Competition in the U.S. Seed Industry and the Role of Intellectual Property

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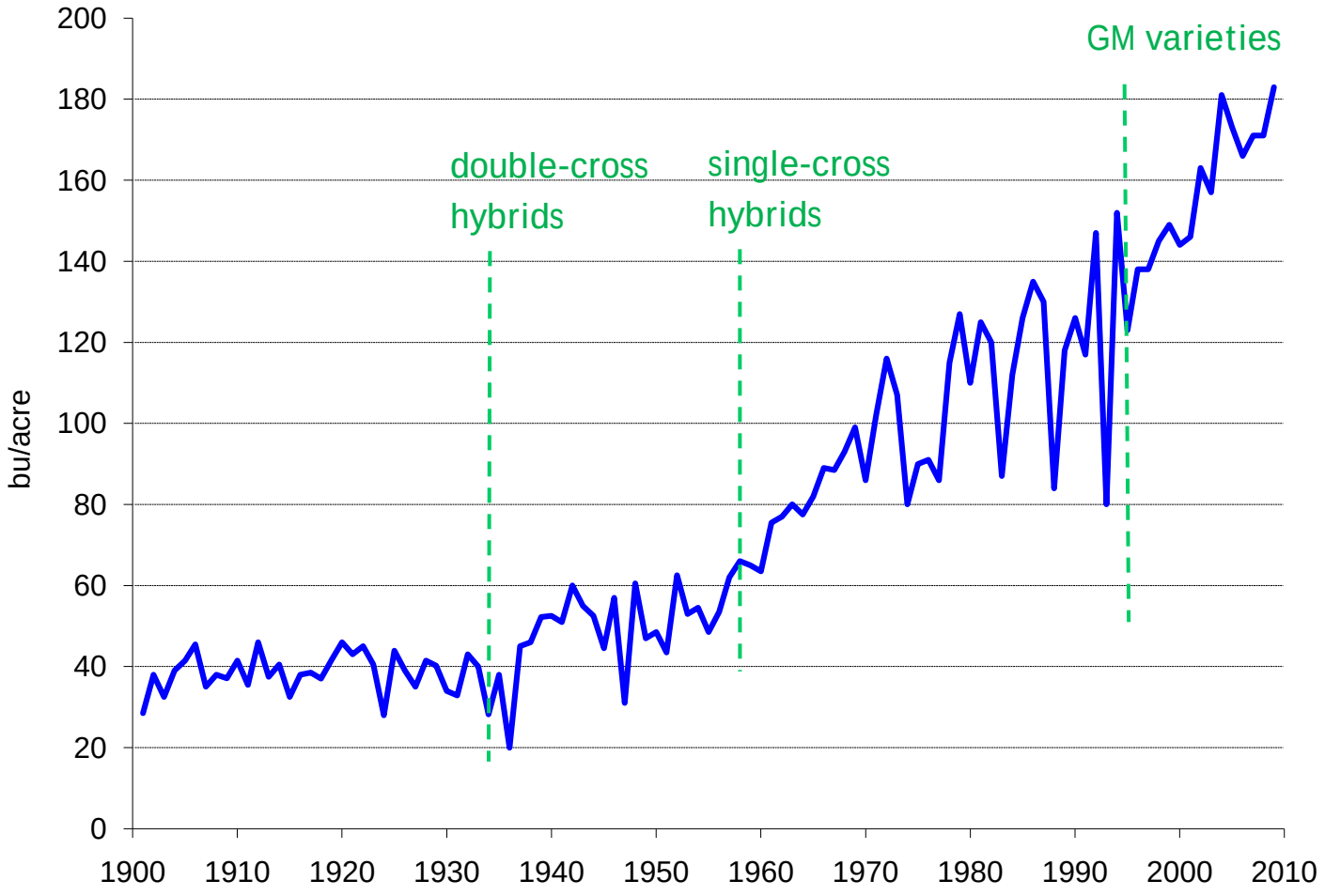
Outline and (preliminary) bottom line

- For the seed industry, R&D and innovation are crucial
- Public R&D is stagnating and private R&D is doing the heavy lifting
- Private R&D relies critically on intellectual property rights (IPRs)
- The seed business is very competitive but the seed industry is certainly not a competitive industry
  - Concentration is high and competition is constrained by IPRs on both biotechnology traits and germplasm
  - Some potential anticompetitive elements warrant scrutiny
- There is a tension between IPR objectives and antitrust concerns as they relate to competition issues in this industry

