China' Agricultural Innovation System: Issues and Reform

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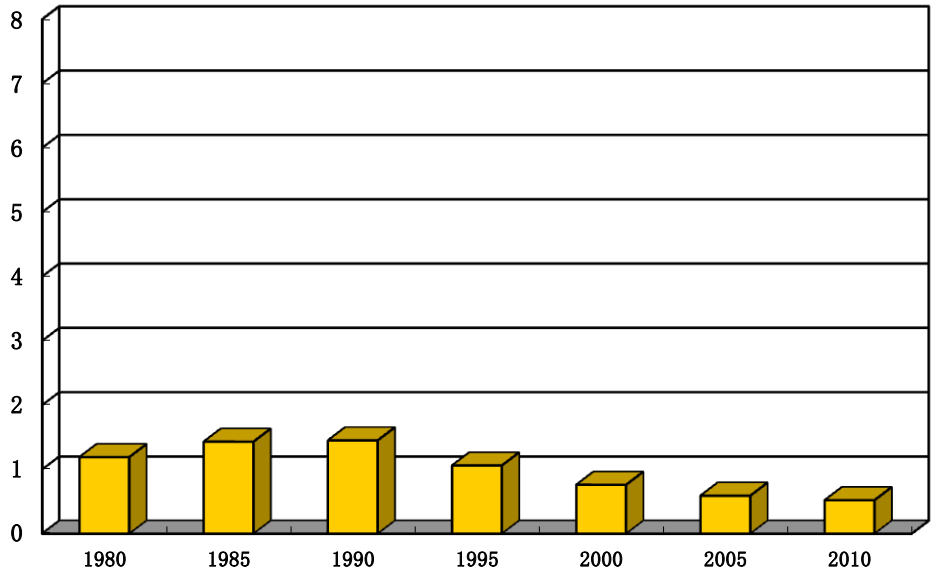
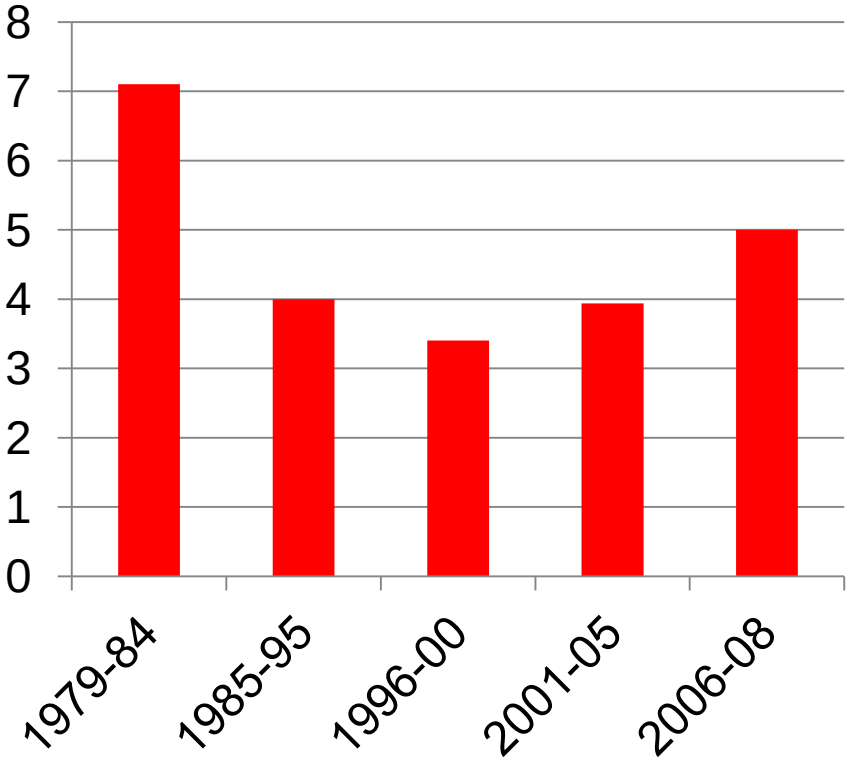
Average annual growth rate in agricultural GDP was about 4 times of population growth rates

