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Imitation and innovation driven development under imperfect intellectual property rights

Christian Lorenczik, Monique Newiak*

Ludwig-Maximilians-University Munich, Kaulbachstrasse 45, 80539 Munich, Germany

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ABSTRACT

Developing countries employ about two-fifth of the world's researchers, originate one quarter of world expenditures on R&D, and their inventions are subject to imitation. Nevertheless, the previous literature focuses on North–South setups in which the South is restricted to imitating northern inventions. To analyze the effects of IPR policies on developed and developing countries, we extend this literature to allow not only for southern innovation and imitation of northern goods, but also for imitation targeted at southern innovations. We find the effects of IPRs on R&D and welfare to be non-monotonic and dependent on innovation efficiency and an innovation threshold in the South. For sufficiently strong IPRs the South engages in original R&D and stronger IPRs promote southern innovation, welfare, and a reduction in the North–South wage gap. Below the threshold, a strengthening of IPR protection fails to promote innovation and decreases welfare. Stronger IPRs exclusively for southern firms can benefit both regions by shifting southern resources from the imitation of northern goods to original southern innovation.

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1. Introduction

The distribution of R&D efforts between developed and developing countries is changing. In its Science, Technology and Industry Outlook, the OECD (2008) reports that non-OECD countries increased their share in global Gross domestic expenditure on R&D (GERD) from less than 12% to over 18% from 1996 to 2005. In China, South Africa, Russia and India, the ratios of R&D expenditure to GDP exceed those of high income countries like Greece and Portugal. UIS (2009)[1] reports an even higher share of developing countries in world R&D for 2007 when developing countries accounted for almost 24% of world GERD and employed almost 38% of world researchers. Fig. 1 plots the Gross expenditures on R&D and GDP per capita against the Ginarte and Park IPR index in 2005.[2]

For the group of countries associated with low levels of IPRs (below an index of about 3), R&D expenditures are below 1% with low variations. Above this level, there is a clear positive correlation between R&D efforts, the level of IPRs and GDP per capita.[3] Thus, the graphs not only show that there is a threshold level of IPRs which has to be exceeded for IPRs to be

* Corresponding author. Tel.: +49 170 476 2632.
E-mail addresses: christian.lorenczik@lrz.uni-muenchen.de (C. Lorenczik), info@monique-newiak.de (M. Newiak).

[1] The UNESCO Institute for Statistics.

[2] Data sources: R&D expenditures for 2007 from UIS (2009), IPR index for 2005 from Park (2008a), GDP per capita for 2007 and country codes are from United Nations Statistics Division: National Accounts. We thank Walter Park for sharing the data on the IPR index.

[3] The plot looks qualitatively similar to the time before TRIPS was introduced, although shifted toward lower levels of IPRs. See Park (2008a) for sources of changes in the index. The same observation is made in Ginarte and Park (1997) who find that high income countries provide the highest level of IPR protection.

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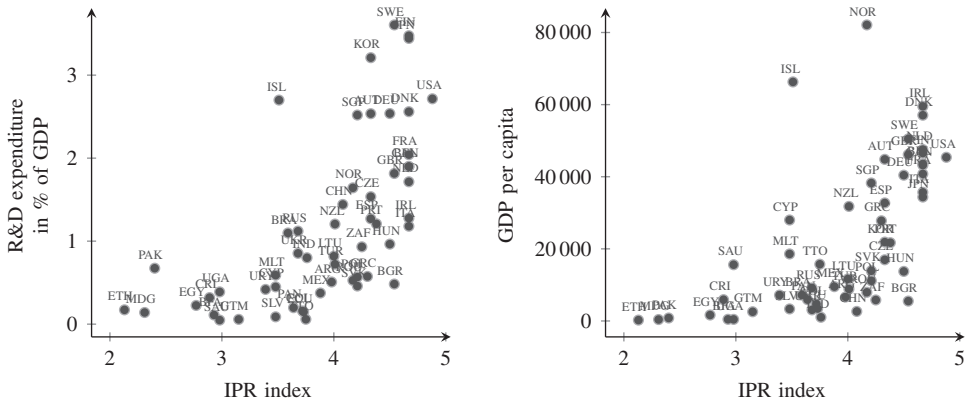

