

**Intellectual Property Rights, Market
Structure and Innovation:
Evidence and Implications from the
Chinese Pesticide Industry**

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Motivation

- Technology and innovation for economic growth
 - Chinese government's concern about its industries' global competitiveness
- Determinants of R&D and innovation
 - Privatization and decentralization?
 - IPR as major incentive mechanism post-privatization
- Market consolidation?
 - Schumpeterian hypothesis
 - Chinese government encourages consolidation in the pesticide industry

In this study, we explore...

- A case study of the Chinese pesticide industry since the mid 1980's
- The relationship between institutional policy, industrial market structure, and innovation
- Implications for firms' strategies and policy analysis

Why focus on the Chinese pesticide industry?

- Dynamic institutional changes in the last twenty years
 - Privatization and transition to the market economy
 - 1985 first Patent Law, and 1993 1st amendment
 - Chemical molecules patentable;
 - Extending the patent period from 15 to 20 years since application
 - 2001 WTO entry (TRIPS and more)

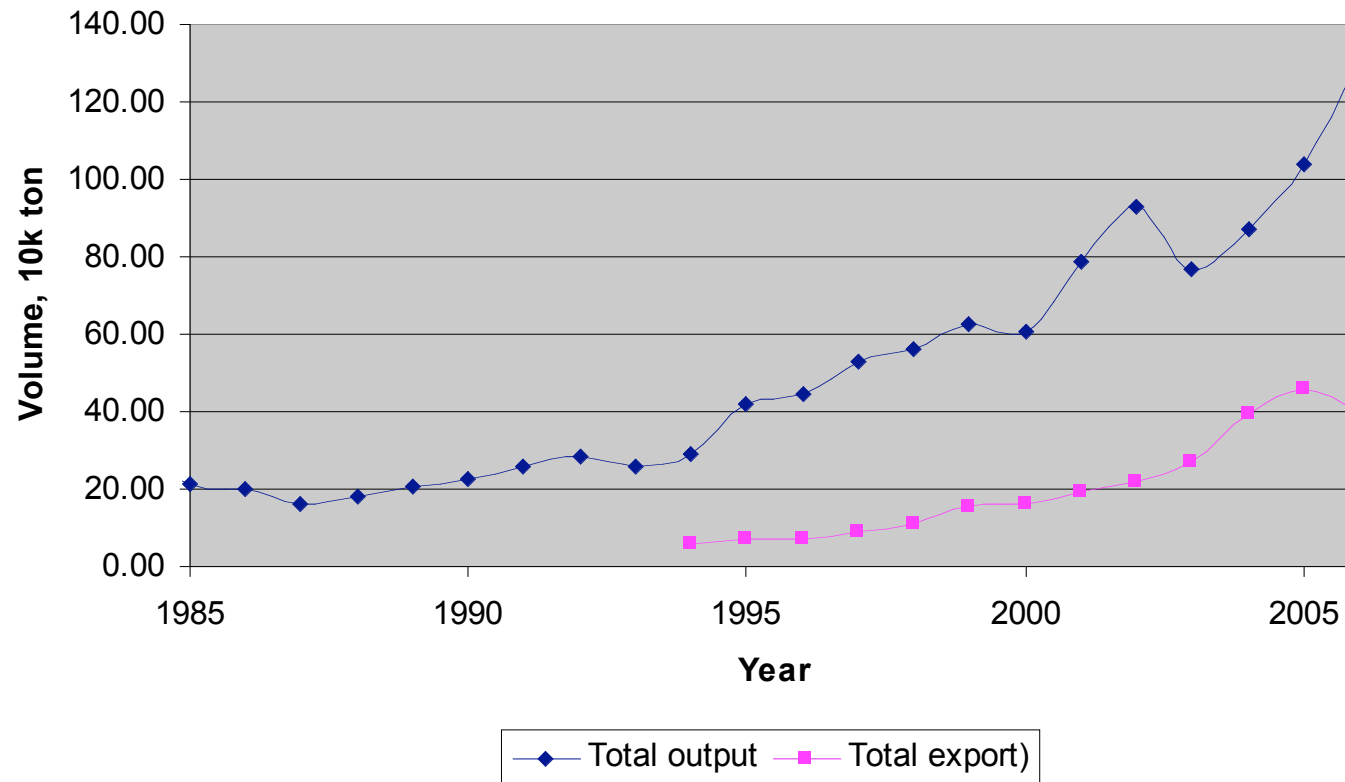
Why focus on the Chinese pesticide industry?