Annual growth rate (%) of population in 1980-2010

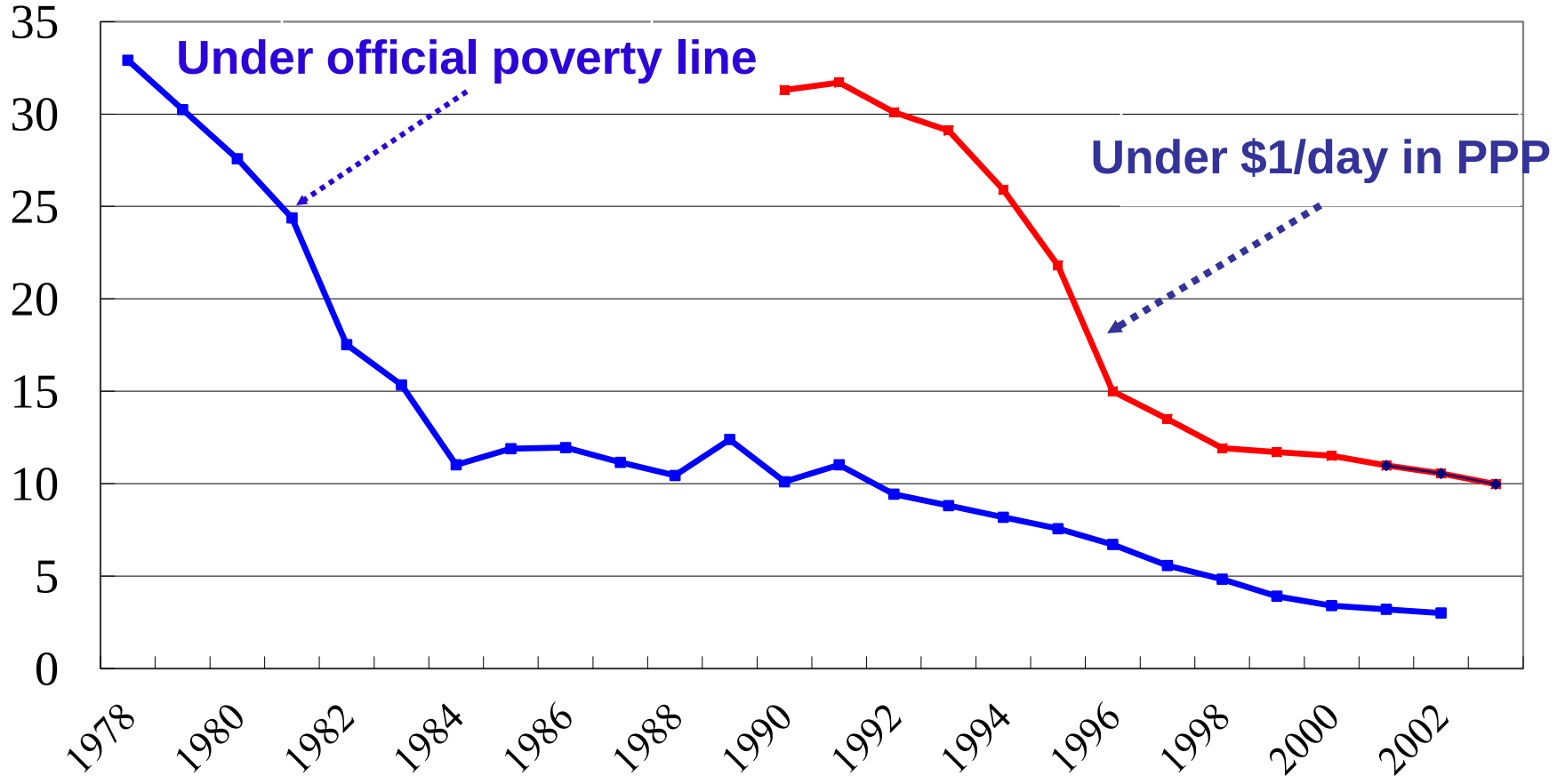


Average annual growth rate (%) of agricultural GDP



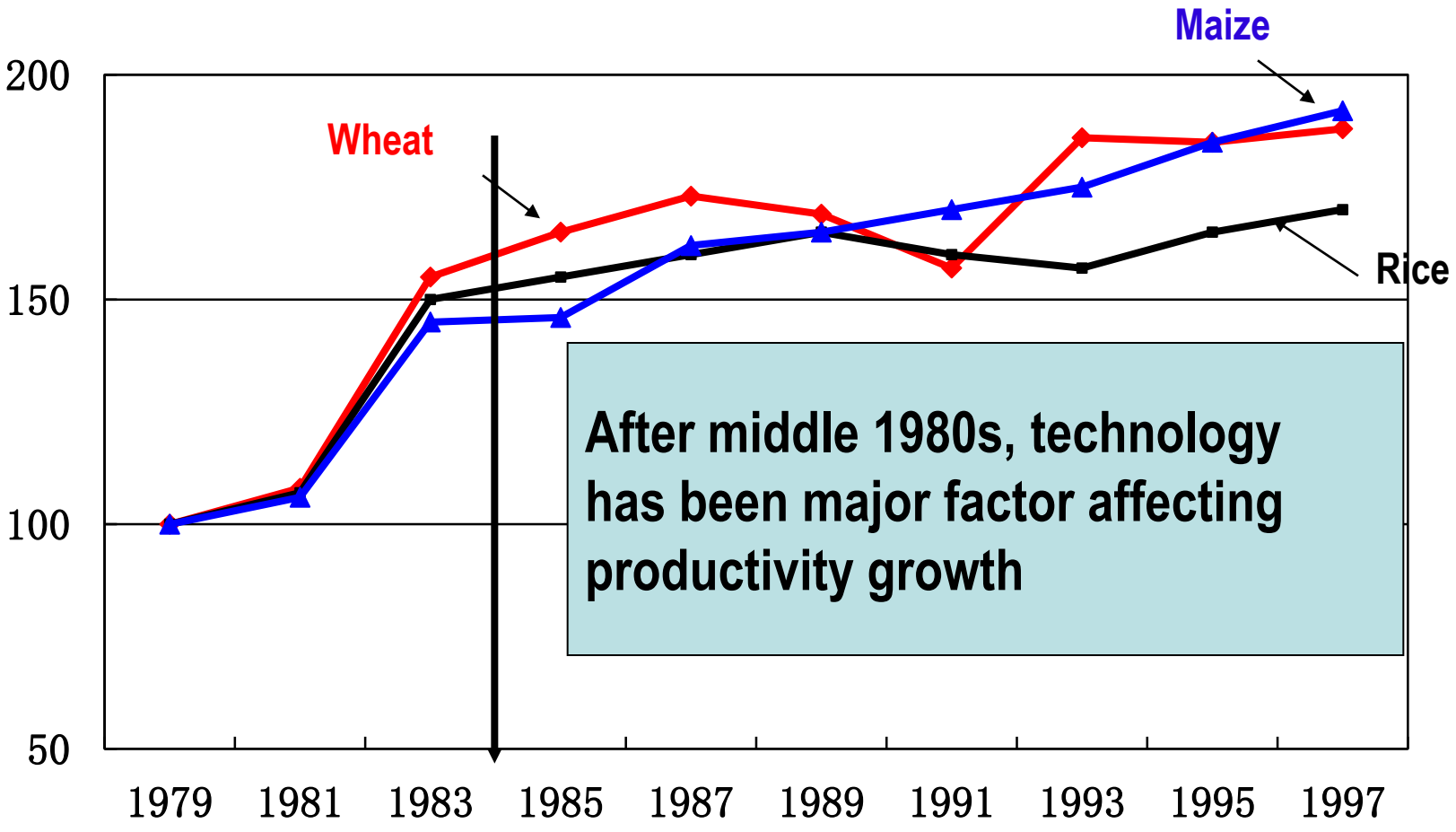
Rural poverty incidence in China, 1978-2007

(Percent of Population)



The fall in the poverty rates in China account for MOST of the entire world's fall in poverty between 1985 and 2005

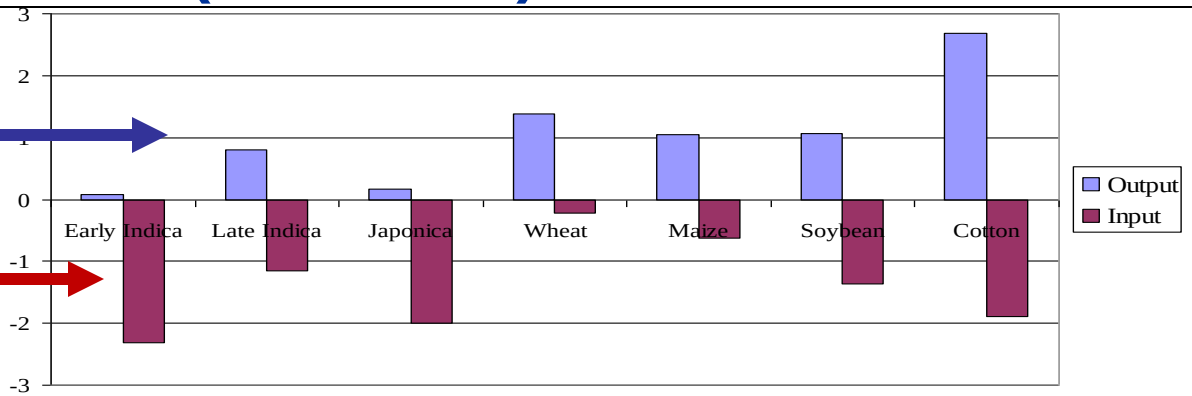
Total Factor Productivity for rice, wheat and maize in China, 1979-94



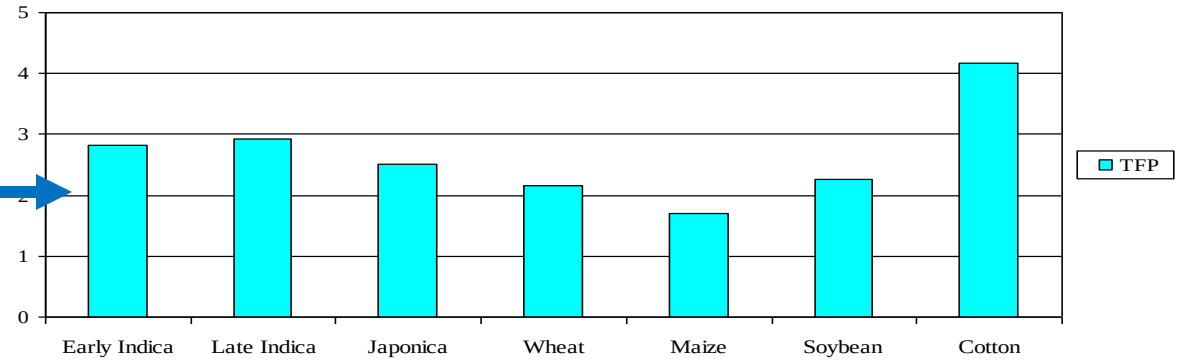
Output, Input, and TFP annual growth rate and Decomposition of TFP Main Grain Commodities and Cotton (1995-2004)

Output rises

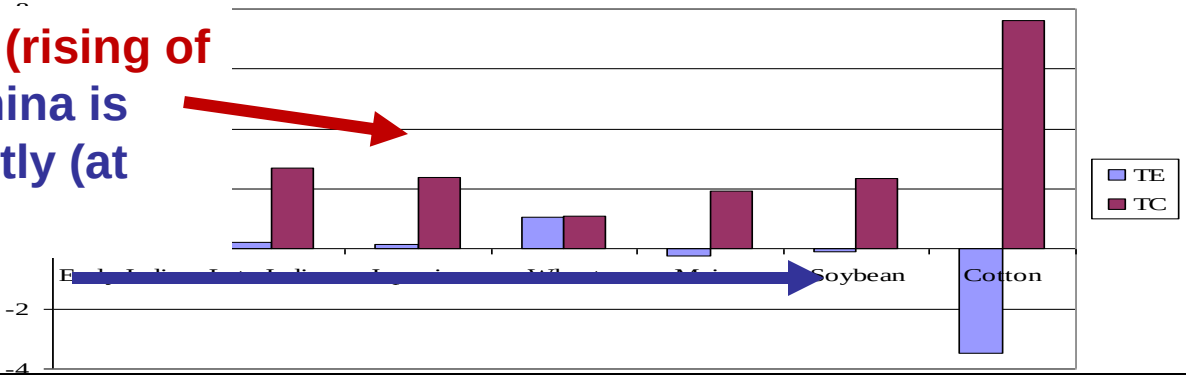
Input reductions



Total Factor Productivity Rises



Mostly Technical Change (rising of production frontier) … China is already operating efficiently (at frontier)



Source: Jin, Huang and Rozelle.

