



## Innovation and appropriation mechanisms: Evidence from Argentine microdata

Darío Milesi\*, Natalia Petelski, Vladimiro Verre

*Instituto de Industria-Universidad Nacional de General Sarmiento, Argentina*

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### ABSTRACT

This paper analyzes the use of mechanisms for the appropriation of innovation profits in Argentine industry, using data on around 200 firms belonging to five industrial sectors. It includes a theoretical discussion of the concept of appropriability and, contrary to what is widely accepted in innovation literature about the influence of appropriability on innovation efforts, argues that the chosen appropriation strategy is determined by the characteristics of the innovation process (innovative effort, type of results obtained, accumulated capabilities, cooperation, and public support) and structural characteristics of the firm (technological intensity, firm size, and age). Probit models are specified and estimated in order to identify the main determinants of the use of each mechanism. The results show that the characteristics of the innovation process indeed influence the choice of appropriation strategy, and the use of each mechanism responds to different aspects of the innovation process. The descriptive statistics show that the use of strategic mechanisms is greater than the use of legal ones, indicating the existence of different sectoral appropriation patterns.

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### 1. Introduction

In recent decades, innovation and knowledge have become widely recognized as key factors affecting the competitiveness of firms and countries. Within this general framework, an established theoretical field focuses on the private appropriation of innovation benefits, that is, firms' strategies for generating profits or capturing value from an innovation. The basic assumption regarding this matter is that innovation becomes a central competitive element for a potential innovator only when he or she is able to appropriate its profits. This premise gives rise to three discussions in the literature. The first concerns the actual impact that potential innovators' perceptions of appropriation have on their efforts. This discussion is not fully settled, although there is some consensus among authors that private innovation efforts are undertaken when innovation benefits are expected to be privately appropriated. From this consensus, a second discussion has arisen, regarding whether the establishment of intellectual property rights (IPR) is justified in order to provide conditions that encourage private innovative efforts. Different analyses of firms' patent activities are the most common type of study in this group. Finally, a third area of discussion relates to

how firms actually appropriate the profits of their innovations once these are introduced into the market; in other words, the strategies and types of mechanisms companies use to protect their innovations.

This article mainly focuses on this last area, exploring the factors that determine the use of different appropriation mechanisms within the Argentine manufacturing sector. There is extensive literature analyzing the evidence for developed countries (Levin et al., 1987; Harabi, 1995; Cohen et al., 2000; Arundel, 2001; Galende del Canto, 2006; González-Alvarez and Nieto-Antolín, 2007; Hughes and Mina, 2010; Pajak, 2010), but it is an under-explored area in connection with developing countries. Argentina, like other developing countries, is characterized by low investment in innovation, and this is mainly biased to embodied technologies, which is reflected in the country's low levels of innovation novelty. An analysis of how manufacturing firms protect their innovations in the context of countries like Argentina is therefore relevant in order to provide new evidence on this topic.

To address this issue, the conceptual framework developed in the second section of this paper re-examines the first area of discussion mentioned above, that is, the relationship between innovation and appropriation. The framework includes an analysis of the mechanisms that firms use to appropriate the results of their innovations and a discussion of the factors determining such decisions. The third section briefly presents the innovative context in Argentina, characterizing the type and magnitude of innovative efforts industrial firms make and the type of results

\* Correspondence to: Instituto de Industria, Universidad Nacional de General Sarmiento, Juan María Gutiérrez 1150, (1613) Los Polvorines, Provincia de Buenos Aires, Argentina. Tel.: +54 11 44697558; fax: +54 11 44697552.

E-mail address: [dmilesi@ungs.edu.ar](mailto:dmilesi@ungs.edu.ar) (D. Milesi).

they obtain. The fourth section specifies the methodology used in the analysis and includes a brief description of data and indicators. The fifth section contains the main results of the paper, including descriptive statistics on the use of appropriation mechanisms and the results of probit models for the identification of determining factors. The sixth section contains conclusions.

## 2. Conceptual framework: Innovation, appropriability, and appropriation mechanisms

Innovative activity has multiple purposes. From an economic perspective, one key purpose is to differentiate firms' products and improve their competitive position in the market. If successful, the innovation generates a specific market position, and in this sense, it allows the innovator to earn an extraordinary income (or quasi-rent) based on this privileged position. The margin by which innovative firm's quasi-rents can be established depends on the degree of innovation novelty. By definition, a novel innovation will have fewer close substitutes for the type of product it is or service it provides and confers a quasi-monopoly position on the innovating firm, which tends to produce higher profit margins or quasi-rents. However, novelty is not the only relevant aspect, and even in the case of a very novel innovation, the innovative firm must develop mechanisms and strategies to protect and appropriate profits. This leads to a discussion of appropriability.

