

## **Has the Shift to Stronger Intellectual Property Rights Promoted Technology Transfer, FDI, and Industrial Development?**

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**Abstract:** This article reviews recent research conducted by the authors that finds that intellectual property right reform increases technology transfers, foreign direct investment inflows, and industrial development. It also places the findings of this work in the broader context of the literature.

Has the global shift to stronger intellectual property rights been associated with positive effects? Even today, more than fifteen years after the ratification of the TRIPs Agreement, opinions about the impact of stronger IPR are varied and continue to reflect issues that arose when TRIPs was debated. Opponents of strong IPR typically raise concerns that stronger IPR raises the costs of protected goods and reduces the accessibility of innovations. Proponents suggest that IPR protection fosters innovation in reforming countries. Proponents also argue that stronger IPR facilitates transfers of technology to reforming countries, increases foreign direct investment (FDI), and spurs industrial development. This essay reviews recent research performed by the authors on the effects related to technology transfers, FDI, and industrial development, and it places the findings of this work in the broader context of the literature.

Before turning to the effects of stronger IPR on technology transfer, FDI, and industrial development, it is useful to review some findings about other effects that have been discussed and examined. Many representatives of developing country governments argue that stronger IPR has worked against the interests of developing countries. The reasons for this negative view of

TRIPS typically stem from the obvious costs of strengthening a patent system: stronger patents confer a greater degree of monopoly power on the patent-holder, and patent holders are often foreign-based multinationals. Research indicates that stronger IPR can indeed lead to higher prices for patent-protected goods and lower consumer welfare.<sup>1</sup> Developing country opponents also contend that stronger intellectual property rights may retard the process of industrial development. According to this view, weak IPR functions as a kind of infant industry policy – it allows indigenous firms to learn from, absorb, and experiment with foreign technology at low cost. If one believes that local firms must build a capacity to imitate before they can innovate, then it is possible that premature imposition of a strong IPR regime could actually hold back economic development rather than promote it.<sup>2</sup>

One argument advanced by proponents of stronger IPR is that stronger IPR stimulates innovation in reforming countries, accelerating growth and providing greater choice to consumers around the world. However, the notion that stronger IPR in developing countries will necessarily induce greater innovation has been questioned within the economics literature on both theoretical and empirical grounds.<sup>3</sup> If the major developed economies already possess strong patent rights and exporters in developing countries can obtain patents in the rich markets, then, in a reasonably integrated global economy, the accession of any one developing country to the strong patent bloc should have limited effects on the incentives for innovation.<sup>4</sup> Economic analyses of large samples of patent reforms have tended to find, at best, limited evidence that stronger IPR induces more local innovation in the short-to-medium run.<sup>5</sup> Economic historians have been able to demonstrate a connection between national patent laws and the *direction* of inventive activity in early industrial history; it has been much harder to document a connection in

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<sup>1</sup> Maskus, K.E., *Intellectual Property Rights in the Global Economy*, (2000), Institute for International Economics, Washington. See also McCalman, P., “Reaping What You Sow: An Empirical Analysis of International Patent Harmonization,” (2001), *Journal of International Economics*, 55, pp. 161-186, and Chaudhuri, S., Goldberg, P., and Jia, P., “Estimating the Effects of Global Patent Protection in Pharmaceuticals: A Case Study of Quinolones in India,” *American Economic Review* 96, pp. 1477-1514.

<sup>2</sup> Maskus, K.E., *Intellectual Property Rights in the Global Economy*, (2000), Institute for International Economics, Washington.

<sup>3</sup> Branstetter, L., “Do Stronger Patents Induce More Local Innovation?” (2004), *Journal of International Economic Law* 7, pp. 359-370.

<sup>4</sup> Grossman, G., Lai, E.L.C., “International Protection of Intellectual Property,” (2004), *American Economic Review* 94, pp. 1635-1653,

<sup>5</sup> Lerner, J., “150 Years of Patent Protection,” (2002), *American Economic Review* 92, pp. 221-225.

that era between national patent laws and the *scale* of local inventive activity.<sup>6</sup> Even studies that focus on industries where patent rights are regarded as effective mechanisms of appropriation typically find that they increase inventive output only in a limited number of special cases.<sup>7</sup> While patent reform in countries with limited innovative capacity might reasonably be expected to yield weak results, the extant literature also provides examples of countries with well developed innovative capabilities that do not appear to have responded to stronger IPR with more innovative effort or increased innovative outcomes.<sup>8</sup> Of course, one can find examples of developing countries and particular industries in developing countries where local IPR reform is temporally coincident with a surge in local innovative activity.<sup>9</sup> There are empirical studies utilizing data from multiple countries which find evidence that stronger IPR yields higher levels of innovative effort.<sup>10</sup> Nevertheless, the number of studies and cases in which this connection is absent or weak gives one pause in attempting to make a positive case for IPR reform based on its effects on local innovation.