Technology has been a major engine of food and agricultural growth in China

- **Roles of agricultural research:**
  - **engine of growth**
  - **food security and poverty reduction**
  - **competitiveness and farmer income**
  - **environment preservation**
- **Changing agriculture requires changing technology**
  - **new modern technologies (e.g., biotech)**
  - **knowledge-intensive**
  - **NRM conservation**
  - **product quality**
  - **high value products**
  - **…**

Questions and policy issues

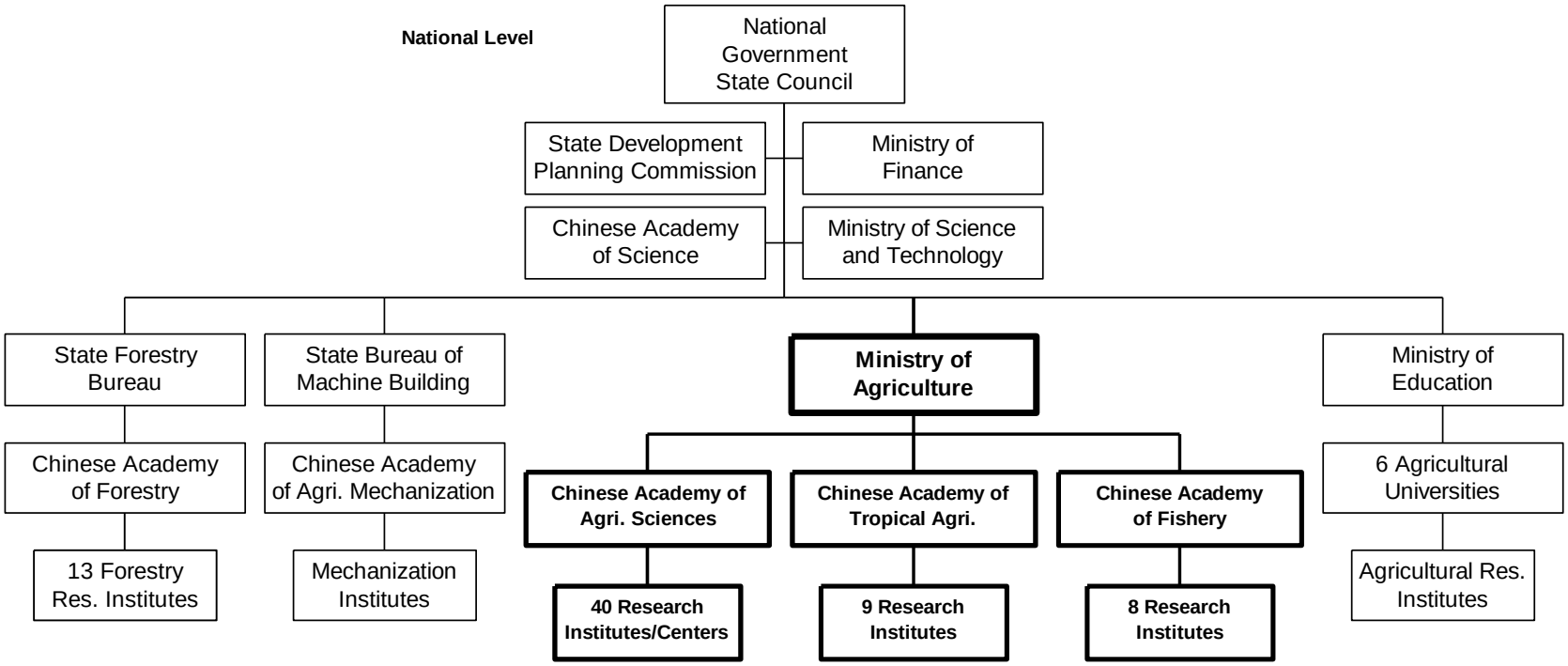
- **What is the main reason that the R&D has contributed significantly to China's agricultural growth?**
- **What we can learn from China's experiences / lessons?**
- **What are the challenges which China should consider in its current agricultural R&D reform?**
- **…..**

Rest of presentation

- China's R&D system
- Challenges and reforms
- Concluding remarks

China's agricultural R&D system:

Organization Chart for Agricultural Research (National level)



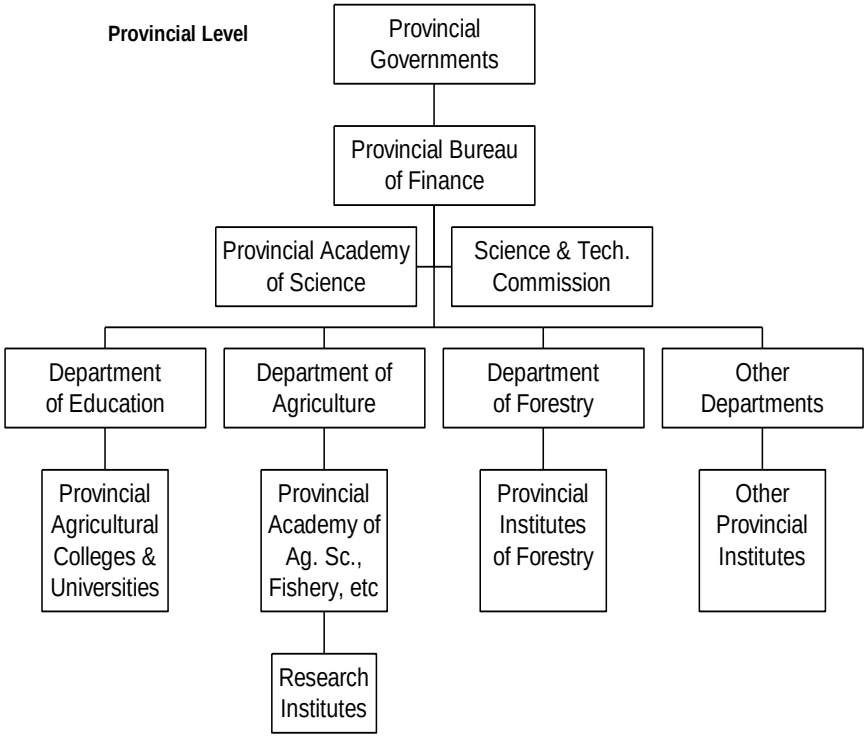
National level research centers account for:

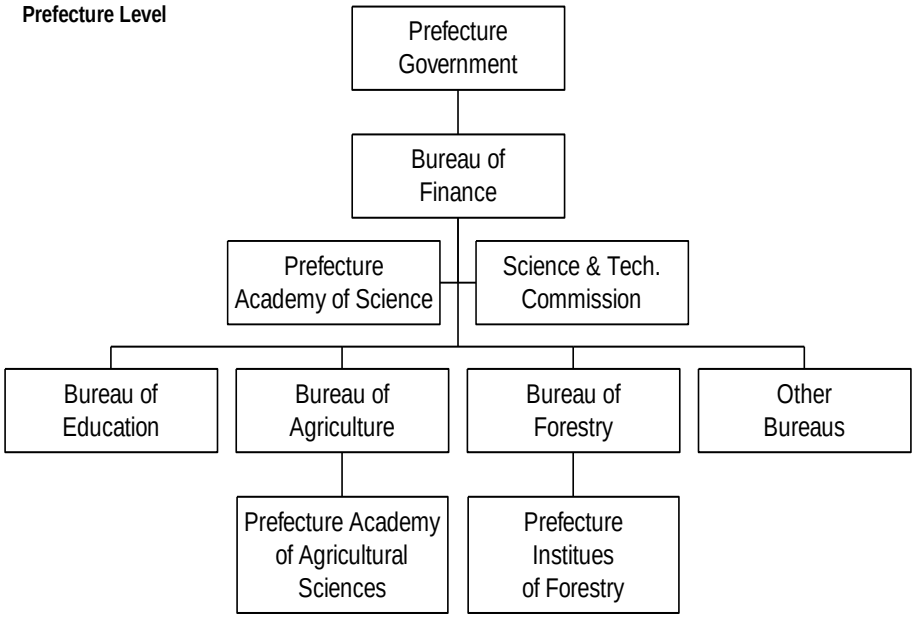
10% of total research staff

15% of total budget

China's agricultural R&D system:

