Role of IPR in International transfer of technology in case of developing countries and countries with economies in transition

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Abstract

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Intellectual property comes in many forms, trade secrets, copyrights, and patents being the most important in relation to technology transfer. The key question is how IP protection affects the extent, form and channel of technology transfer. First, how important is foreign direct investment as a source of international technology transfer as compared, on the one hand, with licensing, and on the other, with imports? A second theme is how IP protection affects these different modes of transfer. Maskus and Penubarti (1995) were the first to relate international trade flows to the cross-country strength of patent laws, using bilateral imports from OECD countries to other OECD countries and to a large group of developing countries in detailed manufacturing categories. However, Primo Braga and Fink (1998) found no statistical relationship between patent rights, measured by the Ginarte-Park index, and international FDI flows or stocks. For our purposes, the question is whether FDI flows and trade respond to patent protection.

1. Challenges for International Technology Transfer

The standard model of economic growth predicts that while a country at the frontier can only grow (at a steady pace) at the rate of technical advance, countries behind the frontier (also called developing countries) should catch up – converge towards the high-income countries in per capita income. Even more sophisticated models (e.g. Romer, 1990) in which technical progress requires investment in research and development, have a similar implication. Technology, once developed, can be applied broadly. The implicit assumption is that technology can be "transferred" with a lower expenditure of resources than were required to develop it in the first instance. Another is that the technologies developed elsewhere are indeed widely useful, which has given birth to the literature on "appropriate technology". Undoubtedly, technologies must be adapted and modified, but few believe that technologies developed and used in technically advanced countries cannot be usefully applied in countries behind the frontier.

A richer conceptualization of technology includes materials and knowledge codified in patents, blueprints and manuals. It also includes know-how, much of it not codified and held as tacit knowledge. Tacit knowledge is costly to transfer and contracting for tacit knowledge is potentially subject to even greater contractual difficulties than for codified technology, which, in any event, is also believed to be difficult to contract over.

Another significant challenge is what is called the absorptive capacity of the recipient – the ability of the receiving country to evaluate and effectively use the technology. An issue which has not received attention is the question of demand for technology. For the most part, this neglect is understandable. Insofar as new (to the recipient country) technology will reduce costs or make available new goods hitherto unavailable, it is inherently valuable. Nonetheless, a little introspection reveals that this is not enough. First, the technology will be transferred only if the benefits outweigh the costs. These costs include not only the costs of transfer, but also the opportunity cost. Simply put, the fruits of the technology may be made available to the recipient incorporated in goods and services exported to the recipient, rather than the technology itself.

In thinking about technology transfer to emerging economies, it is very important to distinguish between technologies intended to serve the domestic market (of the recipient country) vs. technology intended to produce

exports for developed countries. Most of the literature has failed to make this distinction, perhaps because of difficulty in measurement. The consequences of this failure are conceptual confusion and, potentially, conflicting empirical results. A corollary is that there is relatively little attention paid to why IP protection should matter for technology transfer. Although the answer may appear to be obvious, a little reflection reveals that the matter is more complex.

If the technology being transferred is for producing goods and services for the export market, what matters is the patent protection the technology holder enjoys in the export market. In other words, consider the case where a new chemical process is being introduced into a country, where it will be used to produce plastics for export.

Technology transfer can filter through several channels, like exports of capital intensive, skill intensive exports, high technology exports, royalties exports, net FDI outflowsetc. shows that these channels have increased in importance over time, consistent with the broad patterns described earlier. The major modes of transfer are imports of goods and services, especially of capital goods, foreign direct investment (i.e. via multinational corporations (MNCs)), licensing and joint ventures, foreign trade, and movement of people.

Maskus (2004) also points out that technology can be involuntarily transferred, via imitation. The technology holder does not participate in this transfer, and in many cases, may seek to restrict it. This point is worth noting for, as also discussed later, although the presumption is that IP protection may retard such transfer, patents also disclose. Thus, there is an intriguing possibility that patents may facilitate such transfer. A second source of transfer is exports by recipient country firms: it is plausible that exports are a means of learning not only about demand conditions but also technology. Many large firms control supply chains. Firms in developing countries that participate in such supply chains may receive a variety of training and technology from their customers. A third major source of transfer is the diffusion within the recipient country of the transferred technology. This diffusion can itself take place through purchase of goods or licensing but is more likely to take the form of movement of people or direct imitation or both. Here, trade secrecy (and related employment rules such as non-compete clauses) play a more important role.