In the literature, there is a broad consensus that appropriability is an *ex-ante* condition of innovation, i.e., that appropriability is an important determining factor for innovative efforts (Cohen, 1995). Thus, if a company did not expect to appropriate its innovation results, it would not make innovative efforts. Arrow (1962) is a key reference for this line of thought. His main argument is that the generation of knowledge and innovation are subject to numerous market failures that negatively influence innovative efforts. As a result, economies generate fewer innovations than is socially desirable. The main market failures in question are uncertainty about the results of innovative efforts and about the private appropriability of innovation benefits. Arrow's solution to such market failures is the establishment of a regulatory mechanism, especially IPR, to ensure innovators total or partial appropriability of their innovation results (Hurmelinna-Laukkanen et al., 2007).

However, while Arrow acknowledges that the innovation process is far from standard neoclassical microeconomic behavior, the regulatory mechanism he proposes as a means to encourage innovation actually requires the existence of an unbounded rationality agent. Arrow's argument assumes that, among other attributes, innovative firms should be able to contemplate protecting the results of their innovations through IPR before they actually obtaining them, thus giving them an incentive to make innovative efforts. However, this argument implicitly supposes that such innovative firms would be able to anticipate that their efforts may indeed lead to an innovation, and that the potential innovation will have the characteristics required for protection through IPR. In this sense, the argument is somewhat contradictory because, on the one hand, it says that the innovation process is inherently uncertain, but, on the other, it propounds an IPR scheme that ensures the appropriation of an innovation that the potential innovative firm does not, by the same argument, have any certainty of obtaining. However, as mentioned before, the literature has barely discussed that appropriability, as an *ex-ante* condition, is a central determinant of innovation.

One of the exceptions to the aforementioned consensus can be found in Dosi (2006), whose argument is more compatible with an evolutionary interpretation of the innovation process. The

authors hold that minimum appropriability conditions are necessary to encourage innovation, but once these reach a certain level in firms' perceptions – namely, a minimum threshold of possibility that there will be a return on their innovative efforts – strengthening them further does not determine a significant increase in investment in R&D. This view coincides with an extensive literature that indicates that the intensity of innovative activity is determined by a wide set of factors, the most notable of which are firms' characteristics, their previous technological trajectories, sectoral and technological specificities, and regulatory and institutional conditions (Dosi, 1988; Freeman, 1994).

From the latter perspective, the perception of appropriability is less significant as a determining factor for innovation than in the literature as a whole. However, this does not mean that appropriation is not important: it is a crucial aspect of the innovation process, but in a different context than the one highlighted by the literature. This paper argues that firms invest in innovation in order to create competitive advantages over their competitors, and that firms' appropriation strategies become critical tools for them to translate their innovations into sources of competitive advantage in the market, but only after obtaining the innovation. The appropriation strategy refers to the different actions taken by the firm to avoid its innovation being copied by competitors or to protect its market position when copying is unavoidable. The firm decides on an appropriation strategy in order to preserve the competitive advantage derived from its innovation. In this sense, even if, as proposed here, it is accepted that the perception of appropriability as a pre-existing (*ex-ante*) parameter to innovation does not significantly affect innovative efforts, the appropriation strategy actually developed by the innovative firm would clearly still become a crucial component of the competitive process when the innovation reaches the market. This is the context and perspective from which this paper proceeds, in the following paragraphs, with its conceptual analysis of the mechanisms that firms can use to appropriate the results of their innovations and the factors that determine these choices.

### 2.1. Appropriation mechanisms

Based on the evidence gathered by the seminal study of Levin et al. (1987) and many later studies in the same vein (Harabi, 1995; Cohen et al., 2000; Arundel, 2001; Galende del Canto, 2006; González-Alvarez and Nieto-Antolín, 2007), it follows that innovation results can be appropriated by preventing/delaying imitation or, if preventing imitation is impossible, by protecting the innovative firm's market position. The same evidence also indicates that the main appropriation mechanisms used by firms for this purpose fall into two broad categories: (i) legal mechanisms (IPR) and (ii) strategic mechanisms.

Legal mechanisms are characterized by formal instruments that involve the legal registration of an innovation from which the innovator obtains exclusive rights to exploit it. Within this group are patents, industrial designs/models, and utility models.

The patent is a legal arrangement by which the inventor of a new product or process receives (temporarily) an exclusive right to use or produce it (Griliches, 1990). The primary objective of the patent, as discussed above, is to generate incentives for firms to invest in R&D activities. At the same time, anyone applying for a patent must disclose information that can be used by others for further developments. Thus, in theory, patents create conditions that favor an increase in innovations both by assigning exclusive rights to the inventor and by granting other potential innovators open access to technical information about the patented invention.

However, the evidence shows that patents do not work in the way the theory claims because, on the one hand, the appropriation they confer upon the innovator is imperfect and, on the other, the

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