Organization Chart for Agricultural Research (Provincial and Prefecture level)





Provincial research centers account f
41% of total research staff
51% of total budget

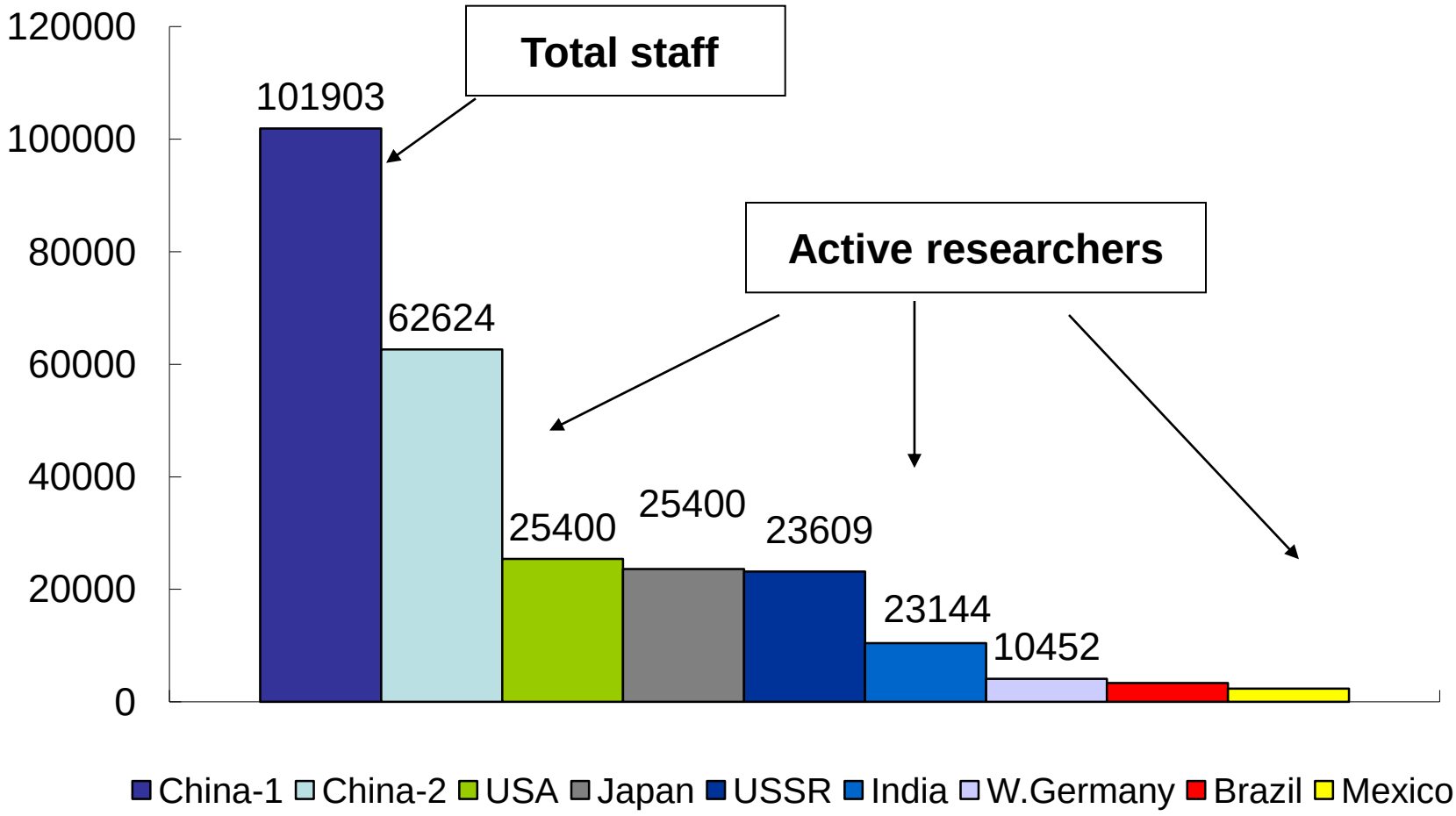
Prefecture research centers account for:
32% of research staff
34% of total budget

China's public agricultural R&D System: not only on basic research, but even more on the development research

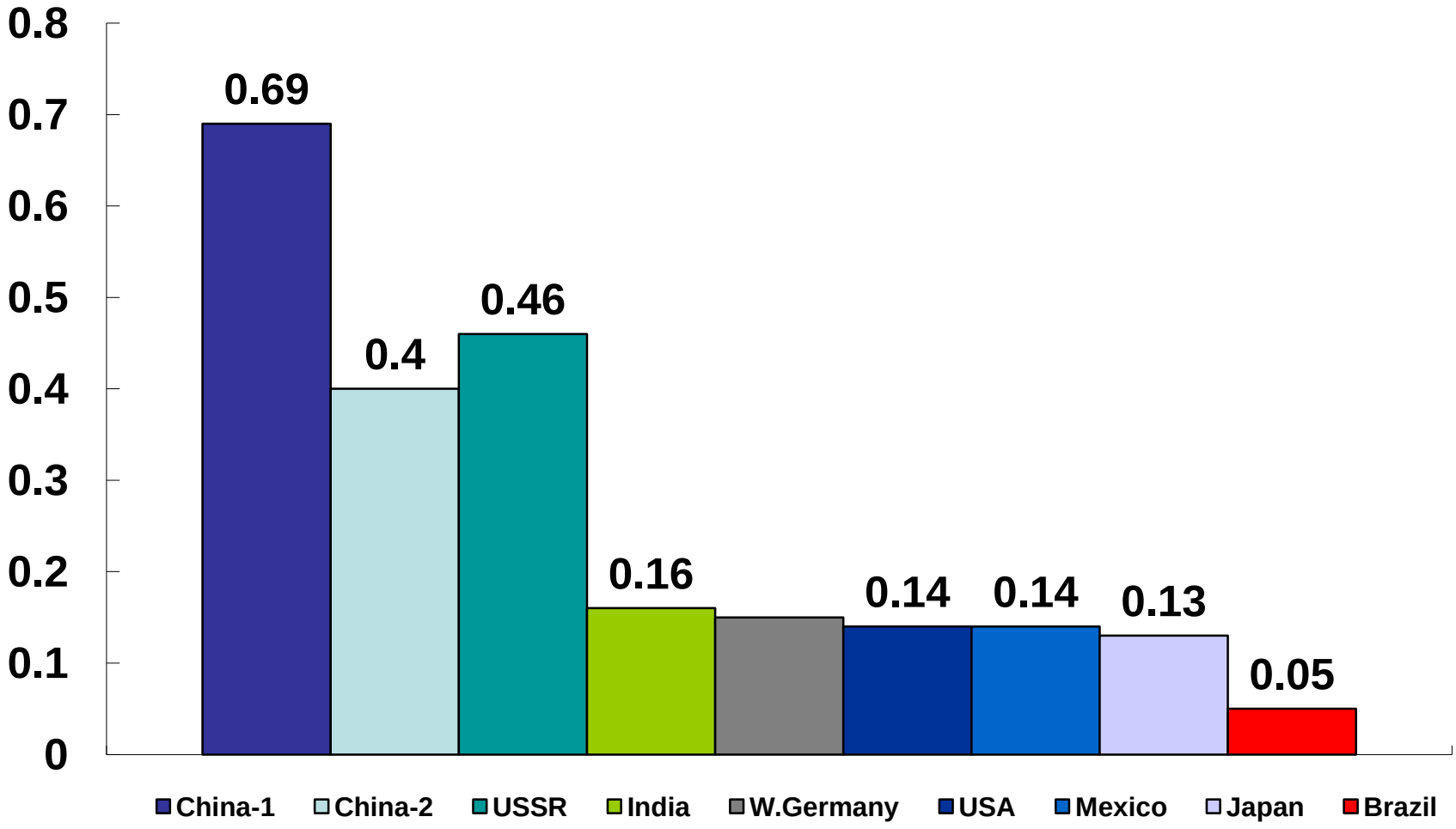
- **Research system**:
  - Central government established agricultural research institutes that covered most of agricultural products in the national wide
  - Local government established agricultural research institutes that covered nearly all agricultural products in the region
  - There are 1237 agricultural research institutes and 88 agricultural universities or technological academies that located in every province or prefecture
  - The research fields covered nearly all agricultural products (Nominal are 109 products) in China
  - 50 innovation product industries have been specially invested by MOA since 2008

