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Stage-dependent intellectual property rights ☆

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ABSTRACT

Inspired by the Chinese experience, we develop a Schumpeterian growth model of distance to frontier in which economic growth in the developing country is driven by domestic innovation as well as imitation and transfer of foreign technologies through foreign direct investment. We show that optimal intellectual property rights (IPR) protection is stage-dependent. At an early stage of development, the country implements weak IPR protection to facilitate imitation. At a later stage of development, the country implements strong IPR protection to encourage domestic innovation. Therefore, the growth-maximizing and welfare-maximizing levels of patent strength increase as the country evolves towards the world technology frontier, and this dynamic pattern is consistent with the actual evolution of patent strength in China.

"China and others are entering the tricky middle-income stage of development in which the big advances from absorbing rich-world technology start to run out." The Economist (2011)

1. Introduction

In the late 1970's and early 1980's, the implementation of a modern intellectual property rights (IPR) system in China was subject to intense debates.[1] Proponents including Deng Xiaopeng, the paramount leader of China at that time, saw the creation of a modern IPR system in China as a necessary means to attract foreign direct investment (FDI) and to provide incentives for domestic innovation. In 1982, the first intellectual property law under the leadership of Deng was drafted in China. Then, through a series of policy reforms, the strength of patent rights in China increased over time. For example, the Ginarte–Park index of patent rights in China gradually increased from 1.33 in 1985 to 4.08 in 2005.[2] In 1992, the statutory term of patent in China was lengthened from 15 years to 20 years.[3] Then, in compliance with the TRIPS agreement,[4] China reformed its patent system again in 2000.[5] Recently, the Third Amendment to the Chinese Patent Law was approved in December 2008 and came into effect in October 2009 with the objective of building China into an innovative country with well-protected IPR by 2020.[6] Following these patent reforms, research and development (R&D) as a percentage of gross domestic product (GDP) in China increased from 0.7% in 1992 to 1.7% in 2009. As for the inflow of FDI to China, it increased from US$11 billion in 1992 to US$185 billion in 2010.[7]

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[1] See for example Allison and Lin (1999) and La Croix and Konan (2002) for a discussion on the historical development of IPR in China.

[2] The Ginarte–Park index is on a scale of 0 to 5, and a larger number implies stronger patent rights. See Ginarte and Park (1997) and Park (2008a) for a detailed description of this patent index.

[3] As for the term of patent for utility model and design patents, it was lengthened from 5 years to 10 years. Also, this patent reform expanded patentable subject matter in China.

[4] The Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) is an agreement of the World Trade Organization (WTO). In summary, TRIPS establishes a minimum level of IPR protection that must be provided by all member countries.

[5] The policy changes include (a) providing patent holders with the right to obtain a preliminary injunction against the infringing party before filing a lawsuit, (b) stipulating standards to compute statutory damages, (c) affirming that state and non-state enterprises enjoy equal patent rights, and (d) simplifying the patent application process, examination and transfer procedures and unifying the appeal system. See for example Hu and Jefferson (2009) who show that this patent reform is a major factor for explaining the increase in patenting activities in China.

[6] See for example Yang and Yen (2010) for a review of the policy changes in this third amendment. In summary, the changes aim at (a) promoting patent applications, (b) encouraging exploitation of jointly owned patents, (c) heightening patentability requirement, (d) increasing statutory damages and administrative fines, (e) clarifying the granting of compulsory licenses, and (f) establishing protection for genetic resources.

[7] Data from the World Development Indicators.

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In addition to strengthening patent rights, China also improved the protection for trade secrets by developing a comprehensive set of laws and regulations over the last two decades.[8] In a recent report issued by NERA Economic Consulting, Sepetys and Cox (2009, p. 3) nicely summarize the evolution of IPR in China as follows.

> "In the early stages of development, with limited resources and limited capacity for research and development, there may be little or no IPR protection. Domestic industry will be characterized by imitation rather than innovation. Imitation allows for low-cost production, low prices for goods and services, and the stimulation of consumption and employment. A weak IPR regime may support technological growth and development through imitation in early stages of development. At subsequent stages of development, however, a weak IPR regime discourages domestic innovation. Innovation and technological development are drivers of economic growth. Economies that succeed in shifting into knowledge-based production are characterized by domestic innovation, typically supported with well-designed and adequately enforced IPR laws."

In this study, we develop a stylized growth-theoretic model to formalize this commonly discussed insight on the evolution of IPR in developing countries using China as a timely example. For example, one objective of China's twelfth five-year plan (2011–2015) is to shift its reliance on foreign technology to domestic innovation. A recent study by Li (2010) provides an interesting case-study analysis of the biotechnology and pharmaceutical industries to demonstrate that China is in the process of transforming from an imitation-oriented economy to an innovation-oriented economy and that strengthening patent rights can play an important role in facilitating this transformation process. This finding is consistent with the implication of our analysis.

