I. Patent Protection and Technology Transfer in Developing Economies

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Outline

A. Technology Transfer
   ▫ Channels
   ▫ Importance
   ▫ Issues

B. Global Patent Protection
   ▫ Measurement
   ▫ Trends

C. Lessons from Economics Research
   ▫ Theory
   ▫ Evidence
A. Technology Transfer

• Channels
  ▫ Trade, Foreign Direct Investment (FDI), Licensing

• Importance
  ▫ Source of Capital, Employment, Technology, Goods & Services
  ▫ Effect on Local Economic Development and Productivity
  ▫ Article 66.2, TRIPS
Issues:

- How IPRs affect inward technology transfer

- “Quality” of technologies transferred
  - Vintage
  - Nature of activity
  - Effects on local development
B. Global Patent Protection

- Patent Rights Index (0 - 5)
  - Duration (0 - 1)
  - Coverage (0 - 1)
  - Restrictions, if any (0 - 1)
  - Enforcement Mechanisms (0 - 1)
  - Membership in International Treaties (0 - 1)

## Sample Estimates

<table>
<thead>
<tr>
<th></th>
<th>1985</th>
<th>1995</th>
<th>2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>4.68</td>
<td>4.88</td>
<td>4.88</td>
</tr>
<tr>
<td>Canada</td>
<td>3.16</td>
<td>4.34</td>
<td>4.67</td>
</tr>
<tr>
<td>China</td>
<td>1.33</td>
<td>2.12</td>
<td>4.08</td>
</tr>
<tr>
<td>Egypt</td>
<td>1.41</td>
<td>1.73</td>
<td>2.77</td>
</tr>
<tr>
<td>India</td>
<td>1.03</td>
<td>1.23</td>
<td>3.76</td>
</tr>
<tr>
<td>S. Korea</td>
<td>2.45</td>
<td>3.89</td>
<td>4.33</td>
</tr>
</tbody>
</table>
Evolution of the Patent Rights Index, 1960-2005

- The vertical bar indicates the advent of the TRIPS Agreement.
Alternative Measures of IPR

- World Economic Forum (WEF) *Global Competitiveness Report*
- Economist Intelligence Unit (EIU)
- Business Software Alliance (BSA), Piracy Rates
Example

World Economic Forum (WEF):

“Intellectual Property Protection in your country
Is Weak and Not Enforced   < 1  2  3  4  5  6  7 >   Is Strong and Enforced

Circling 1 means you *completely* agree with the answer on the left-hand side
Circling 2 means you *largely* agree with the answer on the left-hand side
Circling 3 means you *somewhat* agree with the answer on the left-hand side
Circling 4 means your opinion is *indifferent* between the two answers
Circling 5 means you *somewhat* agree with the answer on the right-hand side
Circling 6 means you *largely* agree with the answer on the right-hand side
Circling 7 means you *completely* agree with the answer on the right-hand side”
## Surveys

<table>
<thead>
<tr>
<th>WEF (out of 7 points)</th>
<th>Measure</th>
<th>EIU (out of 5 points)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Country</strong></td>
<td>2000</td>
<td>2010</td>
</tr>
<tr>
<td>USA</td>
<td>6.5</td>
<td>5.1</td>
</tr>
<tr>
<td>Canada</td>
<td>6</td>
<td>5.5</td>
</tr>
<tr>
<td>China</td>
<td>3.6</td>
<td>4.0</td>
</tr>
<tr>
<td>Egypt</td>
<td>4.0</td>
<td>3.6</td>
</tr>
<tr>
<td>India</td>
<td>3.0</td>
<td>3.6</td>
</tr>
<tr>
<td>S. Korea</td>
<td>3.9</td>
<td>4.1</td>
</tr>
</tbody>
</table>
# Survey Approach

**Advantages**

- Based on experience
- Provides information that is otherwise unobserved (e.g. actual practice)

**Limitations**

- Limited Time-Series
- Comparability Issues
- Lump all IPR together
- Subjective
Piracy Rates

- Egypt
- China
- India
- S Korea
- USA
- Canada

Correlations with other Measures

<table>
<thead>
<tr>
<th>Other Measures:</th>
<th>1995</th>
<th>2000</th>
<th>2005</th>
<th>Coefficient of Variation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economist Intelligence Unit</td>
<td>0.71</td>
<td>0.73</td>
<td>0.72</td>
<td>0.39</td>
</tr>
<tr>
<td>World Economic Forum</td>
<td>n/a</td>
<td>0.74</td>
<td>0.67</td>
<td>0.33</td>
</tr>
<tr>
<td>Software Piracy</td>
<td>-0.74</td>
<td>-0.67</td>
<td>-0.75</td>
<td>0.34</td>
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</tbody>
</table>

**Correlation with Patent Rights Index**

(Coefficient of Variation = 0.47)

Coefficient of Variation = Standard Deviation/Mean
Recap

• Levels of Patent Protection higher in ‘North’ than in ‘South’

• Gap in levels have narrowed

• Next: Impact on Technology Transfer
C. Research Findings

• Theoretical Debates
  ▫ How patents influence technology transfer:
    • Reduce Imitation (non-market access)
    • Market channels: Trade, FDI, Licensing
      ▪ Market Expansion vs. Market Power
        ◦ Role of Imitative Capacity
      ▪ Ownership, Location, and Internalization (OLI)
      ▪ Volume & Composition of Technology Transfers
        ◦ Role of Imitative Risks vs. Setup Costs
Evidence