China has the largest public agricultural R&D System in the world

Number of agricultural R&D staff in 2004



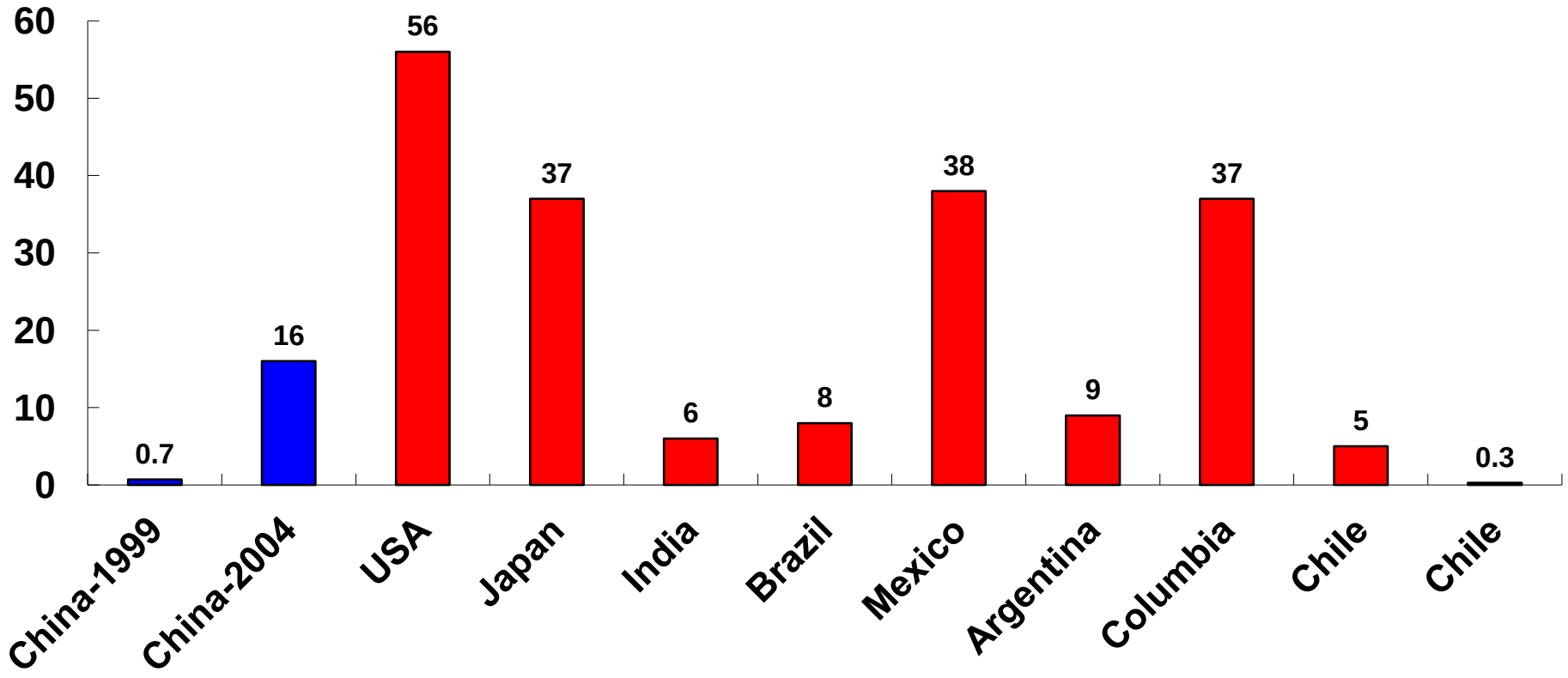
Number of Researchers / 1 million US$ of Agri GDP in 2004



China's research system: overstaffed

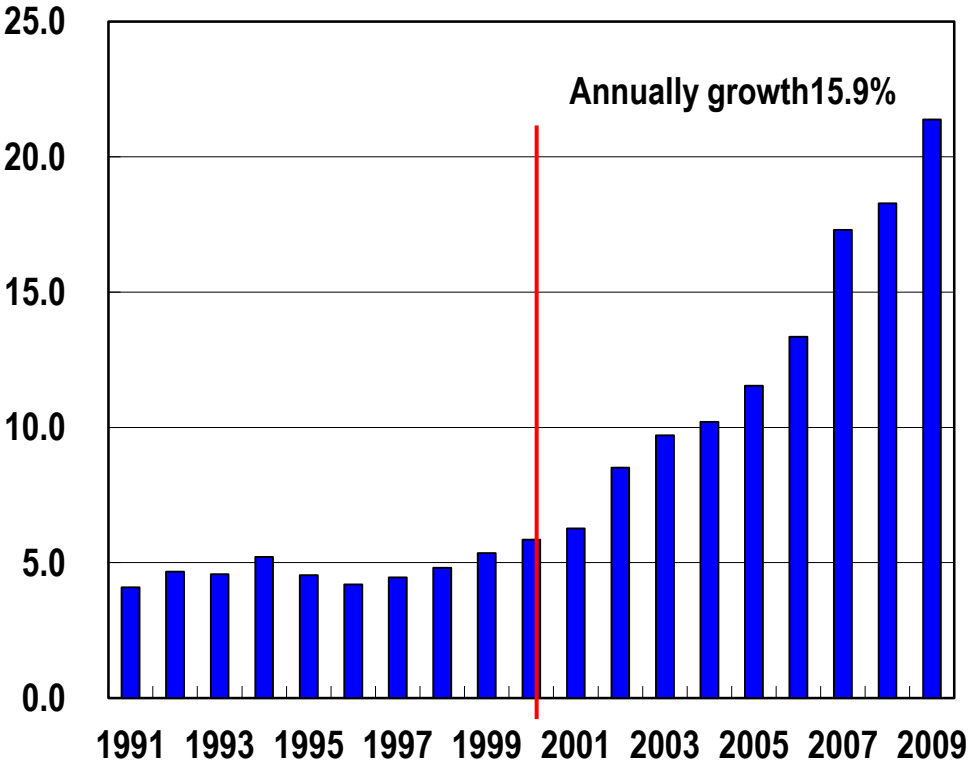
China's agricultural R&D System: public dominated, but changes fast

Private sector's share of agricultural research staff in early 1990s (%)