To analyze stage-dependent IPR for a developing country at different stages of economic development, we consider a Schumpeterian growth model of distance to frontier in which economic growth in the developing country is driven by domestic innovation as well as imitation and transfer of foreign technologies through FDI. We show that the model features an inverted-U effect of patent strength on domestic innovation under a certain parameter space. The intuition is as follows. On the one hand, increasing patent strength has a positive effect on domestic innovation by reducing imitation. On the other hand, the reduction in imitation leads to an increase in FDI that strengthens the displacement effect of foreign technologies on domestic innovation. As for the growth-maximizing and welfare-maximizing strengths of IPR protection, we show that they are stage-dependent. At an early stage of development, the country implements weak IPR protection to facilitate imitation of foreign technologies. At a later stage of development, the country implements strong IPR protection to encourage domestic innovation. Specifically, we derive an analytical result to show that the growth-maximizing level of patent protection increases as the country evolves towards the world technology frontier. Furthermore, we provide a numerical result to illustrate that the welfare-maximizing level of patent protection also increases as the country evolves towards the world technology frontier. These findings are consistent with the actual evolution of patent strength in China and other developing countries.

This study relates to the literature on IPR and economic growth. This literature focuses on an important issue that is optimal IPR protection. An early study by Nordhaus (1969) finds that the optimal patent length should balance the static distortionary effect of markup pricing and the dynamic gain from enhanced innovation. In a dynamic general-equilibrium model, Judd (1985) finds that the optimal patent length is infinite while Iwaisako and Futagami (2003) and Futagami and Iwaisako (2007) find that the optimal patent length can be finite in a version of the Romer model. Kwan and Lai (2003) show that extending the effective lifetime of patent would lead to a substantial increase in R&D and welfare whereas Li (2001) and O'Donoghue and Zweimuller (2004) consider the effects of patent breadth on R&D and economic growth. Dinopoulos and Syropoulos (2007) and Davis and Sener (2012) analyze the effects of rent protection activities on innovation. Chu (2009) and Chu et al. (2012) analyze the effects of blocking patents on R&D and welfare. Recently, Acemoglu and Akcigit (2012) consider optimal state-dependent patent protection based on the endogenous technological gap between the leader and followers in an industry. However, this literature rarely considers optimal IPR protection in developing countries in which economic growth is driven by imitation and transfer of foreign technologies in addition to domestic innovation. We fill this gap in the literature by analyzing the optimal strength of IPR protection in a developing country at different stages of economic development.[9]

Our study also relates to the literature on IPR and North-South product cycles.[10] A key question in this literature is whether strengthening Southern IPR protection stimulates or stifles Northern innovation. Grossman and Helpman (1991) find that strengthening Southern IPR protection either has no effect or a negative effect on Northern innovation.[11] Lai (1998) shows that whether Southern IPR protection has a positive or negative effect on Northern innovation depends on the mode of technology transfer (i.e., imitation versus FDI) whereas Glass and Wu (2007) argue that the effect also depends on the type of technological innovation (i.e., quality improvement versus variety expansion). Instead of analyzing the effects of Southern IPR protection on Northern innovation, the present study focuses on a different issue that is optimal IPR protection in the South as a function of its technology distance from the North.

An influential study by Grossman and Lai (2004) considers globally optimal IPR protection in an open-economy model featuring both developed and developing countries that have asymmetric innovative capability and market size. The present study differs from Grossman and Lai (2004) by considering a model in which (a) economic growth in the developing country is driven by both domestic innovation and foreign technology transfer and (b) the relative importance of innovation and technology transfer changes endogenously as the country evolves towards the world technology frontier. These two features together imply that optimal IPR protection should be stage-dependent, which is an important property that is absent in all the above-mentioned studies.

Finally, this paper relates mostly to studies on distance to frontier and convergence; see Acemoglu et al. (2003, 2006), Aghion et al. (2005), Howitt and Mayer-Foulkes (2005), Benhabib et al. (2012) and Gersbach et al. (2013). Our paper extends these influential studies by endogenizing an important economic institution that is the IPR system and analyzing how it evolves as an economy develops towards the world technology frontier.[12] Furthermore, we consider innovation and multiple channels of foreign technology transfer through imitation and FDI that are key features of the Chinese economy.

The rest of this study is organized as follows. Section 2 presents some stylized facts. Section 3 describes the theoretical model. Section 4

[8] See for example Zuber (2008) for a discussion on the protection of trade secrets in China and the US.

[9] Chen and Puttitanum (2005) also argue that optimal IPR protection should depend on a country's level of development, and they analyze this issue in a one-period game-theoretic model in which the level of development is captured by an exogenous parameter.

[10] See for example Grossman and Helpman (1991), Helpman (1993), Lai (1998), Yang and Maskus (2001), Glass and Saggi (2002a, 2002b), Glass and Wu (2007), Tanaka et al. (2007), Parello (2008), Dinopoulos and Segerstrom (2010), Branstetter and Saggi (2011) and Iwaisako et al. (2011).

[11] Grossman and Helpman (1991) consider a tax (subsidy) on imitation that decreases (increases) Southern imitation, which is similar to the effects of IPR protection.

[12] Wu (2010) also considers the effects of IPR protection in a Schumpeterian model of distance to frontier; however, he focuses on the existence of non-convergence traps and how patent protection affects the convergence of developing countries. Our study differs from his interesting analysis by introducing FDI to the distance-to-frontier model and by analyzing the growth-maximizing and welfare-maximizing paths of IPR protection in developing countries.