2. Regime shifting in international technology transfer

The key question is how IP protection affects the extent, form and channel of technology transfer. Within this broad area, there are several important sub-questions. First, how important is foreign direct investment as a source of international technology transfer as compared, on the one hand, with licensing, and on the other, with imports? A second theme is how IP protection affects these different modes of transfer. Here there are two related questions. First, how does patent protection affect technology transfer within a given mode? Second, how does patent protection affect the choice between these modes? A priori reasoning and some limited empirical evidence suggest both that the relative importance of the different sources may vary over time, and that IP protection may affect these sources differently. As noted earlier, there is relatively little evidence on the impact of non-patent IP protection on technology transfer. Virtually all empirical work has focused on patents instead.

The second challenge is to measure technology transfer itself. Typically, the literature has used measures such as the total payments made for technology imports or technology licensing revenues. This poses a problem insofar as arguably stronger IPR protection may simply result in a higher price for technology rather than higher "quantity" or quality of technology. Some studies, that will be cited later, indirectly try to address this by investigating whether the recipient firm increases its own technology activities, indicating an increase in the extent of technology transfer, rather than merely a price increase. Other possibilities (which I have not seen implemented but are surely feasible with detailed data) include investigating whether the recipient firm increased profits or productivity or, better still, whether it introduced new products or lowered its costs.

Measurement is easier when the focus is on the mode of technology transfer (such as the choice between foreign direct investment and licensing) or the form of the technology contract. However, the key problem here is the counter-factual. Specifically, the empirical analysis is conditioned upon the transfer taking place. technology, is it transferred via FDI, arms-length licensing or some other form? Put this way, the problem is also obvious. It is possible that changes in IPRs may increase or decrease the total amount of technology transfer, in the process changing its share through FDI or licensing or imports. Few of the studies have adequately addressed this issue.

A number of empirical studies have looked at the relation between patents and technology transfer. Eaton and Kortum (1996), albeit studying productivity growth and technology diffusion in the OECD countries, found that the smaller and less-technologically advanced OECD countries derived most of their productivity growth from having foreign inventors patent in their economies. This finding may also apply to the more advanced developing nations. They control for the IPR regime using the Rapp-Rozek index. McCalman (2001) applied the Eaton and Kortum approach to a sample of developed and developing countries. He found that patent harmonization (which has de facto resulted in a strengthening of patent protection) leads to an increase in patent value (as reflected in the contribution to economic growth). Moreover, McCalman (2001) constructed an "enforcement" index, to capture the effect of patent harmonization.

Xu et al (2005) carried out a similar study of international technology diffusion through trade and patenting in a sample of 48 countries for the period 1980–2000. They used the GinartePark index to measure strength of patent protection, together with actual patenting data from WIPO, and found that rich countries benefit from domestic technology and foreign technology embodied in imported capital goods; middle-income countries enjoy technology spill overs from foreign patents (patents filed in the country by foreigners) and imported capital goods; developing countries benefit mainly from foreign patents.

Bascavusoglu and Zúñiga (2002) used as their dependent variable the receipts in technology services flows exported by French firms to 19 countries over the period 1994-2000. These flows captured cross-border patent-licensing and trademark-licensing receipts, revenues from technical assistance and engineering services and income related to R&D services and R&D located overseas. The authors found a positive, although weak, effect of the degree of patent protection at the country level on the amount of such receipts. Patent protection seems to matter most for countries with strong imitative abilities and for industries with a medium level of R&D intensity.

Ferrantino (1993) used data for 1982 on US exports and sales of overseas affiliates of US firms to identify the cross-country determinants of both exports and sales of multinational affiliates of these firms. Patent protection is measured by whether the country is a member of certain IP treaties. It found that membership in IP treaties increases the flows of payments and receipts for intellectual property as long as domestic patent protection is sufficiently strong. Parent companies in the US export more to subsidiaries in countries which do not adhere to such treaties, but their impact on arms-length exports and foreign investment is minimal. In other words, the author suggests that US firms export higher than expected volumes to their affiliates in countries that have weak IP regimes to limit technology leakage to their rivals abroad by confining production within the US.

