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.

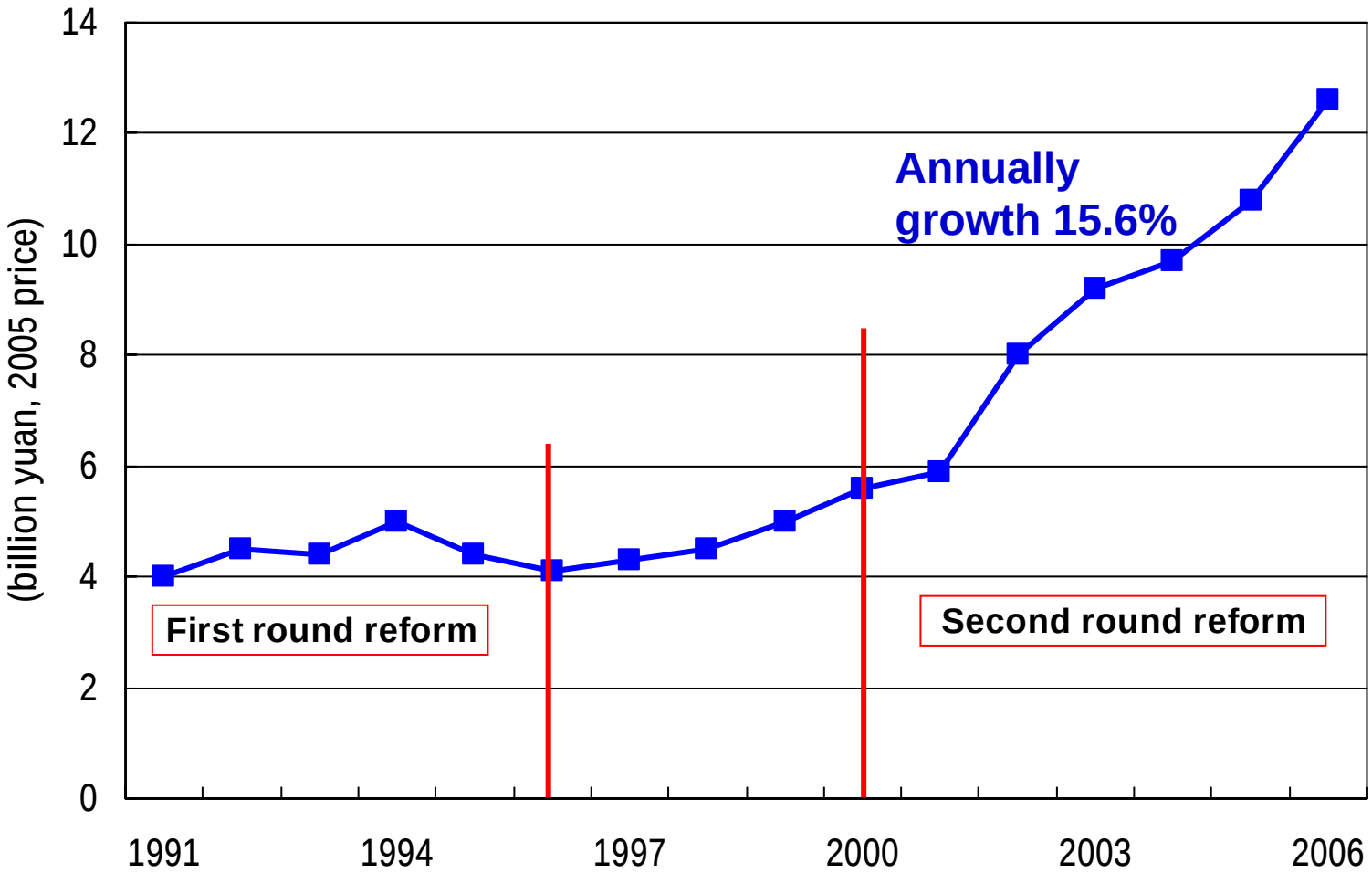
- However, if the analysis is based on the domestic public-private partnership, the results may be more interesting.