- Trends in Trade (Merchandise Imports)

<table>
<thead>
<tr>
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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Developed</td>
<td>4442</td>
<td>69.2</td>
<td>8012</td>
<td>57.7</td>
<td>80.3%</td>
</tr>
<tr>
<td>Developing</td>
<td>1837</td>
<td>28.6</td>
<td>5426</td>
<td>39.1</td>
<td>195.4%</td>
</tr>
<tr>
<td>- Africa</td>
<td>152</td>
<td>2.4</td>
<td>441</td>
<td>3.2</td>
<td>189.5%</td>
</tr>
<tr>
<td>- America</td>
<td>305</td>
<td>4.7</td>
<td>806</td>
<td>5.8</td>
<td>164.4%</td>
</tr>
<tr>
<td>- Asia</td>
<td>1373</td>
<td>21.4</td>
<td>4167</td>
<td>30</td>
<td>203.5%</td>
</tr>
</tbody>
</table>

Data are in constant 2005 billions of U.S. dollars
Source: UNCTAD Stats
Evidence

- Trends in FDI (Inward Stock)

<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Developed</td>
<td>3107</td>
<td>11296</td>
<td>263.5%</td>
</tr>
<tr>
<td>Developing</td>
<td>1039</td>
<td>5377</td>
<td>417.2%</td>
</tr>
<tr>
<td>- Africa</td>
<td>109</td>
<td>501</td>
<td>357.0%</td>
</tr>
<tr>
<td>- America</td>
<td>229</td>
<td>1556</td>
<td>577.8%</td>
</tr>
<tr>
<td>- Asia</td>
<td>697</td>
<td>3310</td>
<td>375.1%</td>
</tr>
<tr>
<td>Least Developed</td>
<td>15</td>
<td>137</td>
<td>492.3%</td>
</tr>
</tbody>
</table>

Data are in constant 2005 billions of U.S. dollars. Source: UNCTAD Stats
Evidence

- U.S. FDI Abroad

Data are in constant 2005 billions of U.S. dollars. Source: U.S. Bureau of Econ Analysis
## Evidence

- **Trends in Licensing (Royalty & Fee Payments)**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>18</td>
<td>23</td>
<td>24.0%</td>
</tr>
<tr>
<td>Canada</td>
<td>4.3</td>
<td>7.0</td>
<td>65.6%</td>
</tr>
<tr>
<td>China</td>
<td>1.4</td>
<td>10.1</td>
<td>598.6%</td>
</tr>
<tr>
<td>India</td>
<td>0.3</td>
<td>1.7</td>
<td>432.6%</td>
</tr>
<tr>
<td>S. Korea</td>
<td>3.6</td>
<td>6.6</td>
<td>80.5%</td>
</tr>
</tbody>
</table>

Data are in constant 2005 billions of U.S. dollars. Source: UNCTAD Stats
Evidence

• U.S. Outward Licensing

Data are in constant 2005 billions of U.S. dollars. Source: U.S. Bureau of Econ Analysis
Statistical Analyses

• Find a “model” to **fit** the data

• Model:
  ▫ Tech Transfer = $\alpha + \beta$ IPR + $\gamma$ Control Variables + $\varepsilon$

• Findings
  ▫ Mixed, but mostly positive $\beta$ estimates

• Gaps in previous studies
  ▫ Usually focus is on one tech transfer mode at a time
  ▫ Need more data from non-U.S. source countries
  ▫ Limited studies on the ‘quality’ or technological content of tech transfers
Impact of Patents on Technology Transfer (holding other factors constant):  
**Range of Findings**

<table>
<thead>
<tr>
<th>Country Group</th>
<th>Single Mode</th>
<th>Joint Modes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Exports</td>
<td>FDI</td>
</tr>
<tr>
<td>Pooled</td>
<td>+, o</td>
<td>+, o</td>
</tr>
<tr>
<td>Developed Countries</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Developing Countries</td>
<td>+</td>
<td>+, o</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Symbol Key:  + positive effect, - negative effect, 0 insignificant, ? indeterminate, n/a not avail.

General Findings
(regarding sensitivity of tech. transfer to patent rights)

• Effects vary by industry, type of intangible asset, and level of economic development of host country

• Sequential Pattern
  ▫ Trade, FDI, Licensing (esp. unaffiliated)

• Role of Complementary Factors
  ▫ Market size, wages, investment climate, market concentration, governance, human capital, ...
Technological Content of Technology Transfers

- How do we assess whether FDI/Licensing involved transfers of substantive “technologies” in developing countries?
  - **Approach 1:** Examine High-tech Sector
  - **Approach 2:** Non-resident patenting
  - **Approach 3:** Local R&D, Joint Research Ventures

*Source: Park and Lippoldt (2012) forthcoming in Hall et al. (eds.)*
Recap (impacts of IPR on technology transfer)

- Market expansion vs. market power effects
- Substitution and scale
- Sequential entry
- Complementary factors, interaction effects
- Level of imitation risk, absorptive capacity
- Alternative means of appropriation
- Varying effects across sectors, technologies, and nature of economic activity
- Higher quality of technologies transferred