A somewhat different approach is taken by Javorcik, who exploited differences in reliance upon patents across industries. She found that firms in industries relying heavily on IPR protection are (ceteris paribus) more likely to invest in transition countries with stronger IPR protection (Javorcik (2004)). This is an example of exploiting the differences across industries and countries.

3. Patents, Trade and FDI Flows

Foreign direct investment is a major source of technology flows across countries. Seven hundred multinational corporations accounted for 46 per cent of the world's total R&D expenditure and 69 per cent of the world's business R&D in 2002 (UNCTAD (2005)). Indeed, the R&D budgets of the largest firms exceeded the entire R&D spending of virtually all developing countries.8 A recent comparison showed that in 2003, the R&D spending of firms such as Ford, Siemens, Pfizer and Chrysler was around 7 billion US dollars each, greater than the combined R&D expenditures of all CIS states, or the newly admitted EU member states (see Javorcik, this publication). Not only does FDI itself introduce new technologies to developing countries, but this knowledge also spills over to other domestic firms in a variety of ways as discussed later. The literature on knowledge spillovers from foreign direct investment is extensive, the results unclear and a review of that literature would be of limited relevance to this publication. However, as discussed later, it is possible that one reason for the mixed results may have to do with differences in patent protection across countries.

For our purposes, the question is whether FDI flows and trade respond to patent protection. Maskus and Penubarti (1995) were the first to relate international trade flows to the cross-country strength of patent laws,

using bilateral imports from OECD countries to other OECD countries and to a large group of developing countries in detailed manufacturing categories. The strength of patent rights was measured by the Rapp and Rozek (1990) index across importing nations. The authors found that import volumes were positively and significantly affected by increases in this patent index across most manufacturing categories, particularly in large and middle-income countries. Smith (1999) found that international firms would expand their exports to imitative (large and middle-income developing countries) nations significantly in response to an increase in the patent strength index. In supplementary regressions, Smith showed that patent rights strongly and positively affected the inflows of knowledge, measured as R&D expenditures undertaken on behalf of affiliates. Again, this finding applied only to recipient countries with strong imitative abilities; the impact was absent in countries with weak imitative abilities.

However, Primo Braga and Fink (1998) found no statistical relationship between patent rights, measured by the Ginarte-Park index, and international FDI flows or stocks. Blyde and Acea (2002) estimated the relationship between patent rights (measured with the Ginarte-Park index) and imports and FDI into Latin American countries. They found that imports were higher for higher values of the Ginarte-Park patent index for developed countries but were insensitive to patents in the developing countries. However, bilateral inflows of FDI from OECD countries were higher for higher values of the Ginarte-Park index, even after controlling for institutional variables, infrastructure, and human capital levels.

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4. Patents and Content of Technology Import Contracts

Nagaoka (2005) analyzed how the price of technology imported by Japanese firms depended on the strength of patent protection, using information over the period 1981-98 across 32 sectors. He found that high royalties are more likely to be observed when the licensing contract also includes patents. In short, stronger IPRs help increase the share of a technology's value the licensor can appropriate. The data was drawn from corporate reports filed by Japanese manufacturing corporations in 1999 under the Security Exchange Law, which requires public firms to disclose important contracts. In the case of licensing-out, 217 firms disclosed 1,458 contracts in total. Nagaoka (2002), using the same data, found that technology out-licensing contracts by Japanese firms were less likely to involve only a patent (rather than both patents and knowhow) when the license country's IPR protection (Ginarte-Park index for patents, and the Business Software Alliance for software piracy) is weak.

Arora (1996) used a sample of 144 technology-licensing agreements signed by Indian firms to test the empirical relevance of patents. He employed the provision of three technical services – training, quality control, and help with setting up an R&D unit – as empirical proxies for the transfer of know-how. He found that the probability of technical services being provided was higher when the contract also included a patent license or a turnkey construction contract.