- 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

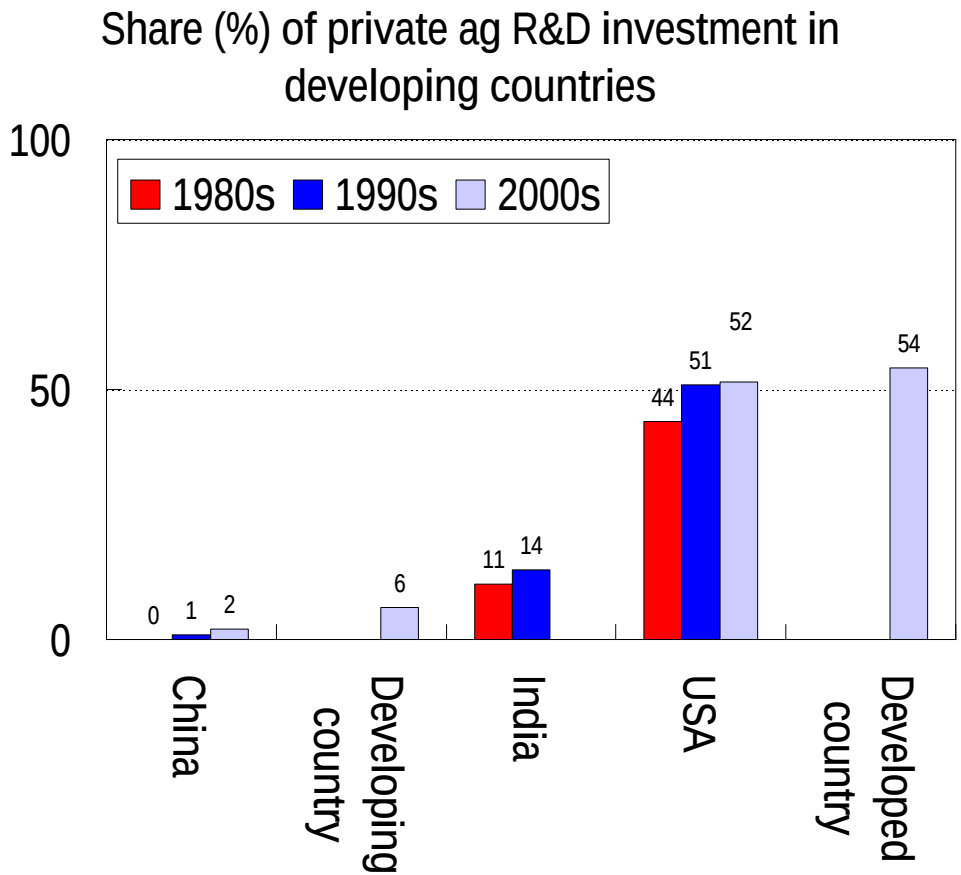
Public ag R&D investment in china, 1991-2006 (billion yuan, 2005 price)



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



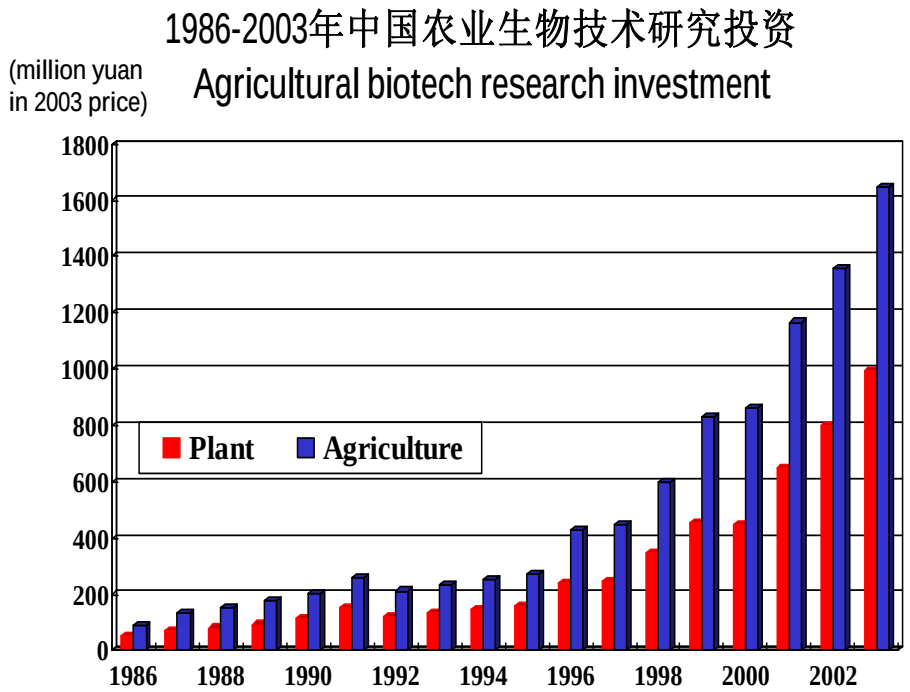
Source: Pardey et al. 2006

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.

