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Technological regimes and firm survival

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ABSTRACT

This paper investigates whether the type of technological regime moderates the effects of entry timing, entry size (i.e., initial resources), and active (post-entry) learning on firm survival. By analyzing a unique dataset of newly founded Korean manufacturing firms, we find that the effects of the factors influencing firm survival differ substantially across technological regimes. Specifically, entry size has the greatest positive effect on firm survival under the regime characterized by low technological opportunity and high R&D appropriability, under which opportunities for disruptive innovation are stagnant and the advantages of initial resources are more likely to persist. Post-entry active learning through R&D, on the contrary, has the greatest effect on firm survival under the regime of high technological opportunity and low R&D appropriability, under which active learning through contemporaneous R&D effort is more crucial for firm survival than initial resource advantages mostly due to the possibility of creative destruction.

1. Introduction

The survival of newly founded young firms has been one of the key research subjects in the fields of industrial economics and strategic management, and a new firm's (initial) entry size and entry timing and its innovativeness at the time of entry have been considered as key factors influencing its post-entry survival.[1] Despite the voluminous literature on firm survival, however, there remain some important lacunas in the literature. First of all, little attention has been given to the idea that the effects of entry size, entry timing, and post-entry innovation efforts on firm survival differ across technological regimes. In addition, compared to the initial start-up conditions, such as entry size and entry timing, and innovation in general, the differential effects of various dimensions of innovation (e.g., contemporaneous R&D intensity and the stock of R&D) have been paid relatively less attention. This paper tries to contribute to the literature by addressing these lacunas.

It is reasonable to consider that firm survival is influenced jointly by various factors including firm-specific start-up (i.e., initial) conditions, firm-specific post-entry efforts, and the market environment. Among the factors, this paper focuses on entry size and entry timing (among the start-up conditions) and the stock of cumulative R&D and R&D intensity (among the post-entry efforts). The reasons for the choice of these four factors are twofold. First, they are the most heavily investigated factors in the literature on firm survival. Second, the choice relies, as a theoretical framework, on the resource-based view of the firm (RBV) as entry size and the stock of cumulative R&D reflect firm-specific tangible and intangible resources (Wernerfelt, 1984; Peteraf, 1993) and R&D intensity reflects firm-specific R&D capabilities or technological competence (Prahalad and Hamel, 1990; Lee and Sung, 2005). The stock of cumulative R&D and R&D intensity are the key determinants of firm-specific dynamic capability that significantly influences firm growth as well as firm survival (Dierickx and Cool, 1989; Teece and Pisano, 1994; Teece et al., 1997; Franco et al., 2009). Meanwhile, entry timing is closely associated with the characteristics of resources (e.g., new product development or marketing and manufacturing; Lieberman and Montgomery, 1998; Suarez and Lanzolla, 2007; Fosfuri et al., 2013).

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[1] For the summary of the factors influencing firm survival and its stylized facts, see, among many others, Geroski (1995), Audretsch (1995b), Caves (1998), Agarwal and Audretsch (2001), Agarwal et al. (2002), Audretsch et al. (2004), and Cefis and Marsili (2006).

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The idea for this study is that these factors influencing firm survival have different effects depending on the type of technological regime, which largely shapes the existence or magnitude and the persistence of their effects on firm survival.[2] The underlying logic for the idea is simple. A firm's decision on how early and how big to enter an industry is primarily determined by the degree of the effectiveness and persistence of early-entry and initial-resource advantages, which are, in turn, shaped largely by, among many industry characteristics, the levels of technological opportunity and R&D appropriability. These two characteristics, which constitute as primary characteristics a technological regime, jointly influence firms' incentives for post-entry innovation or active learning through R&D and thereby the likelihood of their survival.

These two characteristics are, along with the cumulativeness of technological advances and the properties of the knowledge base (i.e., generic or specific; basic or applied), the most defining characteristics or dimensions of technological regimes.[3] As shown in Breschi et al. (2000), they largely determine the concentration of innovation, the stability of the hierarchy of innovators, and the share of first-time innovators in an industry. Regarding firm survival, a few studies suggested either that the effects of the initial entry conditions and post-entry efforts on firm survival are conditioned by certain industry characteristics such as industry age and life cycle (Agarwal and Audretsch, 2001; Agarwal et al., 2002) or found that an industry's technological regime directly influences the survival rates of the firms in the industry (Audretsch, 1991; Audretsch and Mahmood, 1994, 1995). Unfortunately, however, far less attention has been paid to the moderating role of technological regimes in the relationships between factors influencing firm survival and the likelihood of firm survival.