- Chemical industries including pesticides rely heavily on IP protection as a means of appropriating returns
 - e.g. Mansfield 1986, Levin et al. 1987, Cohen, Nelson and Walsh, 2000
- Avoid heterogeneity issues in cross-industry and cross-country studies

Source of information

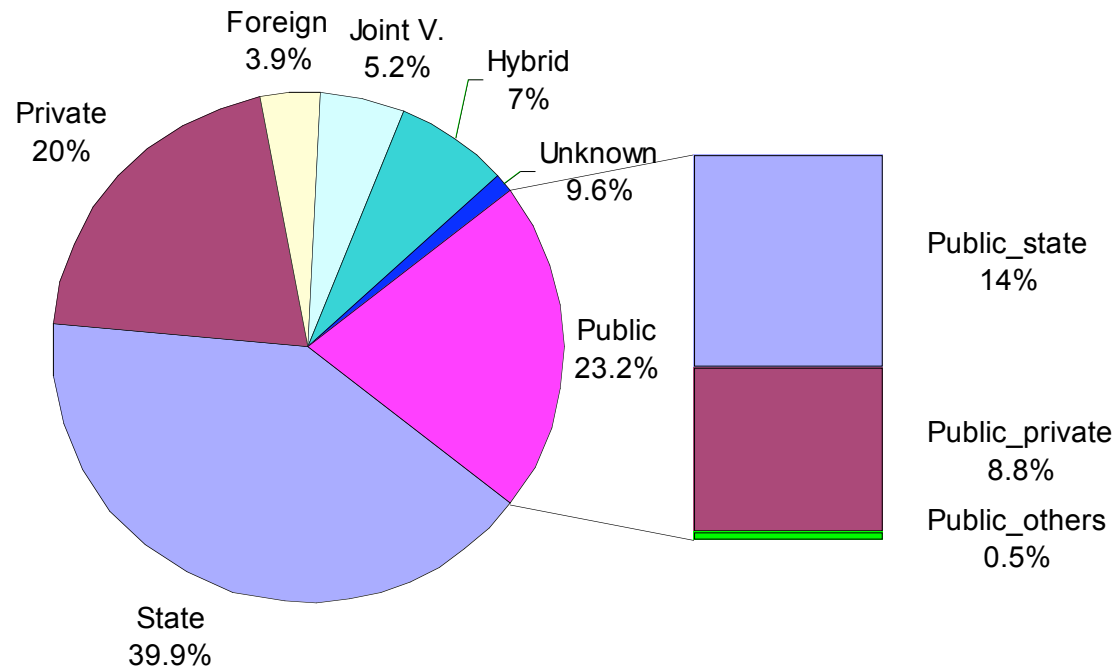
- Interviews conducted in summer 2006 and fall 2007
- China Crop Protection Industry Yearbook, 2005&2006
- Patent office database
- Database for product registration of ICAMA (Chinese “EPA”)

Some facts...



A fast growing industry, ranked top 1 or 2 worldwide

Privatization/entrepreneurship (by 2004)



...produced by many small firms (around 2600 in total, of which 600+ produce AIs, 29 listed in stock market, 30-40 foreign/joint ventures)

Who conducts pesticide R&D?