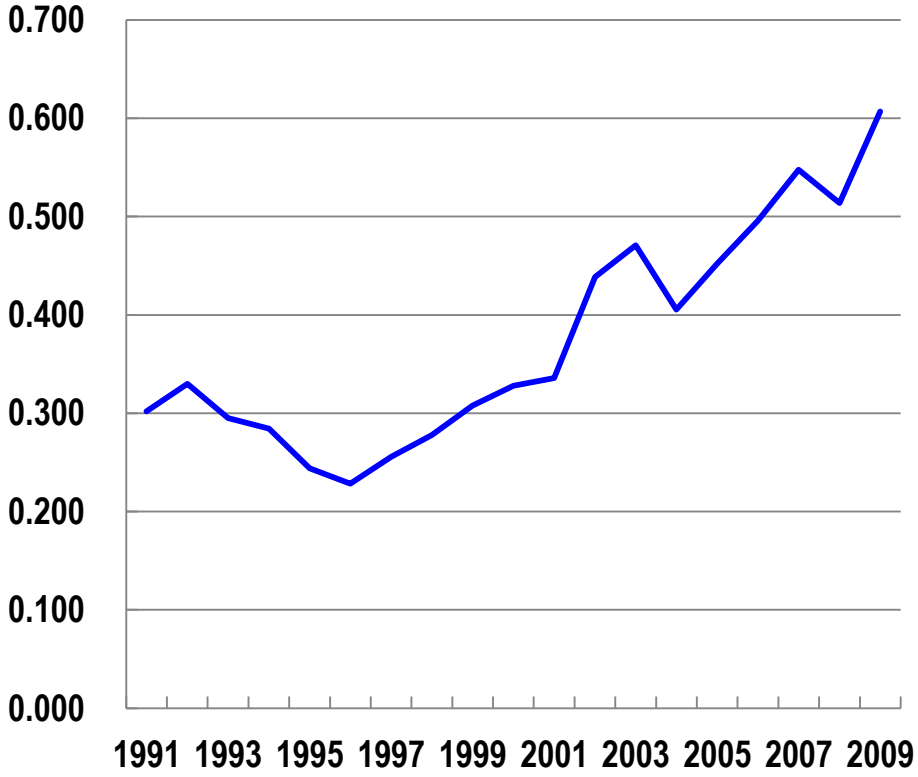


Source: Alston and Pardey (1995); Huang et al., 2003; Hu et al., 2008

Government fiscal investment in agricultural research (billion yuan in 2005 price)

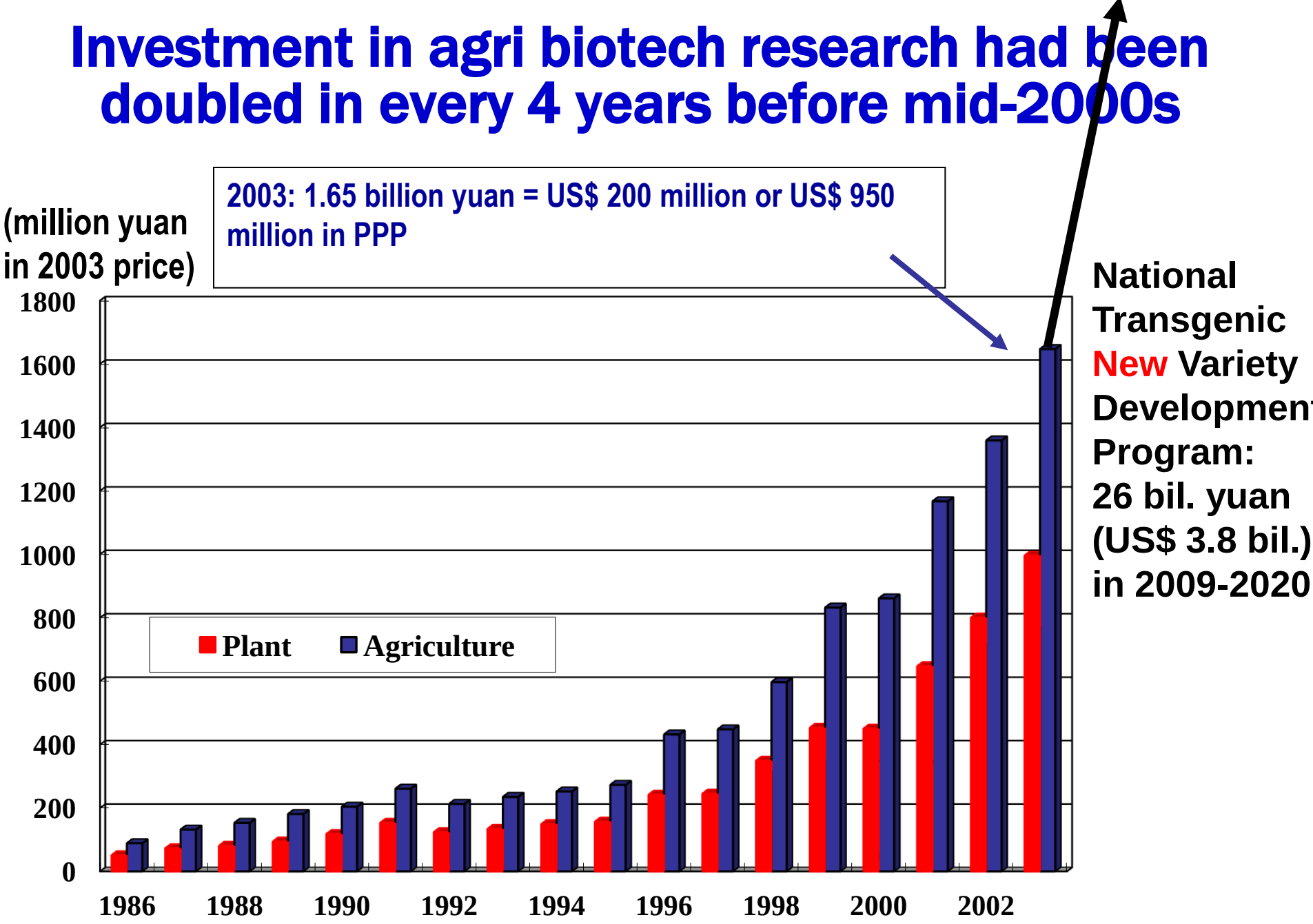


Agricultural research investment intensity (%) in China



Since 2000, the rise in research investment has been higher in China than any other country in the world …

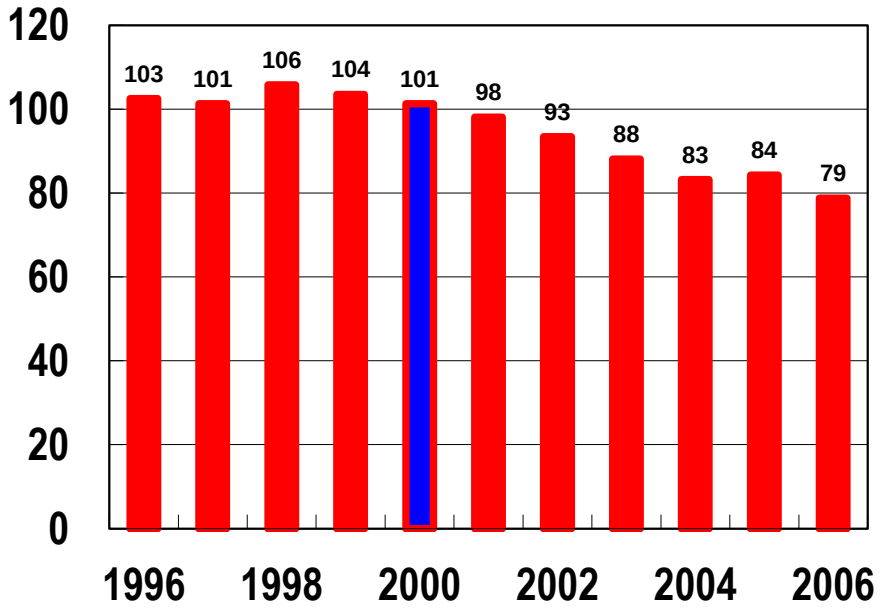
Investment in agri biotech research had been doubled in every 4 years before mid-2000s