Innovation and productivity: Iowa corn yields, 1901-2009

Source: USDA



Innovation in the seed industry

- Modern seeds provide value to farmers from two sources:
  - **Germplasm**
  - **Biotech traits** (e.g., herbicide tolerance, insect resistance)
    - Monsanto's pioneering role
- Germplasm and biotech traits are **essential complementary assets**
  - both are needed for commercially viable genetically modified (GM) varieties
  - also: synergism between seed and agrochemical industries
- Seeds embody "**cumulative innovations**"
  - innovations have long-lasting value (durable goods)
  - innovations are the springboard for further improvements
- Biotech is more than GM traits
  - research tools (e.g., transformation methods, marker-assisted breeding …)

Evolution of the Seed Industry and IPRs

- Emergence of **biotechnology** and increased role of **intellectual property rights** have played (and are playing) a crucial role
  - Mergers and acquisitions (M&A) in the pursuit of essential complementary assets
    — research tools, GM traits, germplasm
  - Example: Monsanto's remarkable transformation into the largest seed company in the world

- Germplasm, GM traits and biotech research tools are **all** amenable to IPR protection
  - **Germplasm**: trade secrets, PVPCs, patents
    — the type of IPRs matters
  - **GM traits** and **biotech tools**: patents

Milestones of IPRs for plants in the United States

- Plants long considered outside the statutory scope of patents …
  — but: 1930 Plant Patent Act (PPA) for asexually reproduced plants
- 1970 – ***Plant Variety Protection Act*** (PVPA). Patent-like protection "certificates" for new and distinct, uniform and stable (DUS) varieties
- 1980 – ***Diamond v. Chakrabarty***
  Supreme Court decision allowing patenting of living organisms
- 1985 – *Ex Parte Hibberd*
  US PTO ruling that *Chakrabarty* applies to plants as well
- 2001 - ***J.E.M. Ag Supply v. Pioneer Hi-Bred International***
  Supreme Court confirms validity of utility patent protection for plants
- Plus: ***Trade secret*** *protection* (State law)

Why intellectual property rights ?

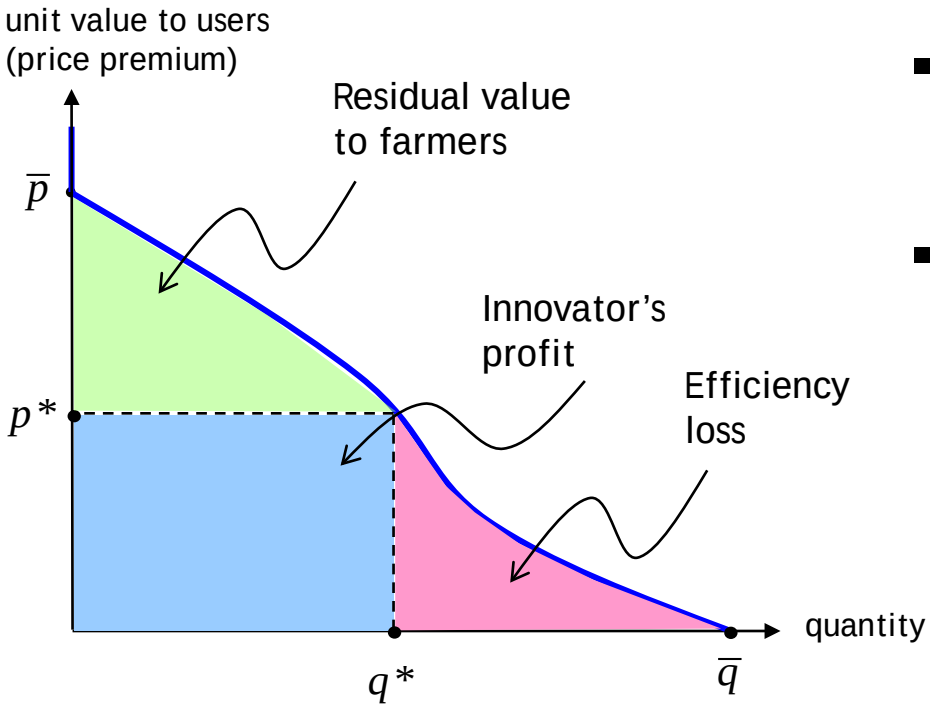
- Knowledge is a "public good"
  - "**non-rival**" and "**non-excludable**" (absent IPRs)
    Example: biolistic gun for DNA insertion into cells