Mendi (2007b) used a sample of technology import contracts by Spanish firms in 1991. The dataset was taken from the records of the Spanish Ministry of Industry. All Spanish firms that imported technology were required, up to 1992, to report the terms of the technology purchase.9 The paper found that shorter scheduled contracts were less likely to include the transfer of know-how. It also found that technical assistance was bundled together

with the transfer of know-how. In another paper based on a dataset derived from the same Spanish administrative records, covering 925 licensing agreements, mostly for the years 1964-68, Villar (2003) found that when the technology is patented, the parties are more likely to agree on fixed payments.

5. Patents and the Mode of Transfer (FDI vs. Licensing)

Smith (2001), in the study cited earlier, found that US firms are more likely to export or invest in direct manufacturing facilities rather than license technology in countries with weak patentregimes. Similarly, Nicholson (2002) and Puttitanun (2003), both of whom used data on the number of various kinds of contracts (exports, FDI, licensing) found that increases in the patent index significantly raised both FDI and licensing, but also that the mode of transfer tended to shift towards licensing. Puttitanun (2003) analyzed decisions on entry mode by US firms in 135 industries and 62 countries in 1995. Using a multi-nomial logit regression model, she showed that while stronger patent rights increase total entries by multinational firms, they especially enhance the location advantage of FDI and licensing vis-à-vis exports. However, strong patent protection is associated more with increases in FDI than licensing. Javorcik (2004) used data on FDI projects to Eastern Europe and found that weak patent protection shifted the composition of FDI away from technology intensive industries, and away from production towards distribution.

On the other hand, Fosfuri (2004) used a comprehensive database on investments in chemical plants during the period 1981-96, distinguishing between wholly owned operations, joint ventures and technology licensing in 75 countries. After controlling for several country characteristics, he did not find that higher values of the Ginarte-Park index were associated with greater levels of licensing or FDI, nor its ratio. Similarly, Pfister and Deffains (2005) found that patent rights exert only a negligible influence on the location choices of French firms among 17 developing countries.

Eapen and Hennart (2002) analyzed whether technology was transferred through joint ventures or licensing for a sample of Indian firms. Data was collected by means of a survey sent to 1,258 managing directors of Indian firms, which had taken technology licenses from, or had entered into joint ventures with, foreign firms. The population was identified from a database of over 7,000 Indian firms and from the listings of foreign chambers of commerce in India. Their final sample consisted of 126 Indian firms of which 75 were local partners in joint ventures with foreign firms and 51 were licensees of foreign firms. They found that whether the technology is patented in India or not their measure of patent protection did not influence the choice between licensing and joint ventures.

Yang and Maskus (2001) found that license fees for industrial processes paid by unaffiliated foreign firms to US firms in 26 countries in the years 1985, 1990 and 1995 were higher for higher values of the Ginarte-Park index. On the other hand, Fink (1997), using German data, found a very weak relationship between the strength of patent protection and the level of technology licensing.

Using the same dataset as Mendi (2007), Mendi (2005) analyzed a sample of contracts that included technology transfers to Spanish subsidiaries of overseas firms in 1991. He found that know-how is more likely transmitted within multinationals than between unrelated firms, but there is no difference in the transfer of codified knowledge.

This mixed evidence reflects a variety of factors, not the least of which involve differences across the transferring firms and differences across technologies. Arora and Ceccagnoli (2005) showed that stronger patent protection increased patenting, but that it does not increase licensing by large firms. Small firms, and firms lacking commercialization capability, are more likely to license in response to stronger patent protection. In other words, stronger patents may favor FDI when the technology is owned by large firms that are able to invest globally. If the technology is owned by smaller firms, this will increase licensing. As discussed in the final section, investigating the source of technology and its response to patent protection is a promising avenue for additional research.

6. CONCLUSION

While the literature on international technology transfer has been growing over recent years, there remain a number of important gaps concerning the role of IPRs in international technology transfer, particularly in developing countries and countries with economies in transition. This paper has sought to identify ways in which those gaps might be partially filled by suggesting avenues for further research and exploring under-researched topics in order to obtain a better understanding of intellectual property and its impact on international technology transfer.

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