A discussion on Linton and Torsekar’s paper:

Innovation in Biotechnology Seeds: Public and Private Initiatives in India and China

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A quick review on Linton and Torsekar’s paper

• Market access:
  – China limits the market access of foreign firms
  – India liberalized seed industry, but implementing price restrictions policy

• IP protection:
  – Both countries adopt the IP and PVR protection policies
  – Public and foreign firms is active use the system. By contrast, domestic firms are not active users of the system

• Regulation:
  – Both countries established a biosafety regulation system to approve biotech seeds
  – Both countries have the enforcement problems for IP and biosafety laws
Above conclusion is based on the analysis of public and private initiatives in this paper.

- It pays more attention on the public and FDI. It pay few attention on the domestic investment.

- However, if the analysis is based on the domestic public-private partnership, the results may be more interesting.

- Particularly in China, domestic analysis is more important.
The development objective

• Both countries made the biotechnology as the top priority to overcome the challenges to meet the demands for agricultural products

• To meet the objective, both countries invest huge in agricultural R&D and biotechnology development
Public ag R&D investment in china, 1991-2006
(billion yuan, 2005 price)

First round reform
Second round reform

Annually
growth 15.6%

Source: Hu et al., 2007
However, the two countries are much different in the biotechnology development.

**Agricultural R&D institution:**
- China: public dominated, private sector germinated and fast developing
- India: public dominated, private sector developed

Source: Pardey et al. 2006
Under the institution, Although Monsanto and other MNCs entered both two countries, it works well in India, but in China, it works a little difficult.

- In India, the developed private sector developed well-operation R&D system. The system have the capability and incentive to cooperate with MNCs.

- In China, new germinated agricultural firms most are no R&D system. They lack the capability to cooperate with MNCs and the experiences to protect IP, although the situation is changing now.

- It can be used to explain that why MNCs more in India than in China
Biotech development stratagem

- Based on the public dominated R&D system, China adopts two biotech development stratagems:
  - Strengthen the public R&D investment

2003: 1.65 billion yuan = US$ 200 million or US$ 950 million in PPP. Next USA, it is the second largest public investors in biotech in the world.

Huang et al., Science, 29 April 2005: 688-690
Biotech development Stratagem

- Priority domestic technology developing stratagem: while China has own technology, the foreign technology could enter.

- This can be used to explain why China has not commercialized other major GM crops although the economic study indicated the commercialization can improve the economic welfare significantly.

• In India, because the private sector developed (although it is not enough strong), it encourage MNCs to enter
Biotech FDI restrictions

- Although China restricts FDI in seed industry, it only restricts in the major crops seeds.
- The government welcomes foreign company to invest in seeds research, non-major crops (such as vegetables, flowers, fruits etc.), and livestocks.
- Some MNCs have establish research institutes in China.
IP protection and Public-private partnerships

• Public and foreign firms is active use the IP protect system. Domestic firms are not active users of the system

• However, the private firms applied fewer patents and PVPs not because they are not active to use the system, but the problems of public-private relationship in China
Number of PVP applications in China, 1999-2007

Number of varieties

- University
- Public research institute
- Private

Number of PVP applications by private sector

- Own developed
- Purchase

Year: 1999 2000 2001 2002 2003

Application numbers:
- 2000: 21 (21 own, 10 purchased)
- 2001: 19 (19 own, 10 purchased)
- 2002: 40 (36 own, 17 purchased)
- 2003: 79 (36 own, 17 purchased)
The public project research investment in China, 1987-2006
### Estimates of Firms Fixed-effected Model on Private Agricultural R&D Investment: Heckman model

<table>
<thead>
<tr>
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<th>If there are investment (1/0)</th>
<th>Firm R&amp;D investment (log)</th>
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<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
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<tr>
<td>Time trend</td>
<td>0.870 (6.97)***</td>
<td>0.958 (7.81)***</td>
</tr>
<tr>
<td>Public R&amp;D investment (lag 5 year)</td>
<td>-0.419 (0.8)</td>
<td>-0.191 (-4.27)***</td>
</tr>
<tr>
<td>Public-R</td>
<td></td>
<td>6.311 (5.50)***</td>
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<tr>
<td>Public-D</td>
<td></td>
<td>-4.473 (5.70)***</td>
</tr>
<tr>
<td>Firm’s sales (1000 yuan)</td>
<td>-0.215 (0.93)</td>
<td>-0.367 (1.47)</td>
</tr>
<tr>
<td>Constant</td>
<td>-3.811 (0.48)</td>
<td>-28.679 (4.63)***</td>
</tr>
<tr>
<td>Observation</td>
<td>4179</td>
<td>4179</td>
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Source: Hu et al., 2008
Other comments

- Some information and numbers:
  - Patents and PVPs
  - Bt commercialization approve time
  - Some GMO rice varieties have completed pre-production trials in early 2000s
  - .......