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Enhancing national innovative capacity: The impact of high-tech international trade and inward foreign direct investment

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ABSTRACT

Innovation productivity differs across economies and latecomer countries are working hard to close the gap with developed countries. An investigation of 80 countries in the years of 1981–2010 shows that international patenting activities vary across countries. We also find that both high-tech related international export and inward foreign direct investment significantly contributes to emerging countries' ability to produce cutting-edge technologies, but this effect does not exist for leading innovator countries. Moreover, although this study shows strong intellectual property rights (IPRs) protection is highly correlated with international patenting activities in leading innovator countries, it has a negative impact on emerging innovator countries' national innovative capacity. The findings thus help better understand the role of international economic activities and IPR in enhancing national innovative capacity, and facilitate emerging countries' effort to catch up with leading innovator countries.

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1. Introduction

Over the last few decades, there has been unprecedented research interest in the role of scientific and technological advance in driving economic progress (Araújo & Salerno, 2015; Mowery, 1984; Temiz & Gökmen, 2014). Despite a substantial agreement that technological innovation plays a central role in the process of long-run economic growth, there is a debate about the underlying drivers of the innovation process itself (Furman, Porter, & Stern, 2002). Previous studies on innovation have argued that increasing national investments in innovation is essential to ensure countries' economic growth (Abramovitz, 1956; Jones, 2002; Romer, 1990; Schumpeter, 1942; Solow, 1956). More recent research has shifted to explore a country's national innovative capacity, which is defined as the ability of a country to produce and commercialize a flow of innovative technology over the long term (e.g., Furman & Hayes, 2004; Furman et al., 2002; Hu & Mathews, 2005, 2008; Liu & White, 2001; Porter & Stern, 2002). Scholars have argued that a country's national innovative capacity depends not only on the intensity of a nation's financial resource and human capital committed to innovation activities, but also on other country-level factors such as its accumulated technological sophistication, the

innovation environment in a nation's industrial clusters, and the strength of linkage between the common innovation infrastructure and industrial clusters (Furman & Hayes, 2004; Porter & Stern, 2002).

Although this stream of research has successfully identified a small set of determinants of national innovative capacity, these analyses tend to consider national innovative capacity as a relatively closed system and often adopt a single economy approach, which thus contradicts with the reality that a country's embracing international trade and inward foreign investments allows the country to benefit from foreign technological advances (Eaton & Kortum, 2002; Fagerberg, 1987; Gong & Keller, 2003). The rapidly rising level of economic integration in the new century, fostered by frequent international trades and market openness to foreign direct investment (FDI) as well as information and communication technology, makes the traditional approach of national innovative capacity with the focus on a closed-system analysis less relevant (Gong & Keller, 2003).

The purpose of this study is to build and enrich the theory around national innovative capacity by answering two important but under-researched questions: (1) how do a country's international economic activities including international trade and inward foreign direct investments affect national innovative capacity? and (2) how do the latecomer countries close the gap with the more developed countries in their national innovative capacity? Our

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point of departure is the existing single-economy version of national innovative capacity framework leads to a closed-system analysis (Furman & Hayes, 2004), and thus stops short of taking account of some important factors beyond a country's boundary in explaining much of the increase in national innovative capacity. For example, a country's engagement in international trades facilitates domestic firms' learning about foreign technological knowledge (Eaton & Kortum, 1996). Its openness to foreign investments also promotes international diffusion of technology (Gong & Keller, 2003). In this study, we employ an open perspective to technological heterogeneity under which the model extends naturally to a world with many countries separated by geographic barriers and connected by international trade and foreign direct investment (Kandogan, 2014; Temiz & Gökmen, 2014; Wu, Wu, & Zhuo, 2014). This new perspective leads to a tractable and open model for incorporating international trade and inward foreign direct investment into the framework to study a nation's innovation capacity and thus helps the development of international companies.

In this study we assess the research model using a longitudinal data of 80 countries from 1981 to 2010. We classify 80 countries into leading innovator countries (7 countries), emerging innovator countries (17 countries), and laggard innovator countries (56 countries). Our parameter estimates allow us to quantify the effects beyond current single-country analyses of national innovative capacity in order to explore the differentiated impacts of international trade and foreign direct investment on national innovative productivity across the leading, emerging, and laggard innovator countries (Furman et al., 2002).