### ***Do Stronger Patents Promote International Technology Transfer, FDI, and Industrial Development?***

The evidence described above suggests that a shift to strong IPR generates some costs for reforming countries and that any benefits associated with increased local innovation are questionable. It is important to consider another source of positive effects. IPR reform may induce multinationals to deploy more and better technology in developing countries, and do so faster, than they would in a weak IPR regime. Some of this technology could eventually diffuse to local firms – especially local suppliers in whose technological competence the multinationals have a strong vested interest.<sup>11</sup> Developing countries may actually absorb technologies faster if

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<sup>6</sup> Moser, P., “How Do Patent Laws Influence Innovation? Evidence from 19<sup>th</sup> Century World Fairs,” (2005), *American Economic Review* 95, pp. 1214-36.

<sup>7</sup> Qian, Y., “Do National Patent Laws Stimulate Innovation in a Global Patenting Environment? A Cross-Country Analysis of Pharmaceutical Patent Protection, 1978-2002,” (2007), *The Review of Economics and Statistics* 89, pp. 436-453.

<sup>8</sup> Sakakibara, M., and Branstetter, L., “Do Stronger Patents Induce More Innovation? Evidence from the 1988 Japanese Patent Reforms,” (2001), *RAND Journal of Economics* 32, pp. 771-800.

<sup>9</sup> Lo, S.-T., “Strengthening Intellectual Property Rights: Evidence from the 1986 Taiwanese Patent Reforms,” (2005), working paper.

<sup>10</sup> Kanwar, S., Evenson, R., “Does Intellectual Property Protection Spur Technical Change?” (2003), *Oxford Economic Papers* 55, pp. 235-264.

<sup>11</sup> Javorcik, B., “Does Foreign Direct Investment Increase the Productivity of Domestic Firms? In Search of Spillover through Backward Linkages,” (2004), *American Economic Review* 94, pp. 605-627.

such absorption is also in the interest of technology owners.<sup>12</sup> While the literature on this topic remains smaller than the literature linking IPR strength and innovation, patterns are emerging across different papers, data sets, and countries suggesting a reasonably robust and positive relationship between stronger IPR and technology transfers and FDI. If this relationship is strong enough – and a stream of recent studies suggests it is – then stronger IPR would promote industrial development.

### *Theoretical Analysis*

It is important to point out that, in theory, the relationship between stronger IPR in the South, North-South FDI, and industrial development could be positive or negative. Since the 1960s, international economists have noted a “product cycle”: production of a manufactured good begins in the most advanced industrial economies, then shifts to less advanced ones as a product becomes more standardized.<sup>13</sup> Theoretical work on the impact of Southern IPR reform on North-South trade and FDI put this notion of a product cycle at the conceptual center of a range of models. Important early research by Elhanan Helpman developed several variants of a North-South general equilibrium product cycle model in which Northern innovation expands the range of differentiated goods produced in the world while Southern imitation leads to North-South production shifting.<sup>14</sup> A robust finding of this analysis is that stronger IPR protection is never in the interest of the South. If stronger IPR in the South is treated as a reduction in the rate of Southern imitation and Northern firms do not shift production to the South through FDI, Southern IPR reform lowers the rate of Northern innovation and thereby limits the portfolio of products available globally. If North-South FDI is permitted, a reduction in Southern imitation leads to more FDI but hurts the South because Northern multinationals tend to charge higher prices than Southern imitators.

It would be difficult to overestimate the impact of Helpman’s early work on the theoretical literature that followed. Helpman’s model provided elegant theoretical underpinnings for the concerns being raised by developing country representatives during the Uruguay Round

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<sup>12</sup> Lin, P., Saggi, K., “Multinational Firms, Exclusivity, and the Degree of Backward Linkages,” (2007) *Journal of International Economics* 71, pp. 206-220. See also Saggi, K. “Trade, Foreign Direct Investment, and International Technology Transfer: A Survey,” (2002) *World Bank Research Observer* 17, pp. 191-235.