- Mostly in the public sector
 - 2 National centers founded in 1995 and 1996
 - About 20+ other universities and research institutes...
 - Less than 100 researchers/unit working on pesticide innovation, many without post-graduate degrees
- Limited industrial R&D
 - Large firms start doing R&D on processes not products
 - Multinationals do little R&D in China

Outcome

31 new Active Ingredients (9% of world total, 345 from 1985-2005)

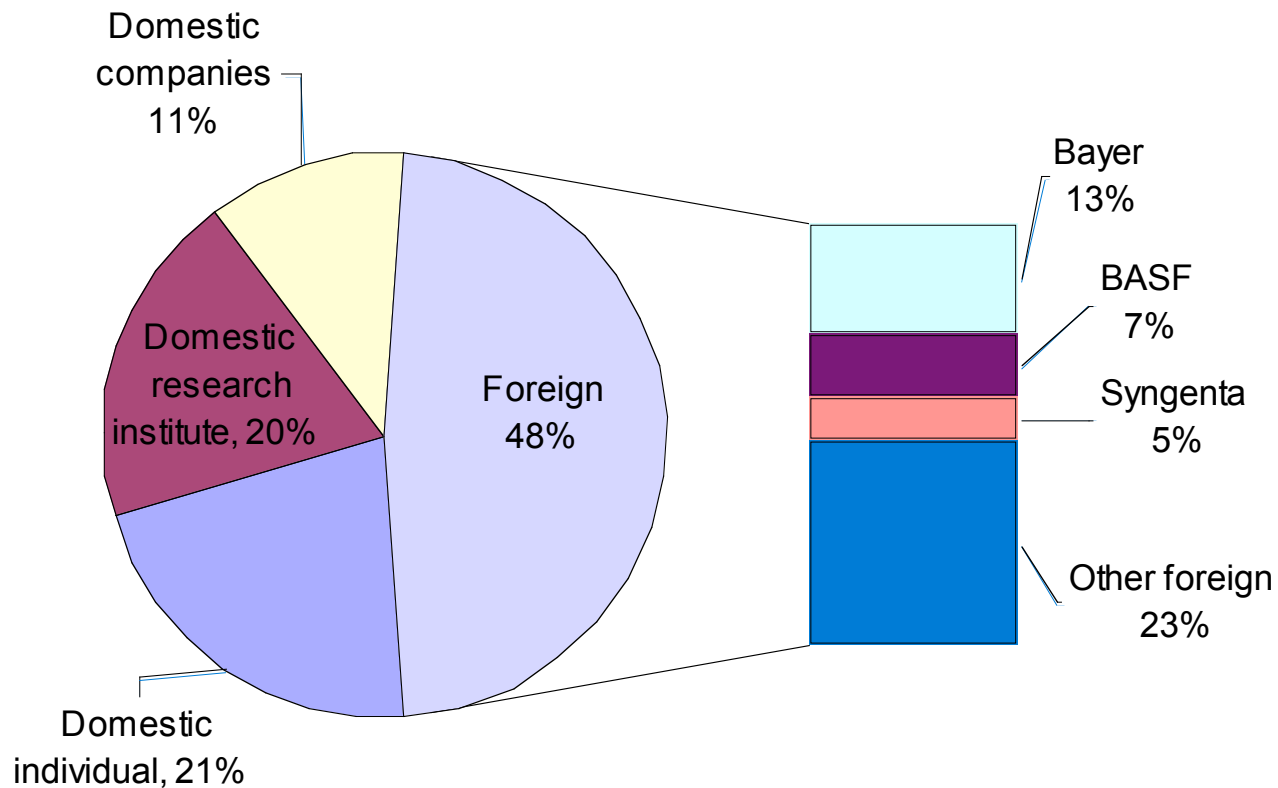
- Low relative to the size of production
- High relative to the amount of R&D input in total

Qualitative assessment of R&D:

Interviews with key informants

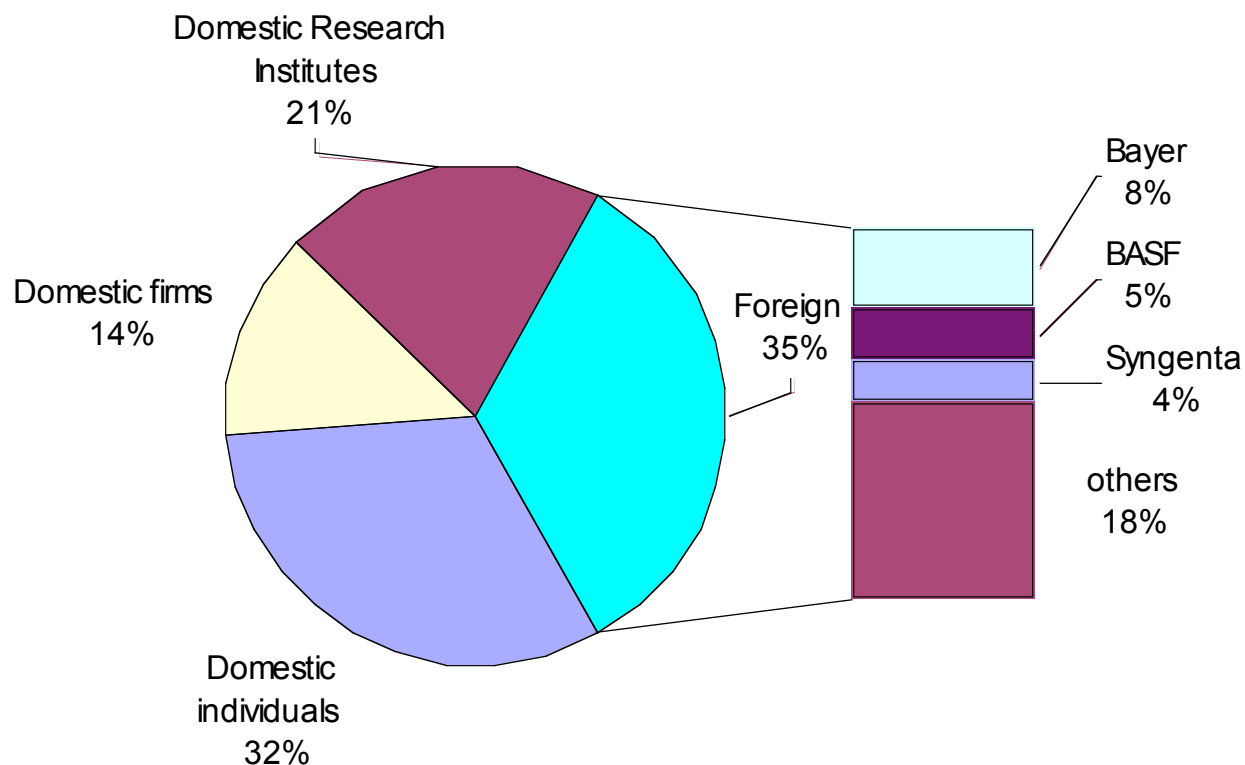
- No truly “new” AIs
- Useful process technologies – mainly from government institutes but often financed by commercial firms
- Useful new formulations developed – again mainly by government institutes funded by commercial sector
- China continues to be a low cost producer of generic pesticides in part because of research and development
- Emerging human capital supply problems (technical, managerial...)

Who applied for pesticide patents in China?