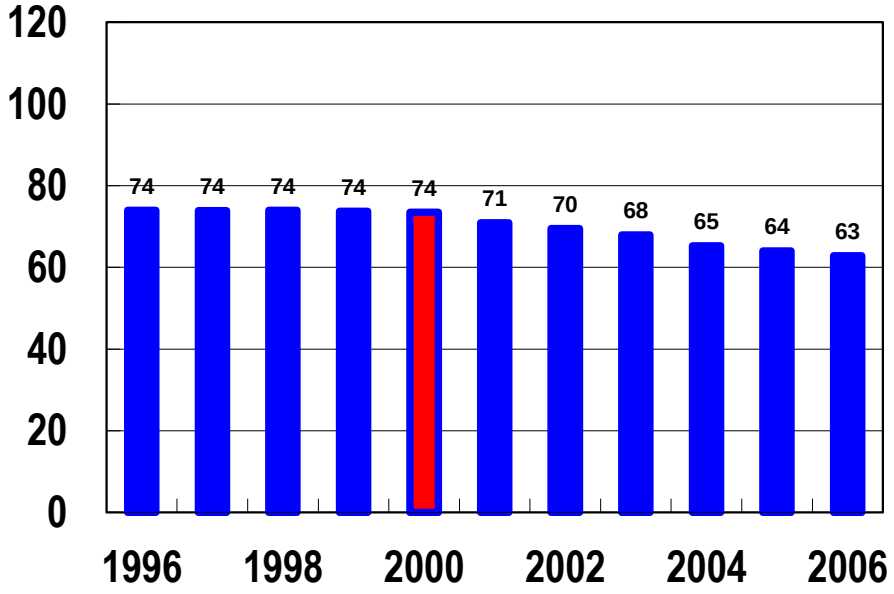
Huang et al., *Science,* 29 April 2005: 688-690

China also has the largest public agricultural extension system in the world

Staff under government agricultural extension system in China (100,000 persons)



Agricultural administrative villages (100,000)



The government agricultural extension stations located in each township, even in the most remote township in China. The system make sure the new innovation can be adopted in time.

Summary

- China's agricultural R&D system is:
  - the largest R&D system in the world
  - top-down government research system
  - more development research than basic research
  - public sector dominated
- Largest agricultural extension system to make sure the agricultural innovation be adopted in time

Challenges by late 1990s

- Public dominated, private sector is lacking:
  - Research program may not capture the most relevant and immediate problems faced by farmers
  - Weak links between generation and dissemination of technologies, between technologies available and farmers' real demand for useful technologies
- Decentralization: decentralized with weak coordination among institutions (central vs local; local vs local…)
- Duplication: duplication of research efforts contributes to wastage of scarce research resources
- Overstaff: low salary, lack of incentive, loss of quality scientists
- Low human capacity

Agricultural research reform in China

Stage I: Initial reform period (1985-98)

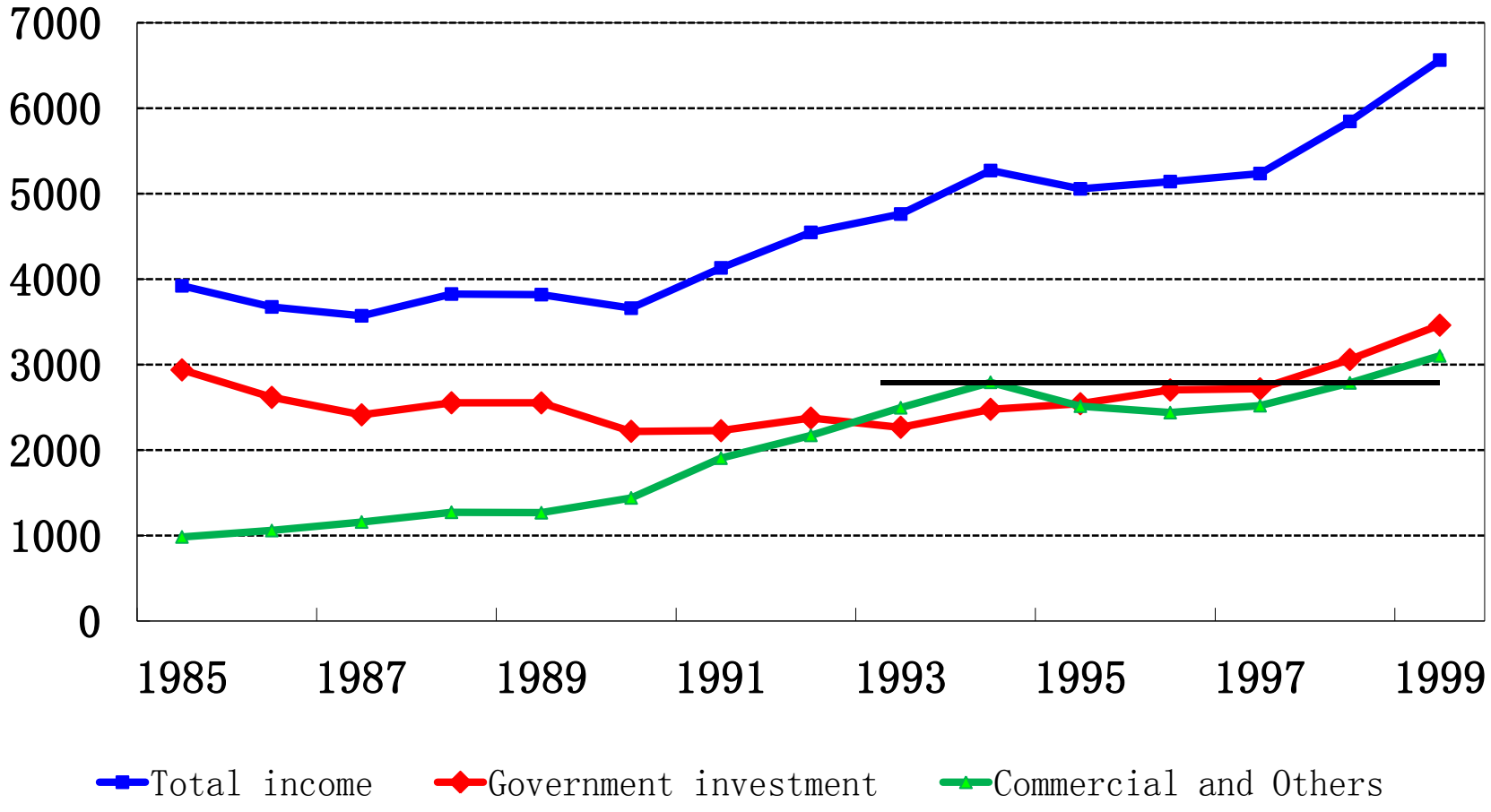
methods:

-- gradually commercializing research

Research grant:

-- gradually moving from formula based allocation toward competitive grants

Changing sources of agricultural research investment (million yuan in 1998 price), 1985-99



Agricultural research reform

Stage II: A new push for radical reform

Goals: to have a market-oriented, effective, creative, and modernized agricultural research system

Strategies:

Researchers:

- **Better scientists** (keep 1/3)
- **Radical commercialization** (2/3)