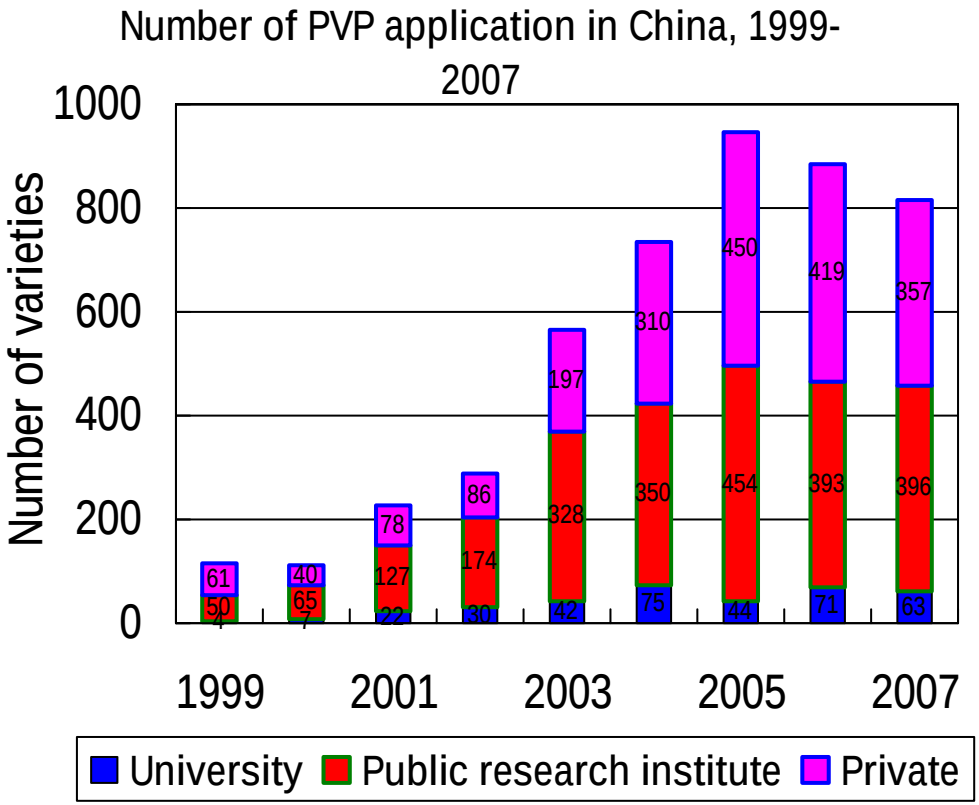
- In India, because the private sector developed (although it is not enough strong), it encourage MNCs to enter