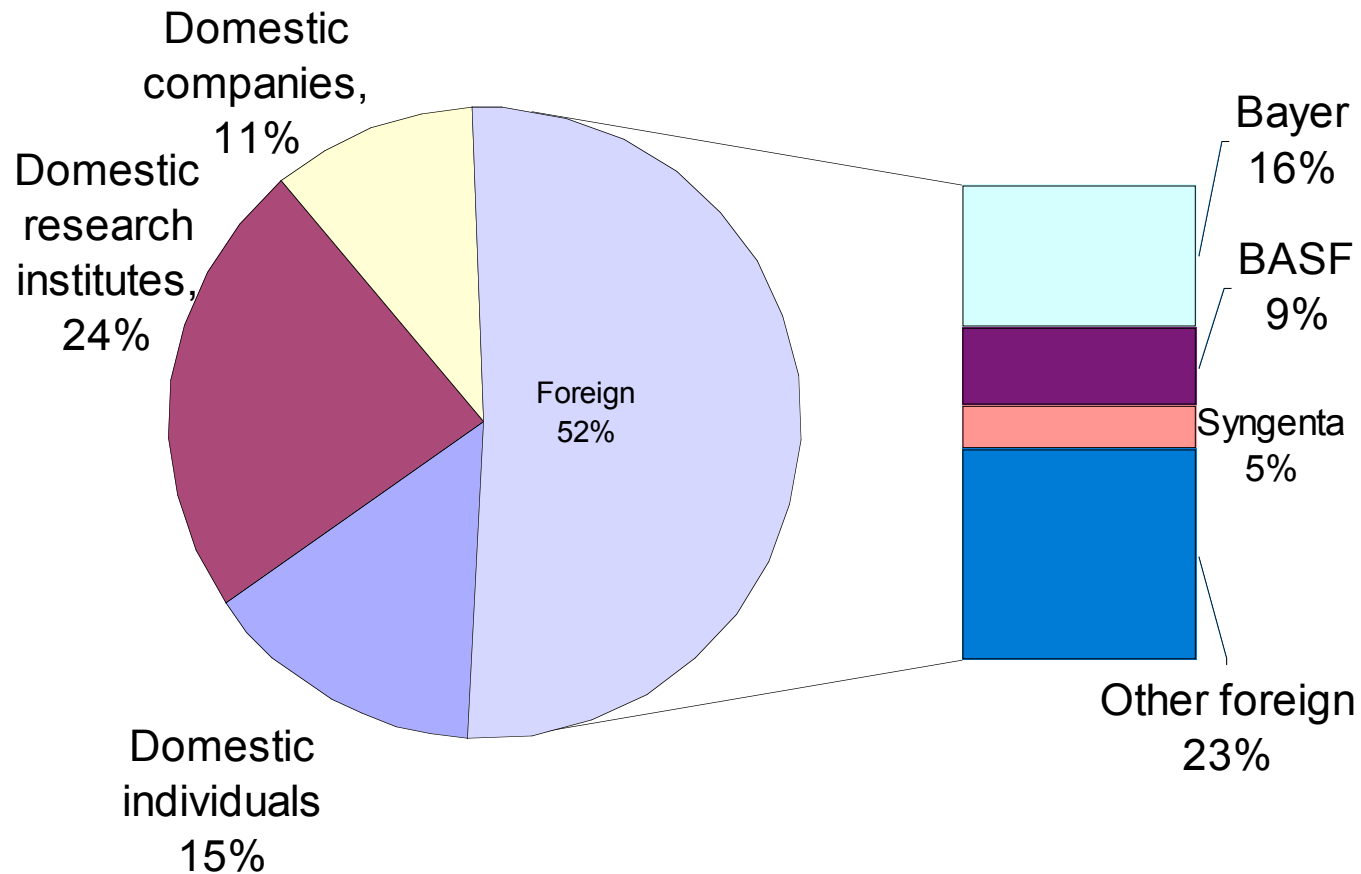
Total applications = 9831, 1985 – March 2007

Who applied for formulation/mixture patents?