- Quintessential "**free rider**" problem:
  - Lack of private incentives to produce a public good
  - " ***innovators*** " vs. " ***imitators*** "

- IPRs "solve" problem by granting an **exclusivity** to innovators
  - E.g., patents grant (limited) monopoly rights
  - It is a **second-best** solution

Economic effects of patents

- New products create value to users
  - exclusivity of patents allow owners to capture some of that value
  - Example: **pricing of a new seed trait** (e.g., insect resistance)



- The profit prospect is a powerful ***ex ante* incentive** to invest in R&D
- Patents restrict adoption of valuable products (***ex post* efficiency loss**)

The ag biotech revolution: U.S. adoption of GM crops

	1996	2000	2003	2006	2009
Soybean	**7%**	**54 %**	**81%**	**89%**	**91%**
Corn	**1%**	**25 %**	**40%**	**61%**	**85%**
Bt		18 %	25%	25%	17%
Herbicide-tolerant		6 %	11%	21%	22%
Stacked genes		1 %	4%	15%	46%
Cotton	**15%**	**61 %**	**73%**	**83%**	**88%**
Bt		15 %	14%	18%	17%
Herbicide-tolerant		26 %	32%	26%	23%
Stacked genes		20 %	27%	39%	48%

Source: USDA, NASS Surveys (1996 data: ARMS Survey)

GM corn hybrids in the United States, 2009 planting

Source: National Corn Grower Association

PRODUCT	EVENT		PRODUCT	EVENT
Syngenta Agrisure CB/LL	Bt11		Syngenta Agrisure GT/CB/LL	SYTGA21 + Bt11
DowAgrosciences Pioneer Hi-Bred Herculex I	TC1507		MonsantoYieldGard Roundup Ready	MON 810 + SYTGA21
MonsantoYieldGard	MON 810		Dow AgroSciences Pioneer Hi-Bred Herculex RW	DAS-59122-7
MonsantoYieldGard Roundup Ready 2	MON 810 + Nk603		Dow AgroSciences Pioneer Hi-Bred Herculex Xtra	TC1507 + DAS 59122-7
YieldGard Corn Rootworm Protection Roundup Ready 2	MON 863 + Nk603		Dow AgroSciences Pioneer Hi-Bred Herculex Rootworm Monsanto Roundup Ready 2	DAS-59122-7 + NK603
YieldGard Corn Rootworm Protection	MON 863		Dow AgroSciences Pioneer Hi-Bred Herculex Xtra Monsanto Roundup Ready 2	TC1507 + DAS 59122-7 + NK603
Monsanto Roundup Ready 2	Nk603		YieldGard VT™ Rootworm/RR2	MON 88017
Bayer CropScience LibertyLink®	T25		YieldGard VT™ Triple	MON 810 + MON 88017
MonsantoYieldGard Plus	MON 810 + MON 863		Syngenta Agrisure RW	MIR604
MonsantoYieldGard Plus with Roundup Ready 2	MON 810 + MON 863 + NK603		Syngenta Agrisure GT/RW	MIR604 + SYTGA21
Herculex I Roundup Ready 2	TC1507 + NK603		Syngenta Agrisure CB/LL/RW	Bt11 + MIR604
Syngenta Agrisure GT	SYTGA21		Syngenta Agrisure GT/CB/LL	SYTGA21 + Bt11 + MIR604

