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Intellectual Property and its Role in the Generation and Diffusion of Green Technologies,
Hong Kong China
11 November 2014

The role of IP in the transfer of green technologies: what economists tell us

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What is technology transfer?

- Technology transfer refers to any process by which the technical information of one party is acquired or learned by another and successfully incorporated into the latter's production structure.
  - Today fragmentation in production and also knowledge sourcing
- It includes four key modes of technology transfer: (i) physical objects or equipment; (ii) skills and human aspects of technology management and learning; (iii) designs and blueprints which constitute the document-embodied knowledge on information and technology; (iv) and production arrangement linkages within which technology is operated.
  - Or TT may simply involve purchasing an input or service and placing it into production without acquiring know-how.
- Full TT generally requires absorbing knowledge about how a process works.
  - No formal transaction may be necessary in cases where a technology is easily imitated or copied, such as software and pharmaceuticals. Complex machinery, processes and financial services may not be so easy to copy without the co-operation of the right owner.

How does technology flow across borders?

- Trade in goods and services
- Foreign direct investment (FDI) through multinational enterprises (MNEs)
- Technology licensing, either within firms (where MNE retains proprietary control of the intellectual property and know-how) or between unrelated firms at arm's-length.
  - Mixed form of licensing and FDI - joint ventures
- Cross-border movement of technical and managerial personnel
- Non-market channels such as imitation
  - through product inspection, reverse engineering, decompilation of software, and even simple trial and error
  - studying patent applications
  - temporary migration of students and scientists to universities, laboratories, and conferences
  - ➢ IPRs may reduce learning through non-market channels

Do IPRs help or hinder technology transfer?

- Theory tells us of dual role of IPRs – resolves market distortions of one kind (underinvestment) but introduces another (raise imitation costs)
  - IPRs could solve some potential problems in tech transfer – weak appropriability because of spillovers, asymmetric information, and high transactions costs in contracting and monitoring
    - Other critical determinants of TT include market size, demand growth, supplies of skilled labour, infrastructure, openness to trade and FDI, and fundamental governance
- Evidence from empirical studies
  - –Foreign patents account for over 90% of productivity growth in most OECD countries (Eaton&Kortum); Low human capital level and greater distance from knowledge sources, lead to lower spillovers (Peri, 2005); greater integration into GVCs, greater knowledge diffusion (Piermartini, 2014).
- Patent reforms:
  - Have significant impact on volume and pattern of high tech exports (Maskus, Yang, 2012); Attract local production in IPR-sensitive sectors (Javorick, 2004); Increase unaffiliated licensing by foreign firms (Maskus et al, 2005); Increase volume of affiliated technology flows, R&D investments (Branstetter et al, 2006) – more in long life cycle industries (Bilir, 2010);
- What is clearer from recent studies is that patent reforms lead to more trade (imports), more FDI and more technology transfer
  - Caveat– not clear if applicable to small countries; or those with low education levels.
- Stronger IPRs may block learning through non-market channels, mainly imitation – some anecdotal evidence – Indian pharma sector
- Difference between sectors – debate about green technologies

Technology transfer and climate change

- UNFCCC could have specific legal obligations to reduce green house gases on the model of other MEAs such as the MP
  - Technology is the essential cause of anthropogenic climate change and is necessary part of the solution
  - Need enabling environment to generate break-through, disruptive, new platform technologies as well as cumulative and adaptive innovation
- A growing sense of urgency – need to increase transparency, reduce transaction costs and reduce diffusion time
  - Many economists advocate a carbon tax and other market formation policies that would induce faster development of new and diffusion of existing technologies
  - Some argue that at least patents or other IPRs taken out on green innovation financed by governments should be diffused widely on reasonable terms
  - But diffusion needs deployment, not localization (Gallagher, 2014)
    - Large market a necessary condition for localization
- Ethical/human rights context for adaptation technologies
  - Adaptation technologies linked to right to food, health, shelter

Lessons from the diffusion of clean energy technologies

- For 4 CETs (gas turbine, advanced automotive batteries, solar PV, coal gasification), volume of world trade grew at 259% between 2000-2010
  - Chinese exports of solar PV were 45% of global exports in 2011- from 3% in 1997; price fell by 75% from 2008-2011
  - In 3 out of 4 sectors, Chinese patents have overtaken foreign patents
- Market formation through government policy crucial for rapid diffusion
  - Localization not necessary for deployment/diffusion
- Fear of IPR infringement not serious impediment to diffusion
- Equally, IPRs not a barrier to access for most CETs
  - possible exception: gas turbines, advanced batteries but IP role difficult to isolate as there are many other challenges - weak policy support, high costs and technological complexity
  - Anticompetitive/monopolistic behaviour hinders diffusion

Montreal Protocol: case studies on IPRs being a barrier to access to ESTs

1. Korean Trade Promotion Agency, “Case Study 4: The Republic of Korea and the Montreal Protocol” in Veena Jha & Ulrich Hoffmann, eds., *Achieving Objectives of Multilateral Environmental Agreements: a package of trade measures and positive measures* (United Nations Conference on Trade and Development UNCTAD/ITCD/ TED/6), http://www.unctad.org/en/docs/itcdted6_en.pdf
2. Jayashree Watal, “Case Study 3: India: The Issue of Technology Transfer in the Context of the Montreal Protocol” in Veena Jha & Ulrich Hoffman, eds., *Achieving Objectives of Multilateral Environmental Agreements: A Package of Trade Measures and Positive Measures* (United Nations Conference on Trade and Development UNCTAD/ITCD/TED/6) 45–55, http://www.unctad.org/en/docs/itcdted6_en.pdf

Some caution on any absolute conclusions

- First, positive technology diffusion impacts are generally found only in larger and middle-income countries, and possibly in more mature technologies. There is little evidence of these effects in the poorest and smallest developing economies, where, if anything, patents are not of much relevance for TT or domestic industrial development, nor in areas where latest technologies are controlled by few.
- Second, the fact that international activities expand does not always imply a stimulus to domestic production. Local firms may come under considerable pressure to shrink, change product lines or close down if they cannot adapt to the new competitive environment.
- A final qualification is that this evidence captures only one part of a two-sided process. Installing legal procedures to support technology diffusion through market-mediated channels is surely going to raise such activity, at least in countries that are prepared to absorb it. However, it may also diminish prospects for learning from abroad through non-market channels, with an unclear overall impact on TT.

Concluding remarks

- Role of IPRs in technology development and diffusion contentious area in WTO and UNFCCC
- IPRs not sufficient condition to induce either but has largely positive effect on technology transfer, although need to consider how to accelerate rate of diffusion and overall welfare effects