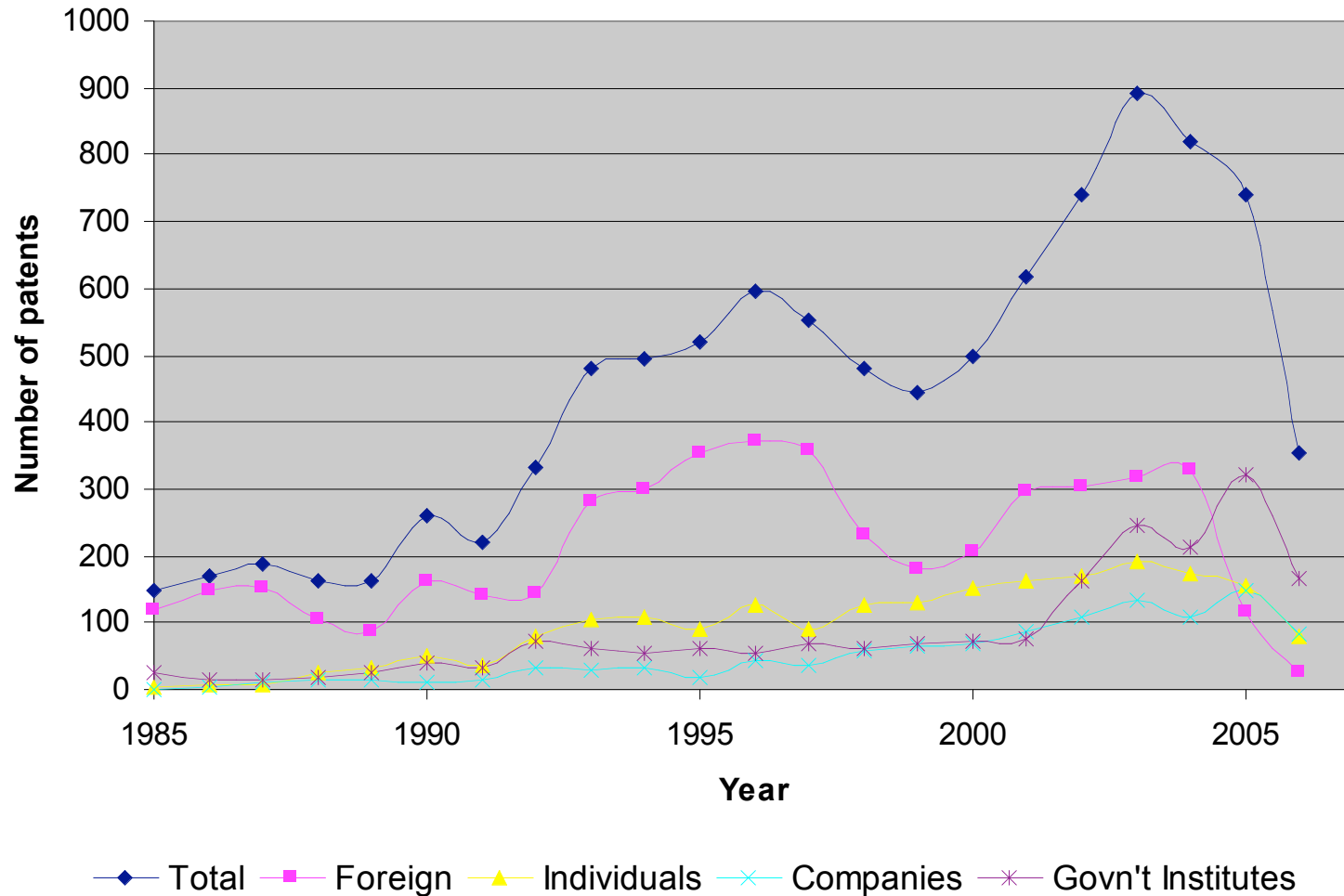
Total applications = 6295, 1985 – March 2007

Whose patents are valid now?