<sup>13</sup> Vernon, R., “International Investment and International Trade in the Product Cycle,” (1966), *Quarterly Journal of Economics* 80, pp. 190-207.

<sup>14</sup> Helpman, E., “Innovation, Imitation, and Intellectual Property Rights,” (1993), *Econometrica* 61 (6), 1247-1280.

trade negotiations that eventually produced the TRIPs Agreement. He was able to derive closed form results for welfare changes that subsequent researchers have struggled to match. Nevertheless, the stark results of Helpman's model flow out of a particular set of assumptions. Helpman assumes that FDI between North and South leads to an equalization of wages across regions. While this is a standard outcome in many trade models, North-South wage convergence has certainly not yet been achieved in the real world, and, in fact, low wages in the South are a key driver of FDI. Helpman also assumes that there is no innovation whatsoever in the South. Changing these key assumptions can lead to quite different predictions regarding the effects of increased IPR protection in the South.

Lai extended Helpman's model to allow both the level of FDI and Northern innovators to respond endogenously to changes in the strength of Southern IPR protection.<sup>15</sup> This model is further extended in work by the current authors, to the case where innovation, FDI, and imitation are all endogenously determined.<sup>16</sup> In these extensions, in any equilibrium with a positive rate of imitation, North-South FDI does not lead to equal wages in the two regions. A lower wage in the South creates an incentive to move production of existing goods there, but multinationals seeking to benefit from this incur a higher risk of imitation. Imitation is a costly activity that requires deliberate investment on the part of Southern firms seeking to copy Northern products.<sup>17</sup> Stronger IPR protection in the South increases these costs, reducing imitation and lowering the risks faced by multinationals. Multinationals that move to the South employ the labor resources freed up by the decline in imitative activity. Production shifting allows for a reallocation of Northern resources towards innovative activity. Under certain parameter assumptions, a strengthening of Southern IPR protection enhances Southern industrial development because the increase in North-South FDI more than offsets the decrease in Southern imitation.

In these theoretical extensions, it is possible that industrial expansion of the South could still be welfare reducing – if the prices charged by multinationals are sufficiently higher than prices charged by indigenous firms, the negative welfare effects engendered by those higher

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<sup>15</sup> Lai, E.L.C., "International Intellectual Property Rights Protection and the Rate of Product Innovation," (1998) *Journal of Development Economics* 55 (1), pp. 133-153.

<sup>16</sup> Branstetter, L., Fisman, R., Foley, F., Saggi, K., "Intellectual Property Rights, Imitation, and Foreign Direct Investment: Theory and Evidence," (2007) NBER WP No. 13033.

<sup>17</sup> Grossman, G., Helpman, E. *Innovation and Growth in the Global Economy*, (1991) MIT Press, Cambridge.

prices could outweigh the increase in Southern output, relative wages, and terms of trade. Allowing for innovation, FDI, and imitation to all respond endogenously to Southern IPR changes complicates welfare analysis, and no paper yet circulated in the academic community has provided a full-fledged mathematical analysis of welfare effects under these conditions. However, it appears that a necessary condition for Southern welfare to rise with stronger IPR is that IPR reform accelerates industrial development, in part by inducing an increase in FDI.

### *Empirical Evidence*

Recent evidence indicates that IPR reform has this effect. In previous work, two of the current authors identified substantive IPR reforms in 16 countries and demonstrated that U.S. multinationals increased their technology transfer to their affiliates in reforming countries after reform.<sup>18</sup> Furthermore, the increase in technology transfer was significantly higher for affiliates of technology-intensive parents, who could be expected *ex ante* to be more responsive to reform. The magnitudes of these effects were quite large – reform induces an increase in the flow of technology of roughly 17% per year, and, for the affiliates of technology-intensive parents, the increase is 30-34% per year, depending on the specification. A similar pattern was found in the R&D spending of U.S. multinational affiliates. These increased in the wake of reform and increased by larger amounts for affiliates of technology-intensive parents. In most countries, affiliate R&D is a complement to technology imports from the parent – one designed to modify parent technology to suit local tastes or conditions.<sup>19</sup> The similarities in the movement of R&D and technology transfer suggested that there was an increase in the quantity of technology provided to affiliates after reform rather than just the price charged for technology. Of course, demonstrating a multinational response to IPR reform is not sufficient to prove that it fosters industrial development. Multinationals could increase the technological intensity of their operations without increasing their scale, and an expansion of multinational activity could come at the expense of a decline in indigenous activity, resulting in a net decrease of industrial activity.