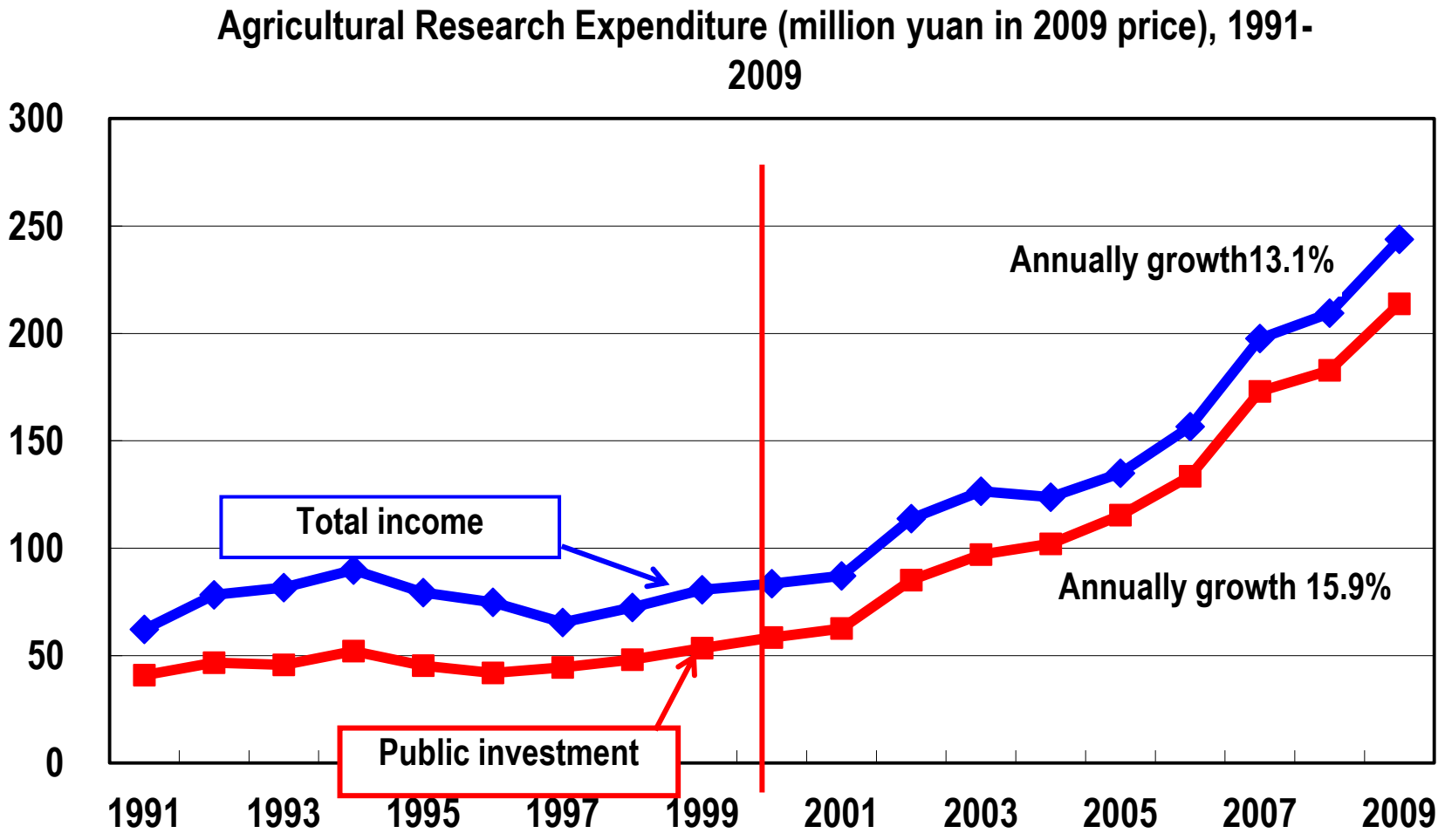
Investment:

- **More investment**
- **Improve efficiency (competitive grant)**

Management:

- **Incentive system reform**
- **More market-oriented reform**

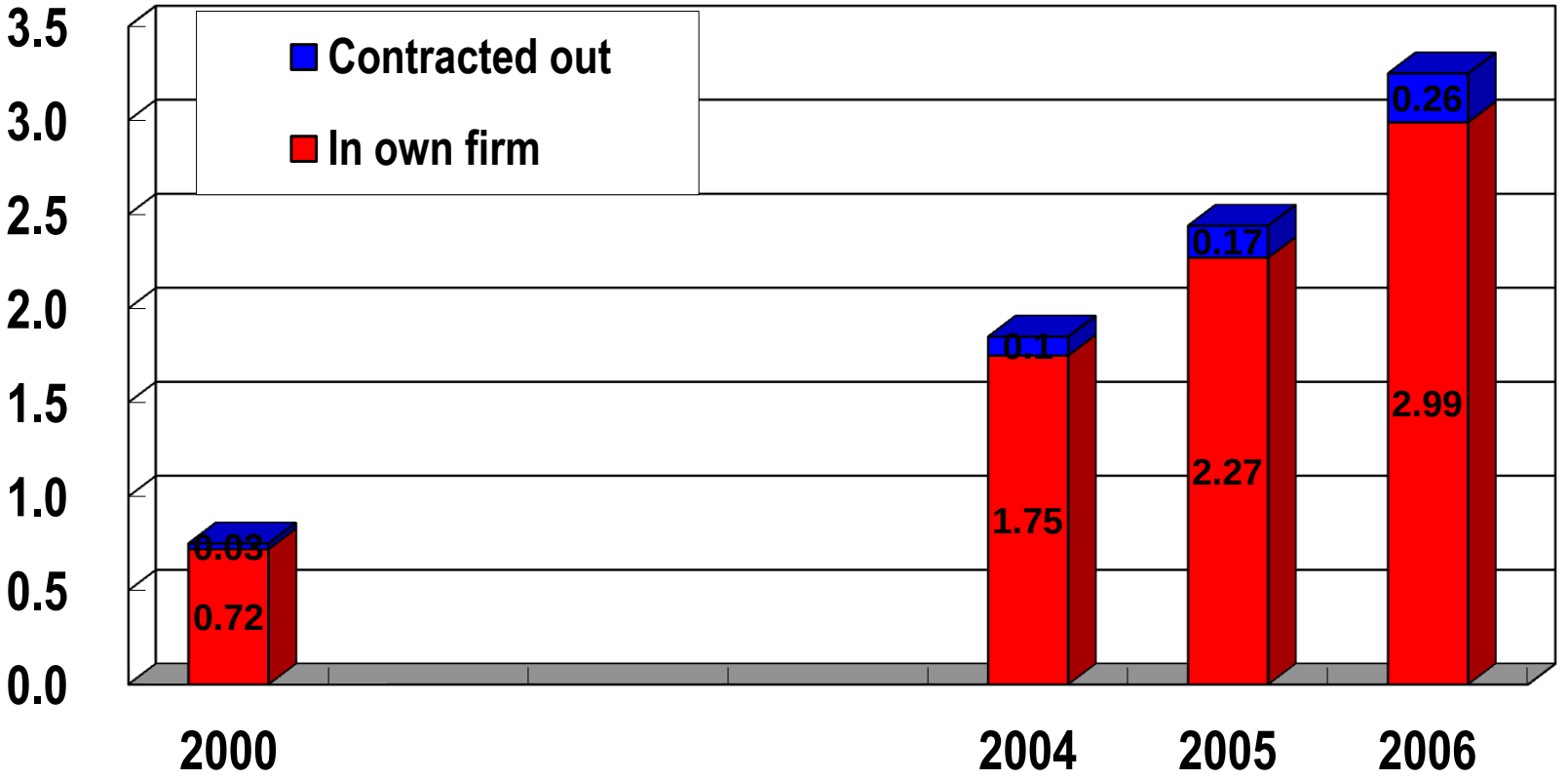
The government R&D investment increased at 15% annually during 2000-2005



Rising R&D expenditure, but most are competitive grants: this is a new challenge.

Source： Hu et al., 2007

Private agricultural R&D investment in China (Billion RMB yuan, 2006 price)



Source: Hu et al., 2008

Does the government investment remarkably contribute to the rise of private sector's R&D investment?

Investment in Agricultural R&D by Private Sector

	Model 1	Model 2	Model 3	Model 4
Privatization:				
		Ln (Private R&D)		Ln (Private R&D)
政府R&D投资 Public R&D Exp.		-0.001***		
-- 基础与应用Foundation+Application				0.017***
-- 开发投资 Development				-0.004***
公司年龄 Years started company		165.5***		168.2***
公司年销售额 Company's annual revenue		0.003***		0.003***
私人公司个数 Number of private companies		1.842***		1.799***
		(0.005)		(0.005)
of public-D		-0.004***		-0.004***
Government funding for private R&D			0.302***	0.310***
			(0.00)	(0.00)

Public-dominated R&D investment restrict the private investment

Concluding remarks

- Agricultural research has been an engine of agricultural growth in China in the past.
- With rising food demand in China, China's leaders believe agricultural technology is major solution to improve the nation's food security and have developed a national agricultural R&D system and also have tried to reform this system so that the technologies generated can be more response to farmers' demand.

Concluding remarks

China has also invested significantly in R&D in the past, particular in recent years.

However, China's agricultural research and extension are also facing great challenges, a public dominated system has its pros and cons.

The leaders are well aware of its cons and recently have tried to encourage private sector to join public sector in agricultural R&D system –---- if this is going to happen, it is expected a new era of China's agricultural R&D will come…

Thanks