Using a unique dataset of newly established Korean manufacturing firms, this paper finds the following. First, as expected, the hazard of exit tends to decrease, aside from its statistical significance, with entry size, R&D intensity or the stock of R&D, and early entry. This implies that larger initial resources, greater post-entry learning efforts, and earlier entry help new firms survive longer. Second and more importantly, the magnitude of the effects of these factors on firm survival and their statistical significance differ substantially across different types of technological regimes characterized by technological opportunity and R&D appropriability. Specifically, initial resources and the stock of R&D have the greatest positive effect on firm survival under the regime of creative accumulation (or Schumpeter Mark II) characterized by low technological opportunity and high R&D appropriability, while post-entry active learning through R&D has the greatest effect under the regime of creative destruction (or Schumpeter Mark I) characterized by high technological opportunity and low R&D appropriability.

This paper is organized as follows. Section 2 reviews the literature on firm survival, focusing on the effects of entry size, post-entry innovation efforts, and entry timing on firm survival and Section 3 establishes hypotheses on the moderating role of technological regimes in relation to firm survival. Section 4 describes the data, variables, and empirical specifications employed to test the hypotheses and Section 5 presents the results of hazard regression analysis and discusses their implications for firm survival. Section 6 concludes the paper.

2. Literature review and research motivation

2.1. Entry size and firm survival

The literature, especially empirical studies, identifies the size of firm at the time of entry as the most critical factor that determines the likelihood of exit of newly founded young firms.[4] They have shown rather consistently that the hazard of exit tends to decrease with entry size. Some plausible explanations are available for the finding. First, given that the initial size of entrants reflects their expectations regarding their own initial capabilities (Caves, 1998), efficiency (Geroski, 1995; Cabral, 1995), or productivity (Frank, 1988), larger entrants having higher expectations regarding their innate abilities are more unwilling to exit the market. Second, larger entrants can benefit more from potential cost advantages due to economies of scale (Audretsch, 1995b). Finally, larger entrants are more likely to have greater organizational or managerial resources and, more importantly, better capabilities for continuous learning (Almeida et al., 2003; Bercovitz and Mitchell, 2007).[5]

Few studies on firm survival, however, specifically investigate whether various dimensions of technological regimes jointly shape the effectiveness for firm survival of the cost advantages and learning capabilities associated with entry size. The logic underlying the potential moderating role of technological regimes in the relationship between entry size and new firm survival can be observed, among others, in Breschi et al. (2000). They showed that under the regime of low technological opportunity and high R&D appropriability technological innovation follows the Schumpeterian pattern of creative accumulation, which is associated with the low likelihood of technological entry of new innovators, the concentration of innovations by large incumbent firms, and high stability in the ranking of innovators. On the contrary, under the regime of high technological opportunity and low R&D appropriability technological innovation follows the Schumpeterian pattern of creative destruction, in which the size advantages of large entrants are less likely to be protected and the likelihood of technological entry of new innovators increases. These findings imply that the size advantages of large entrants in firm survival differ across different technological regimes. Similarly, Agarwal and Audretsch (2001) found that large entrants have competitive advantages in the markets of low-tech products, because such industries tend to have routinized regimes rather than entrepreneurial regimes.[6]

2.2. Innovation, post-entry learning, and firm survival

A firm's purposive and persistent innovation efforts after its entry are critical for its post-entry performance including the likelihood of survival, as they bring innovations for technological

[2] A technological regime refers to a combination of certain industry-specific attributes or characteristics that together define the knowledge and learning environment and, therefore, shape the pattern of innovative activities of firms within the given industry (Malerba and Orsenigo, 1993, 1997; Breschi et al., 2000; Peneder, 2010).

[3] The dimensions of technological regimes include, in general, the levels of technological opportunity and R&D appropriability and the degree of the cumulativeness of technological knowledge (Malerba and Orsenigo, 1993), and later the properties of the knowledge base (Breschi et al., 2000). The appropriability of R&D refers to the degree of reaping the returns to R&D possibly through various mechanisms utilizing intellectual property rights, secrecy, and fast time to market (Levin et al., 1987; Breschi et al., 2000).

[4] For a summary of the effect of initial entry size on firm survival, see, among many others, Evans (1987b), Geroski (1995), Sutton (1997), Caves (1998), and Esteve-Perez and Manez-Castillejo (2008).

[5] Almeida et al. (2003) suggested that startup size is positively related with the likelihood of external learning (e.g., more opportunities to access and apply internally external knowledge). In the same vein, Bercovitz and Mitchell (2007) emphasized that entry size reflects organizational capital (e.g., the availability of financial resources, routines, and external ties), which confer survival advantages.

[6] Gort and Klepper (1982) also suggested that, if information based on non-transferable experience is an important input in generating innovative activity in low-tech industries, incumbent firms have innovation advantages over late entrants. However, they did not consider the moderating role of R&D appropriability in the effect of entry size on potential competitive advantages.