics of market structure. In Section 4 we present the spirit and the logic of the model, the structure of which is outlined in Section 5. Then in Section 6 we run the basic simulation exercises. Finally in Section 7 we draw the main conclusions.

2. The background

The notion that user–producer relationships might be a fundamental source of technological advances and innovation was first introduced by Lundvall (1992) and since then it has had a profound impact on the economics of innovation. Lundvall (1992) emphasized that users are quite knowledgeable about products uses and applications, and that their interactions with suppliers provide the latter with information, ideas and feedbacks. The establishment of close relations between producers and users can facilitate the transfer of tacit knowledge, the development of trust, the ability to customize products, etc. Thus, the development of close and stable relations between suppliers and users might be beneficial to both parties and therefore such interactions should be properly used and organized.

More generally, the recognition that the development of new technologies in many cases requires close communication and interaction between users and producers has deeply influenced our understanding and our representations of the innovation process. The relevance of user–producer interactions appears in a vast range of different streams of research: the literature is so large and pervasive that cannot be reviewed here. Suffice it to mention, as examples, that von Hippel (1986, 1988, 2005) pointed to lead users as sources of ideas for the innovation process of producers and to the role of users as innovators themselves. Bresnahan and Greenstein (2001) have emphasized that users and producers may co-invent new process technologies and introduce organizational innovations. Producers knowledge and innovations are modified by users when they are adapted to their specific organization and production processes. Often this takes place with the active participation of both producers and users. The whole literature on networks of firms has argued that vertical R&D joint ventures and cooperative agreements between suppliers and users are a major source of innovation and new product development (Powell and Grodal, 2005). The idea of the importance of user–producer interactions is a key element in the development of the various notions of national, regional and sectoral systems of innovation, whereby it is often argued that it is precisely these relations that may significantly contribute to explain the development of innovative regional clusters or the export performance of countries in specific industries (Fagerberg, 1993; Porter, 1990). However, it has also been argued that relations between users and producers may not always be beneficial to innovation: in some cases they may hinder it, especially if new (disruptive) technologies