Fig. 1. R&D expenditures (GERD), IPRs, and GDP per capita.

positively associated with R&D, but also that IPR protection is positively related to income only if the country has a sufficiently developed R&D sector.[4]

The theoretical literature typically divides the world into industrialized innovating countries (the North) and imitating developing countries (the South), but does not explain why these roles are assumed in the world economy.[5] What is more, this separation does not account for the increasing investments into R&D in developing economies shown by the data and does not allow for a transition of imitator countries to become innovators as demonstrated by emerging countries like the Asian Growth miracles and earlier Japan.

In this paper, we develop a North–South increasing variety model which allows for original innovation in both the North and the South, and also for the imitation of both northern and southern inventions. We show that our model can explain the IPR-R&D threshold level shown in Fig. 1, and determine the conditions under which IPRs can stimulate southern innovative activity and increase welfare. We then use the model to analyze the effects of different IPR policies in the South. The aspect of southern firms being subject to imitation has two main implications: First, stronger IPRs affect southern R&D incentives directly via their effect on imitation of southern innovations and indirectly via the profitability of northern varieties as imitation targets. Second, we can examine the effects of discriminatory IPR protection of northern or southern goods. While international treaties as the Paris and Berne Convention prescribe the national treatment principle, i.e. equally strong protection for domestic and foreign innovations, this principle may not be followed by developing countries. For instance, as Kumar (2003) describes for the case of Japan until the 1970s, IPR legislation might be in place to unilaterally advance domestic technology adoption from abroad.

We find that southern innovative R&D takes place if IPRs surpass a critical threshold level. This critical level is lower for higher southern research efficiency and a larger southern population. This implies that large countries with efficient R&D sectors are likely to engage in innovation even under weak IPR regimes. Likewise, to encourage an inefficient R&D sector in a small country, IPRs have to be very strong. In stimulating southern original R&D, the protection of northern and the protection of southern innovations are shown to work as imperfect substitutes. If innovation takes place in the South, strengthening IPRs for both regions' innovators increases welfare in both regions. In contrast, an increase in IPRs that does not surpass the threshold level fails to stimulate innovation, increases the wage gap between the regions and decreases real consumption in the South. We show that a southern deviation from the national treatment principle in favor of domestic innovators does not harm either region if the South is not innovative and benefits *both* regions if the South engages in innovation: By increasing R&D incentives for southern firms, it shifts the southern attention away from the imitation of northern goods.

(*footnote continued*)

The data has been suspected to include imitation expenditures together with original R&D expenditures. However, for its components *basic research* and *applied research* the diagram looks qualitatively similar. *Experimental development* captures product developments based on existing knowledge and thus might be inflated by imitation expenditures; for this component, the scatter plot does not shows a clear association with IPR protection. Our notion of innovation relates to the first two components, see OECD (2002) for more information on the data.

[4] As pointed out by one referee, Fig. 1 may simply depict a non-linear pattern rather than a threshold effect. However, the stark distinction between an imperceptible association of IPRs with R&D activities at low protection levels and a clear association beyond a specific level clearly indicates a regime change. Park (2008, 2006) finds an empirical threshold effect of IPR protection he relates to a required market size or size of the R&D sector; Mohtadi and Ruediger (2010) find a threshold level for IPRs and growth which depends on the level of human capital.

[5] Important contributions with this feature include Grossman and Helpman (1991), Deardorff (1992) and Helpman (1993) and more recently Gustafsson and Segerstrom (2010). For a criticism of the lack of southern R&D in North–South models see Park (2008). For two examples of models in which the South can innovate, but is not the subject of imitation itself see Currie et al. (1999) and Glass (2010). For firms' private incentives to protect their intellectual property compare Eicher and García-Peñalosa (2008).

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