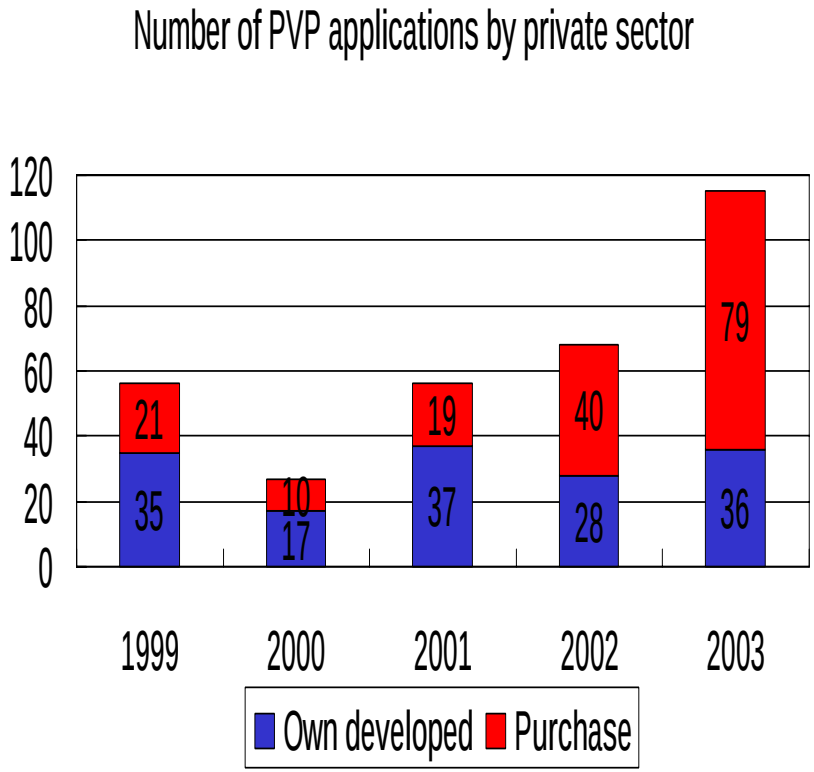
Biotech FDI restrictions

- 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

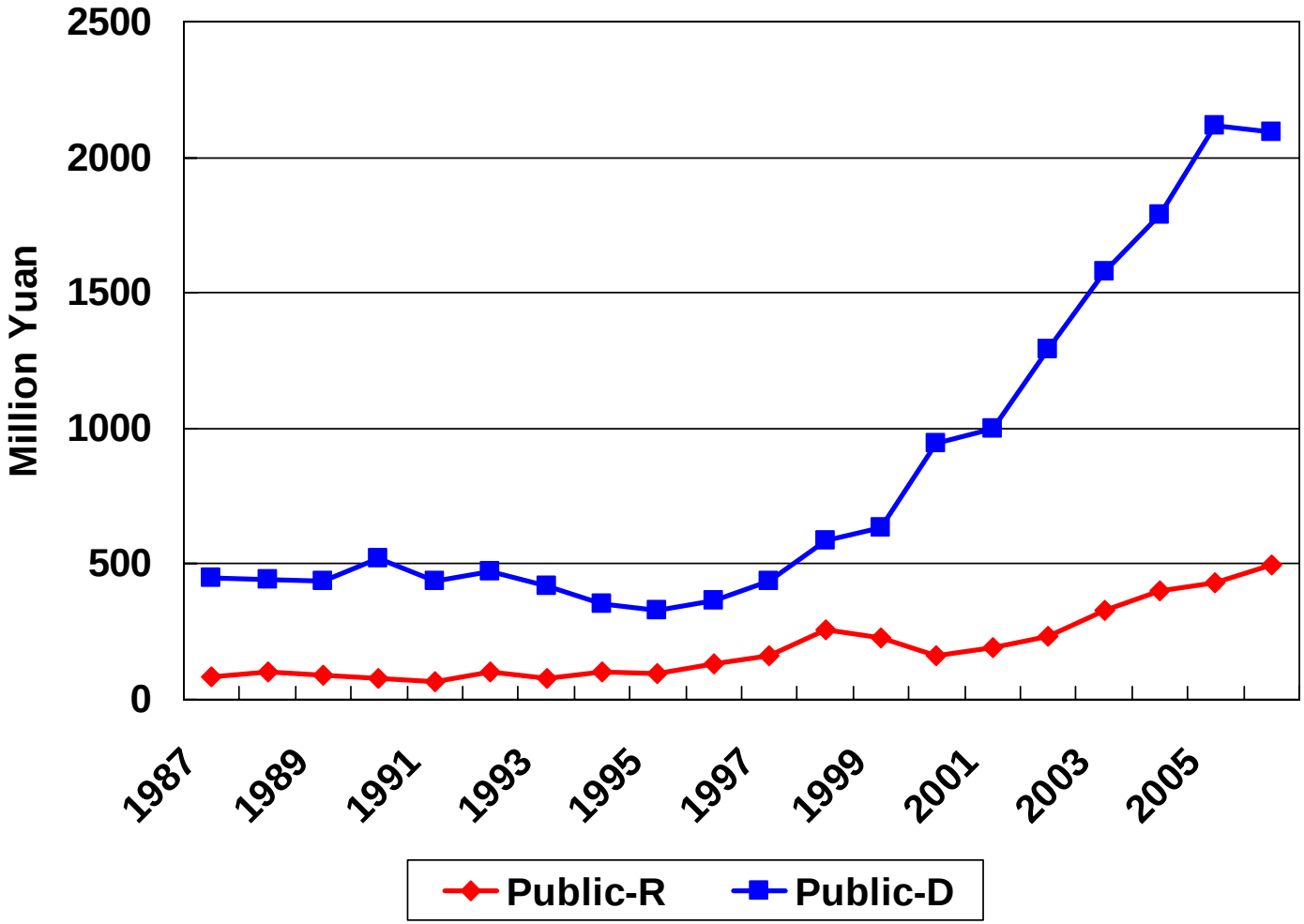
IP protection and Public-private partnerships

- 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 application in China, 1999-2007
Number of varieties
1000
800
600
400
200
0
1999
2001
2003
2005
2007
61
50
4
40
65
7
78
127
22
86
174
30
197
328
42
310
350
75
450
454
44
419
393
71
357
396
63
University
Public research institute
Private


Number of PVP applications by private sector
120
100
80
60
40
20
0
1999
2000
2001
2002
2003
21
35
10
17
19
37
40
28
79
36
Own developed
Purchase

The public project research investment in China, 1987-2006



Estimates of Firms Fixed-effected Model on Private Agricultural R&D Investment: Heckman model

	If there are investment (1/0)		Firm R&D investment (log)	
	(1)	(2)	(1)	(2)
Time trend	0.870 (6.97)***	0.958 (7.81)***	0.182 (15.74)***	0.202 (17.56)***
Public R&D investment (lag 5 year)	-0.419 (0.8)		-0.191 (-4.27)***	
Public-R		6.311 (5.50)***		0.893 (9.61)***
Public-D		-4.473 (5.70)***		-0.843 (11.07)***
Firm's sales (1000 yuan)	-0.215 (0.93)	-0.367 (1.47)	0.272 (11.52)***	0.253 (10.87)***
Constant	-3.811 (0.48)	-28.679 (4.63)***	2.989 (5.78)***	3.262 (5.46)***
Observation	4179	4179	4179	4179

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
  - ……