Our newly proposed theoretical model is thus original in several aspects: Our model adopts an open-system approach to consider the determinants of national innovative capacity. While scholars have studied the framework of national innovative capacity in a large number of countries (Furman et al., 2002; Hu & Mathews, 2005, 2008), prior studies have overwhelmingly focused on a close-system approach and made limited efforts to consider other variables beyond a country's boundary. This new model suggests that it is useful to extend a single-economy model of national innovative capacity to a multiple-economy model and thus presents a general approach to understanding the determinants of national innovative capacity.

Second, our study with the open-system model helps answer the question why some countries are able to dramatically increase their ability to generate a stream of leading-edge innovations while other countries cannot, including a number of countries with historically higher levels of innovation. One feature of this study is that it recognizes, in a nuanced way, the important role of legal environment including intellectual property rights (IPR). Building on the literature on emerging innovator economies, recent studies (e.g., Hu & Mathews, 2005; Kim, Lee, Park, & Choo, 2012; Park & Park, 2003) find that strong intellectual property protection does not contribute to innovation and economic growth in developing countries. Instead, a weak form of intellectual property rights is conducive to innovation and economic growth in the developing economies (Hu & Mathews, 2005), even though IPR protection is positively associated with leading innovator countries' national innovative capacity (Kim et al., 2012). In other words, strict IPR protection may have a negative impact on emerging innovator countries' international patenting activities, and thus is worth further exploration in an open-model framework.

2. Literature review and conceptual framework

In the final two decades of the 20th century, a group of emerging innovator countries joins elite innovator countries (Furman et al., 2002). Economic growth and the fast catch-up of

these emerging innovators raise a central issue for studies on economic growth: what are the factors that facilitate the catch-up and the extent of convergence in economic conditions between emerging innovator countries and leading innovator countries (Furman & Hayes, 2004; Furman et al., 2002)? Political scientists, economic historians, economists, international business scholars, and policymakers have devoted most sustained attention to the role of technology in helping latecomer countries increase their wealth and technological progress at a higher rate than that of leading innovator countries (Araújo & Salerno, 2015; Ellis, 2010; Love & Ganotakis, 2013; Song & Shin, 2008). This line of research suggests that later-industrialized countries may be able to accelerate their growth rates by adopting technology developed by leading innovator countries and may be able to leapfrog leading innovator countries by developing institutions that deal with contemporaneous challenges more effectively than those already developed (Gerschenkron, 1962; Giuliani, Gorgoni, & Rabellotti, 2014; Luo & Tung, 2007). The centrality of innovation in economic growth has been widely acknowledged since the seminal contributions of Schumpeter (1942), Solow (1956), and Abramovitz (1956).

2.1. The conceptual framework of national innovative capacity

Drawing on three distinct research streams, Porter and his colleagues proposed a novel framework to explore national innovative capacity (e.g., Furman et al., 2002; Porter & Stern, 2002). National innovative capacity refers to the ability of a country, as both a political and economic entity, to produce and commercialize a flow of new-to-the-world technologies over the long term (Furman et al., 2002; Hu & Mathews, 2005; Porter & Stern, 2002). National innovative capacity is related to but distinct from scientific and technical advances per se, as the latter does not necessarily imply the economic application of new technology (Porter & Stern, 2002). It is also distinct from current national industrial competitive advantage or productivity, which results from many factors (e.g., the skills of the local workforce and the quality of physical infrastructure) that go beyond those important to the development and commercialization of new technologies (Porter & Stern, 2002). National innovative capacity depends in part on the overall technological sophistication of an economy and its labor force, but also on an array of investments and policy choices by both the government and the private sector (Furman et al., 2002; Hu & Mathews, 2008; Liu & White, 2001).

According to their work, the determinants of national innovative capacity can be grouped into three categories: (a) the common innovation infrastructure including the common pool of institutions, resources commitments, and policies that support innovation; (b) the particular innovation orientation of groups of interconnected national industrial clusters; and (c) the quality of linkages between the two (Furman & Hayes, 2004; Furman et al., 2002; Hu & Mathews, 2008; Liu & White, 2001). The first determinant, the common innovation infrastructure, consists of (1) an economy's aggregate level of technological sophistication and (2) the size of the available pool of scientists and engineers (Furman & Hayes, 2004). These two are important determinants of the production of ideas highlighted by endogenous growth theory. It also expands to include other cross-cutting factors that impact innovative activity such as the extent to which an economy invests in higher education and public policy choices such as patent and copyright laws, the extent of R&D tax credits, the nature of antitrust laws, the rate of taxation of capital gains, and the openness of the economy to international competition (Furman et al., 2002; Monreal-Pérez, Aragón-Sánchez, & Sánchez-Marín, 2012). The second determinant, cluster-specific environment for innovation, includes the high quality human resources for cluster-

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