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Foreign competition, domestic knowledge base and innovation activities: Evidence from Chinese high-tech industries

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ABSTRACT

Using panel data analysis for a sample of Chinese high-technology industries from 1998 to 2008, this study examines how industry characteristics affect industry innovation activities. Differing from existing studies, our research considers the impact of foreign competition on innovation activities at industry level in a large emerging economy. The results indicate that the intensity of competition from foreign invested enterprises (FIEs) and domestic skill intensity affect industry buy and make activities. Foreign competition is positively associated with the intensity of buy activity, but negatively affects the intensity of make activity. Further, the findings show that domestic skill intensity weakens the impact of foreign competitive pressure on innovation activities. Our empirical evidence has important policy implications.

1. Introduction

Academics and managers have become increasingly aware of the importance of innovation. Significant progress has been made in understanding performance implications or outcomes of innovation activities (Bogliacino and Pianta, 2013; Carpenter and Nakamoto, 1989; Cassiman and Veugelers, 2006; Guan et al., 2013; Li and Wu, 2010; Prajogo and Ahmed, 2006; Roberts and Amit, 2003). There are different types of innovation activities, such as make and buy. The former involve developing new products and technology internally, whereas the latter acquire new technology through outsourcing externally (Guo, 2008). Different innovation activities may have profound implications for building industry technological capability. Despite the importance of innovation activities, most existing studies tend to take buy and make innovation activities as given without investigating why such activities occur in the first place; not until recently has what lies behind and promotes make and buy activities been investigated (Cacciatori and Jacobides, 2005).

Increasing research interest has been devoted to the relationship between sector-level dynamics, industry architectures and innovation activities (Castellacci, 2008; Breschi et al., 2000; Jacobides and Winter, 2005, 2012; Jacobides et al., 2006; Malerbra, 2002; Malerba, 2005). A number of studies have highlighted that knowledge regimes, market structure, and the degree of embodied technological change of sectors affect innovation (Malerbra, 2002; Malerba, 2005; Jung and Lee, 2010; Jacobides and Winter, 2012). However, few studies examine how foreign competition affects make and buy innovation activities, with little attention given to the high-tech sectors of emerging economies. Therefore, the relationship between foreign competition and industry innovation activities is still not well understood in the context of emerging economies.

Building on the industry-based view and knowledge-based theory (KBT), we examine whether foreign competition and industry knowledge base influence the intensity of make and buy activities in high-tech industries, and emphasize that the intensity of make and buy activities is industry contextual dependent. Confronted with increasing foreign competition in emerging economies, domestic industries might respond to such competition differently when conducting innovation activities. Hence, we examine a fundamental question of what drives the intensity of buy and make activities in the face of intensified foreign competition in emerging economies. Combining insights from the industry-based view and the KBT enables us to shed new light on the determinants of industry innovation activities and in so doing address an important research gap presented in existing studies, where the impact of foreign competition and its inter-relationship with industry knowledge base – on innovation activities has been understudied.

Chinese high-tech industries represent an exciting laboratory for examining the relationship between the context of high-tech industries and innovation activities. Such industries have been

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successful in driving the country's economic growth and have undergone substantial dynamic changes due to economic transition from a centrally planned economy to a market economy (Li and Wu, 2010; Liu and Buck, 2007). Supporting innovation is the priority of governmental industry policy. Our research setting also enables us to extend existing studies by analysing how competition from foreign invested-enterprises (FIEs) affects the intensity of make and buy activities in China, a country which is the largest recipient of foreign direct investment (FDI) in the developing world and has maintained this position for nearly 20 consecutive years (MOFCOM, 2010). The increasing presence of FIEs may affect the domestic market structure and intensify industry competition, thus affecting industry innovation activities.

Our study makes a number of contributions to extant literature. First, in contrast to most existing studies that mainly focus on the relationship between innovation activities and performance; we examine in detail how the intensity of innovation activities is affected by foreign competition and industry knowledge base in Chinese high-tech industries. It is important to examine the innovative activities of these high-tech sectors in the context of foreign competition, as these sectors in emerging economies are the most dynamic, technological leaders (Liu and Buck, 2007). Hence, the findings from our research help to provide new insights into domestic innovation activities and enhance our understanding of how innovation activities are contingent on industry contextual factors. In particular, we explicitly examine how the intensity of foreign competition affects innovation activities. This helps to shed new light on the impact of FIEs in an emerging economy.

Second, we move beyond examining the individual impact of industry characteristics and consider the interaction effect between foreign competition and skill intensity across industries. Informed by the KBT, we investigate how the industry knowledge base which was measured by industry skill intensity affects the intensity of buy and make activities both directly and indirectly through interaction with foreign competition. The findings from our study help to enhance our understanding of how the interrelationship between domestic skill intensity and foreign competition shapes make and buy activities at the industry level.