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<sup>18</sup> Branstetter, L., Fisman, R., Foley, F., 2006, "Do Stronger Intellectual Property Rights Increase International Technology Transfer? Empirical Evidence from U.S. Firm-Level Data," (2006), *Quarterly Journal of Economics* 121 (1), 321-349.

<sup>19</sup> Kuemmerle, W. "The Drivers of Foreign Direct Investment into Research and Development: an Empirical Investigation," (1999), *Journal of International Business Studies* 30, pp. 1-24.

Recent research by the current authors addresses these broader issues.<sup>20</sup> This research shows that U.S. multinationals expand their capital stock and employment compensation after IPR reform, and these effects are greater for the affiliates of technology-intensive parents. For these affiliates, post-reform increases in capital stock and employment compensation are on the order of 20%. Additional regression analyses use industry-level data from the U.N. Industrial Development Organization to examine the impact of IPR reform on the level of industrial value-added. Controlling for country-specific time trends, the study demonstrates that industrial value-added expands rather than contracts following IPR reform, and these effects are especially large in technology-intensive industries.<sup>21</sup> The study also attempts to get at a more direct measure of the speed with which countries are cycling into the production and export of new goods by counting, for their 16 reforming countries, the number of new 10-digit categories in which positive exports to the U.S. are recorded for the first time. The study concludes that this count is systematically higher after reform, suggesting an acceleration in the operation of the international product cycle.<sup>22</sup>

It is natural to wonder about the potential endogeneity of the IPR regime changes – are IPR reforms causing an increase in FDI, or is the underlying attractiveness of a market inducing both an increase in FDI and a combination of external and internal pressure for stronger IPR? In the aforementioned study, the authors are able to point to evidence that technology transfer, R&D spending, and affiliates' capital stocks do not expand much prior to patent reform.<sup>23</sup> After reform, there is a gradual expansion, addressing some of the endogeneity concerns. A second problem is the coincidence between IPR reform and other reforms and changes that would make a market attractive to foreign firms. Theoretical work by two of the current authors has demonstrated that a cut in the corporate tax rate, for example, could lead to the same kinds of shifts as stronger IPR.<sup>24</sup> Fortunately, Branstetter, Fisman, Foley, and Saggi employ a rich set of firm- and country-level variables that control directly for many of the shifts other than IPR

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<sup>20</sup> Branstetter, L., Fisman, R., Foley, F., Saggi, K., forthcoming, *Journal of International Economics*.

<sup>21</sup> Ibid.

<sup>22</sup> Ibid.

<sup>23</sup> Ibid; Branstetter, L., Fisman, R., Foley, F., "Do Stronger Intellectual Property Rights Increase International Technology Transfer? Empirical Evidence from U.S. Firm-Level Data," (2006), *Quarterly Journal of Economics* 121 (1), 321-349.

<sup>24</sup> Branstetter, L., and Saggi, K., "Intellectual Property Rights, Foreign Direct Investment, and Industrial Development," (2009), NBER WP no. 15393.

reform that could induce greater FDI, more rapid industrial expansion, and a more rapid cycling into the production and export of new goods.

Other authors have also found a positive relationship between U.S. FDI and the strength of intellectual property rights.<sup>25</sup> Stronger patent rights in Eastern Europe and former Soviet Union states appear to have a positive effect on foreign FDI (from a range of host countries) in high-technology sectors.<sup>26</sup> IPR reform appears to increase international technology transfer from Japanese multinational firms to their affiliates, a result that parallels the findings of Branstetter, Fisman, and Foley.<sup>27</sup> Set against these findings, stronger IPR appears to have a negative effect on the location decisions of French multinationals.<sup>28</sup>

Fewer authors have attempted to assess the impact of IPR on industrial development more broadly, but a recent study by Hu and Png is also consistent with the findings of Branstetter, Fisman, Foley, and Saggi.<sup>29</sup> Hu and Png find that patent-intensive industries in more advanced economies grow more quickly after IPR reform. They do not identify FDI as a causal mechanism nor do they directly measure FDI in their empirical work, but their finding that patent reform appears to have driven industry expansion through more rapid factor accumulation and increasing productivity is consistent with MNEs responding to IPR reform by increasing their capital stock and transferring technology to affiliates. The rise in developing country industrial activity could reflect far more than pure FDI effects. It is possible that some of the transferred technology could eventually diffuse to domestic firms, especially domestic suppliers in whose technical competence foreign firms have a vested interest. Evidence is also emerging that

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<sup>25</sup> Lee, J.Y., Mansfield, E., "Intellectual Property Protection and U.S. Foreign Direct Investment," (1996), *Review of Economics and Statistics* 78, pp. 181-186; Nunnenkamp, P., Spatz, J., "Intellectual Property Rights and Foreign Direct Investment: a Disaggregated Analysis," (2004) *Weltwirtschaftliches Archiv* 140, pp. 393-414.

