



Persistence of various types of innovation analyzed and explained



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ABSTRACT

This paper analyzes the persistency in innovation behavior of firms. Using five waves of the Community Innovation Survey in Sweden, we have traced the innovative behavior of firms over a ten-year period, i.e., between 2002 and 2012. We distinguish between four types of innovations: process, product, marketing, and organizational innovations. First, using transition probability matrix, we found evidence of (unconditional) state dependence in all types of innovation, with product innovators having the strongest persistent behavior. Second, using a dynamic probit model, we found evidence of “true” state dependency among all types of innovations, except marketing innovators. Once again, the strongest persistency was found for product innovators.

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1. Introduction

The performance of firms even in the same industry is highly skewed and this heterogeneity in performance is to a high extent persistent over time.¹ Innovation can be seen as one major determinant of the performance of firms, which would imply that the observed heterogeneity in performance among firms actually mirrors persistent differences in innovation behavior among firms (Geroski et al., 1997). This implies that in every industry we should be able to observe firms that innovate persistently, firms that innovate now and then and firms that never innovate. Although evi-

dence shows that firms tend to innovate persistently in high-tech industries, e.g., semiconductor (Jelinek and Schoonhoven, 1990), it is still interesting to understand what factors induces firms to choose strategies implying continuous, intermittent or no innovation (Brown and Eisenhardt, 1998).

Innovation is here seen as the purposeful result of the ability of firms to generate new knowledge and their decisions to apply it to new products and product varieties, processes, organizational designs, and combinations of inputs and markets (Fagerberg et al., 2005). The persistence of innovation highlights the influence of past and current innovation on future innovation. It has become an important topic in applied industrial economics since the publication of a seminal paper by Geroski et al. (1997), while already pointed out in the key contribution of “Innovation Marathon” (Jelinek and Schoonhoven, 1990). The line of empirical research that followed gave rise to an increased conviction that the competitive advantage of firms mainly depends on their ability to innovate over longer periods of time (Le Bas and Scellato, 2014). However, this ability is a function of environmental, organizational, process

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¹ In this paper, we will not discuss the problems of actually defining an innovation since we are using the definitions used in the European Community Innovation Surveys. The definition problem is highlighted in, for example, Garcia and Calantone (2002).

and managerial characteristics of firms. We still have a limited understanding of the long-term determinants of the innovation behavior of firms including their investments in different types of innovation, such as products, processes, organization and markets (Tavassoli, 2015). To increase our understanding of these issues, we in this paper try to answer the following five related questions: Is innovation persistent at the firm level? Is this true for all types of innovation? Does the degree of persistency the same or differ from each other in different types of innovation? If innovation persistence exists, is it a “true” or “spurious” one? Are the drivers of persistency the same for all types of innovation?

Why are these questions interesting and important? Persistence in innovation has far-reaching effects for various fields of economics dealing with innovation, for the strategic management and operation of innovation processes and for public policy focusing innovation (Peters, 2009). Firstly, they are important from the point of view of economic theory. A proven persistence would validate endogenous growth theory, since according to that theory sustainable economic growth is a function of firms' capacity to accumulate economically useful technological knowledge. However, different endogenous growth models make different fundamental assumptions about the determinants of the innovation performance of firms. In the Romer model, it is assumed that innovation mainly is persistent at the firm level and the cumulative knowledge creation are the fundamental sources of innovation and economic growth (Romer, 1990).² Secondly, from a strategic management perspective persistence of innovation, i.e., a continuous loop of innovation, supplies a fundamental building block of maintained competitive advantage and long-lived inter-firm performance differences (Ganter and Hecker, 2013). Thirdly, knowledge about the drivers of firms' innovation behavior is critical for policy makers. If innovation is persistent in the sense that innovation drives innovation, policies designed to support innovation can be expected to have more far-reaching effects since they not only affect innovation in the current period but also in future periods and thus in principle should be able to raise innovation to new levels. Thus, true innovation persistence implies the existence of inter-temporal and inter-generational spillovers, which provides a foundation for the evaluation public programs designed to stimulate innovation. The existence of true and strong innovation persistence also suggests that innovation policies should avoid stimulating the start-up of firms and firms entering new markets. On the other hand, if the observed persistence is the result of other underlying firm characteristics, policy makers should rather try to stimulate those underlying characteristics of firms that drive innovation.