Third, adopting industry level analysis enables us to draw some unique insights into the determinants of industry innovation activities. It is difficult to generalize the results based on individual firms to the whole economy or industries. In contrast, industry-level studies are able to detect the pattern or tendency of innovation activities in a given section or capture the impact of changes in industry structures. Firms operating in the same industry are likely to share the same technological opportunities, knowledge base and market structure (Pavitt, 1984; Breschi et al., 2000; Dosi et al., 2006; Guo, 2008; Guan and Chen, 2009; Li, 2011; Malerba, 2005). The strength of industry-level analysis enables us to account for the technological heterogeneity across industries in an effective way, whereas such heterogeneity is generally captured in a limited way using industry dummy variables in firm-level studies. Such crude industry proxies are insufficient to capture the trend of industry development and competitive pressure precisely. In this regard, our industry level analysis complements findings based on individual firms.

Finally, conducting panel data analysis, we treat innovation activities as a dynamic process. Such an empirical setting, thus, differentiates our research from those based on a cross-sectional research design. In addition, a panel data analysis at firm level excludes crucial information on new entry and exit in an industry. This omission may produce biased results, whereas this problem does not appear in industry analysis (Bogliacino and Pianta, 2013). Thus, the evidence based on industry analysis enhances our understanding of how industry contextual factors influence make and buy activities and has important policy implications for both China and other emerging economies.

The remainder of the paper is structured as follows. The next section discusses the theoretical framework for this empirical study and presents the research hypotheses. Section 3 specifies the empirical model and introduces our data. The estimation and results are presented in Section 4. These are discussed in Section 5, which concludes with policy implications.

2. Theory and hypotheses

Previous research on the sectoral systems of innovation has proposed the relationship between the characteristics of the innovative process and patterns of innovation in different historical periods and industrial settings (Dosi, 1988; Freeman et al., 1982; Nelson and Winter, 1977; Pavitt, 1984). Technological paradigms are regarded as a "pattern" of solution to selected technological problems, the distinct trajectories followed by industrial sectors and the related web of vertical linkages between sector-specific technological regimes and trajectories (Archibugi, 2001; Castellacci, 2008; Marsili and Verspagen, 2002; Malerbra, 2002; Nelson and Winter, 1982; Pavitt, 1984). Specifically, technological regimes can be characterized by four main aspects, namely technological opportunities, properties of the knowledge base, appropriability, and cumulativeness conditions. Some researchers have provided empirical evidence for the relationship between the patterns of innovation activities and the technological regime in a sector (Castellacci, 2008; Breschi et al., 2000; Malerbra, 2002). In the context of catch-up by latecomers, several studies have adopted the perspective of technological regimes to examine technological catch-up by Korean and Taiwanese industries (Lee and Lim, 2001; Lee et al., 2005; Park and Lee, 2006). More recently, Jung and Lee (2010) have suggested that the patterns of sectoral technological catch-up in Korean industries are related to the extent of the explicit nature of knowledge, the level of concentrated markets and the exposure to the world market as well as technological cycle.

Existing studies have enhanced our understanding of the sectoral patterns of innovation activities. However, these studies have typically focused on developed countries. Few studies have extended this line of research to the context of emerging economies that have attracted a large amount of FDI and increasing foreign competition. This competition has had a profound impact on local innovation activities. We know relatively little about the extent of foreign competition affects the intensity of make and buy activities in the context of emerging economies. Moreover, existing studies have not investigated how domestic skill intensity interacts with foreign competition and jointly affects the extent of buy and make activities. To remedy this omission, we adopt the industry-based view and the KBT to examine the role of foreign competition and domestic skill intensity in make and buy activities in the context of an emerging economy.

Industry competition plays a critical role in determining strategic activities within an industry (Porter, 1990). Adopting the industry-based view enables us to take foreign competition into account when examining the intensity of buy and make activities across high-tech industries. More specifically, there is much yet to be learned about the structures through which innovation is likely to occur in a given industry (Brunnermeier and Cohen, 2003; Bogliacino and Pianta, 2013; Chang and Shih, 2005). An investigation of industry competition that may affect the intensity of buy and make activities represents a temporal development in the literature, from an emphasis on the firm to the identification of the impact of industry forces on innovation activities more broadly (Ahuja et al., 2008; Jacobides and Winter, 2005, 2012). Based on this rationale, competitive intensity is considered the most fundamental force affecting buy and make activities (Ahuja et al., 2008; Li,