<sup>26</sup> Javorcik, B., "The Composition of Foreign Direct Investment and Protection of Intellectual Property Rights in Transition Economies," (2004), *European Economic Review* 48, pp. 39-62.

<sup>27</sup> Ito, B. and Wakasugi, R., "The Effects of Stronger Intellectual Property Rights on Technology Transfer: Evidence from Japanese Firm-Level Data," (2009), *Journal of Technology Transfer* 34, pp. 145-158.

<sup>28</sup> Mayer, T. and E. Pfister, "Do Stronger Patent Rights Attract Foreign Direct Investment? Evidence from French Multinationals' Locations," (2001), *Location, Region et. Development* 13, pp. 99-122.

<sup>29</sup> Hu, A. and Png, I.P.L., "Patent Rights and Economic Growth: Evidence from Cross-Country Panels of Manufacturing Industries," (2010), working paper, National University of Singapore.



knowledge spillovers occur in developing countries through transfers of employees from MNEs to indigenous firms.<sup>30</sup>

Most theoretical North-South product cycle models of IPR reform predict an acceleration in Northern innovation as production flows to the South. In the models, this stems not just from stronger protection but also from a general equilibrium resource reallocation in the North from production to R&D. Perhaps not surprisingly, attempts to directly measure the impact of particular Southern IPR reforms on Northern innovation fail to find much discernible impact.<sup>31</sup> Most individual Southern countries are too small and the lags involved in such a resource reallocation are likely to be too long and variable for the data to identify much of an effect. It is nevertheless interesting to observe that the years following the ratification of the TRIPs Agreement have been ones in which innovative activity in the United States appears to have accelerated. TFP growth surged and remained at relatively high levels until the recent financial crisis, and the fraction of the labor force engaged in activities that connected to R&D has increased, even as the fraction of the labor force engaged in production labor has continued to decline.<sup>32</sup>

### ***Conclusions and Policy Implications***

A substantial and growing body of work indicates that IPR reform is associated with an acceleration of industrial development. Earlier concerns that a shift to stronger IPR would freeze the industrial development of countries – or send it into reverse – now seem overblown. However, it is important to keep in mind that the empirical results described above are focused on one type of effect of stronger IPR and the results may not generalize to all countries. For example, the poorest countries attract little FDI, and a change in the IPR regime may do relatively little to induce large FDI flows simply because the degree of IPR protection is only one of many determinants of inward FDI.

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<sup>30</sup> Poole, J., “Knowledge Transfers from Multinationals to Domestic Firms: Evidence from Worker Mobility,” (2009), working paper, UC-Santa Cruz.

<sup>31</sup> Park, W., “North-South Models of Intellectual Property Rights: An Empirical Critique,” (2010), working paper.

<sup>32</sup> See Gordon, R., “Exploding Productivity Growth: Context, Causes, and Implications,” (2003), *Brookings Papers on Economic Activity* 2, pp. 207-298, and Kortum, S. and Lerner, J., “Stronger Protection or Technological Revolution? What Is Behind the Recent Surge in Patenting?” *Research Policy* 28, pp. 1-22.

Much remains to be done to extend recent research. Further empirical analyses could reveal what sorts of countries and industries obtain the greatest boost from IPR reform and whether increases in industrial development persist in the long run. Research that employs high quality price data in a way that allows analysts to conduct welfare calculations would be particularly informative. Additional work could also reveal the extent to which production shifting reshaped the Northern economies. Is the temporal coincidence of rising patent rates, higher R&D intensity, and accelerated productivity growth in the United States with the shift of production overseas a consequence of the mechanisms emphasized in these models described above?

There is also a clear need for more theoretical work in this area. Under what circumstances is the acceleration of industrial development induced by stronger IPR truly welfare enhancing? Under what circumstances are the benefits of more rapid industrial development undercut by other effects of stronger IPR? The mathematical challenges that theorists confront in building models that could address these questions are clear, but so are the potential benefits for policymakers and empirical researchers. Given the number of questions for which we still lack complete answers, this domain is likely to be an area of active research in economics for some time to come.