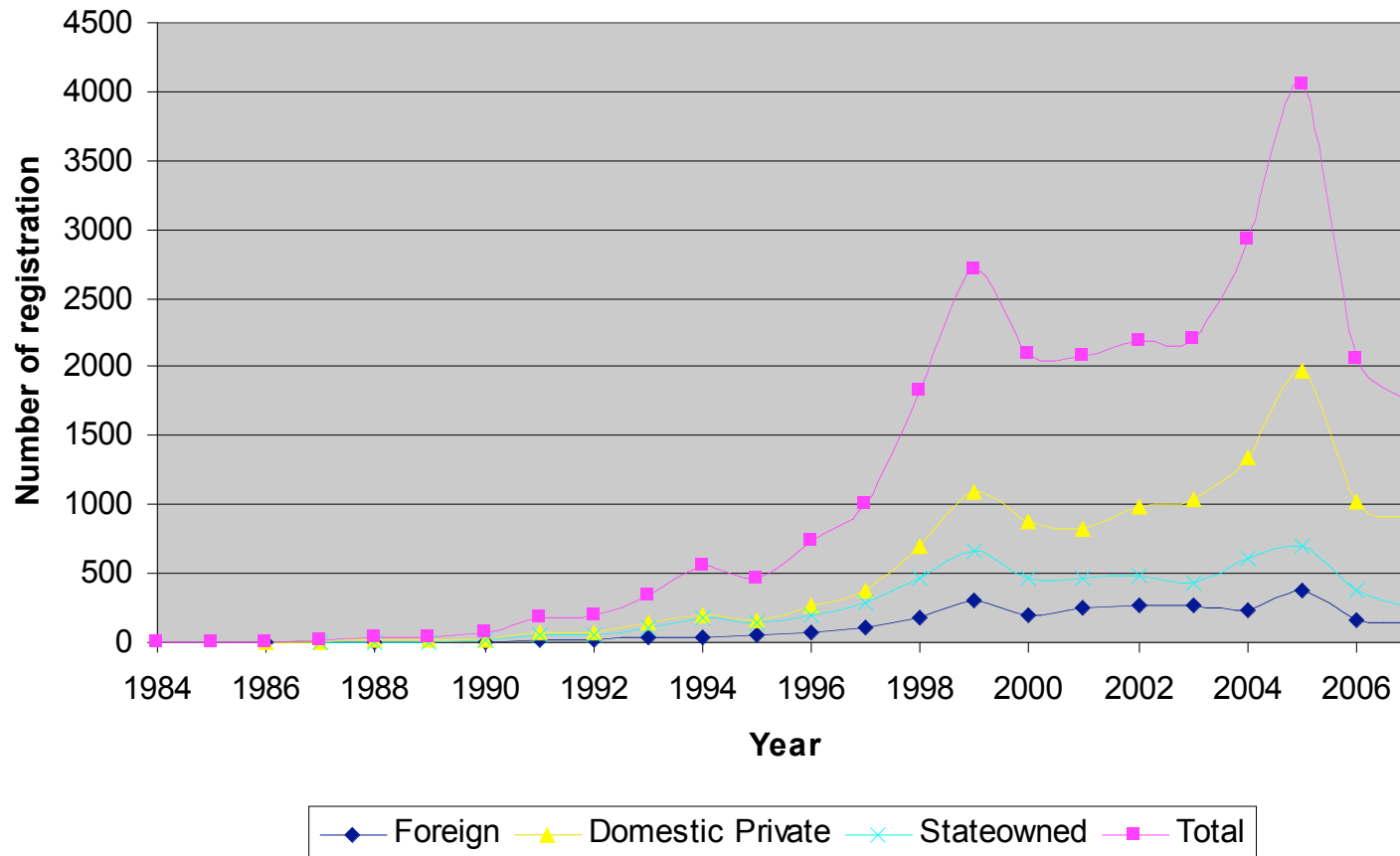


Total valid patents (by July, 2007) = 2284

Impact of research and policy changes: Trends in Ag Chem. Patents, 1985 - 2006



Impact of research and policy changes: Trends in pesticide provisional registration 1985 - 2006



Preliminary results

- Both patent applications and product registrations increase statistically significantly over years

However, patterns differ by applicant's type

- Foreign applicants are more cautious with patent application, compared to local individuals
 - Likely structural break points in early 1990s and late 1990s
- Private local firms are more aggressive in product registration compared to foreign firms and state owned companies
 - Likely structural break points in mid 1990s

Conclusions

- Institutional changes have strong impacts on R&D behavior
- Commercial funding of research is growing due to
 - Continued growth in demand – particularly for exports
 - Stronger IPRs and enforcement
 - Influence of privatization on funding
- Public and private research have been successful in reducing costs of production, developing new formulations, and supporting exports
- No evidence for Schumpeterian hypothesis, maybe because the market is not settled yet?