The purpose of this paper is to analyze persistent patterns of innovation for different types of innovation using Swedish data from five waves of Community Innovation Surveys and to test possible explanations for proven persistence. The contribution of this paper is as follows: (i) moving beyond commonly used technology-related innovation and instead incorporating four types of innovation based on actual Schumpeterian classification, i.e., product, process, marketing, and organizational innovations in an economy-wide setting,³ (ii) theoretically and empirically distinguish between the persistency of four Schumpeterian types of

innovation and showing that these four types do not behaving with the same degree of persistency,⁴ (iii) using a long panel of Community Innovation Survey (CIS) data and tracing the innovative behavior of firms during ten years period (this is, to our knowledge, the longest panel of CIS that is constructed), and (iv) moving beyond the usual manufacturing sector and including the service sector in the analysis as well.⁵

The rest of the paper is organized as follows. Section 2 starts with the general theoretical causes of innovation persistence (Section 2.1) and then provides arguments specifically for each type of innovation (Section 2.2). Section 3 offers a short overview on empirical evidence concerning the persistency of innovation. Section 4 shows the data. Section 5 investigates whether there is a persistency in various types of innovation, while Section 6 analyses whether it is a true persistency or not and distinguishes between the degree of persistency in various types of innovation. Section 7 concludes.

2. Literature review

2.1. The general underlying theoretical causes of innovation persistence

The underlying theoretical causes of innovation persistence are not well understood to put it mildly. And when it is discussed, it is mostly biased toward technological innovation and non-technological innovations are less discussed (Le Bas and Scellato, 2014). However, by consulting a few different fields of economics and also management, we may at least be able to present some general causes to why innovation might demonstrate state dependence over time, no matter which innovation type is in question. The main underlying theoretical causes of innovation persistence can be seen through the lens of knowledge, learning and dynamic scale economies. Already, Geroski et al. (1997) suggested that innovation persistence could be explained by a combination of learning effects from the innovation process and positive feedback mechanisms between the accumulation of knowledge and innovation processes generating dynamic scale economies. Thus, innovation is the result of cumulative knowledge patterns and learning dynamics (Colombelli and von Tunzelmann, 2011). Knowledge is as an economic good characterized by being cumulative and non-exhaustible (Nelson, 1959; Ruttan, 1997). At the same time as knowledge is an input in knowledge production process, it is also an output from the same process (David, 1993). These attributes have distinct implications for innovation persistence, no matter which types of innovation is in question. The creation of new knowledge vintages have an effect on the disposable knowledge stock that can be used as an input in knowledge generation due to that knowledge is non-exhaustible. This implies that firms that have been able to start creating new knowledge use their own knowledge stock to create new additional knowledge at a lower cost compared to competitors at the same time as they develop their innovative capability exploiting dynamic economies of scale. Such generation of knowledge is important not only for technological innovation (product and process), but also for non-technological innovation (marketing and organizational) because all types of innovation entails some degrees of novelty that has not existed before (at least for the firm) and can be only introduced through knowledge generation.

Experience of innovation among the employees generate dynamic increasing returns as a result of learning effects, which increase a firm's knowledge stock and hence increase their innova-

² However, the Romer approach neglects the role of new entrants and creative destruction as drivers of innovation and economic growth and to acknowledge this we have to turn to endogenous growth models including creative destruction processes, which, for example, assume a process of a perpetual renewal of innovators (Aghion and Howitt, 1992). The only way to assess these different representations of the economic growth process and the dynamics in the innovation behavior of firms is through empirical analyses (Cefis, 2003).

³ Ganter and Hecker (2013) is an exception. Nevertheless, this study did not incorporate marketing innovation.

⁴ In the theoretical part, this is done by bringing together arguments from a wide range literature spanning from management to economics.

⁵ Peters (2009) is an exception.

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