Monsanto's domination of GM traits, United States

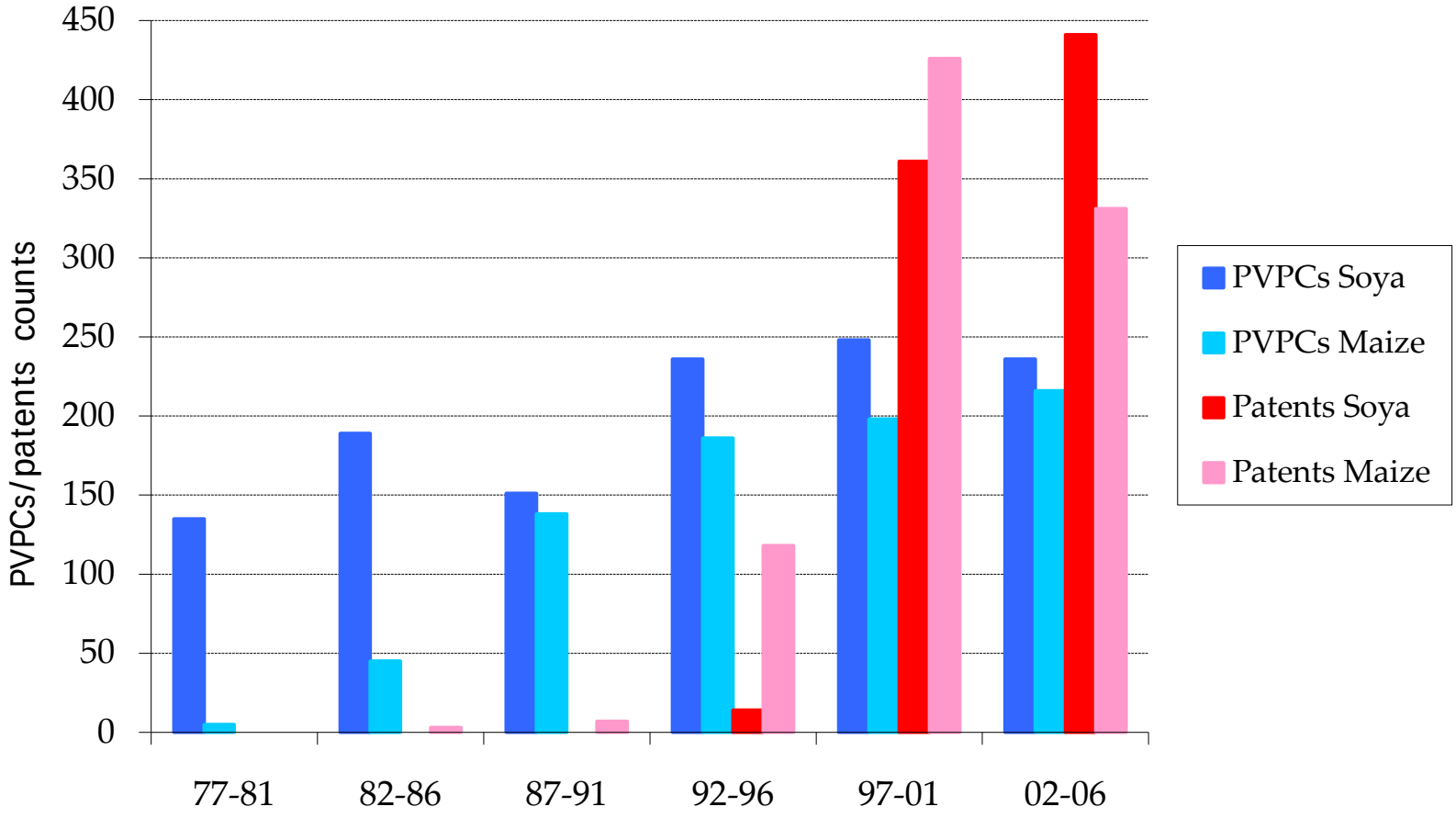
		2000	2005	2009
CORN	Single-Trait Acres	17.2	27.8	14.1
	Double-Trait Acres	0.1	13	4.5
	Triple-Trait Acres	0	1.3	31.2
	RR w/ non-Monsanto traits	0	0.5	20.7
	Total Monsanto trait acres	17.3	42.6	70.6
	% ot total planted acres	**21.8%**	**52.1%**	**81.1%**
COTTON	Single-Trait Acres	5.6	3.2	1.2
	Double-Trait Acres	4.1	7.7	5.3
	RR w/ non-Monsanto traits	0	0	0.7
	Total Monsanto trait acres	9.7	10.9	7.1
	% ot total planted acres	**62.6%**	**76.8%**	**78.9%**
SOYBEAN	Roundup Ready	45	66.4	71.7
	Roundup Ready 2 Yield	0	0	1.5
	Total Monsanto trait acres	45	66.4	73.2
	% ot total planted acres	**60.4%**	**92.1%**	**94.5%**

Source: Monsanto (percent values calculated based on USDA planted acres)

IPRs on corn and soybean Germplasm

U.S. PVPCs and patents, 1977-2006

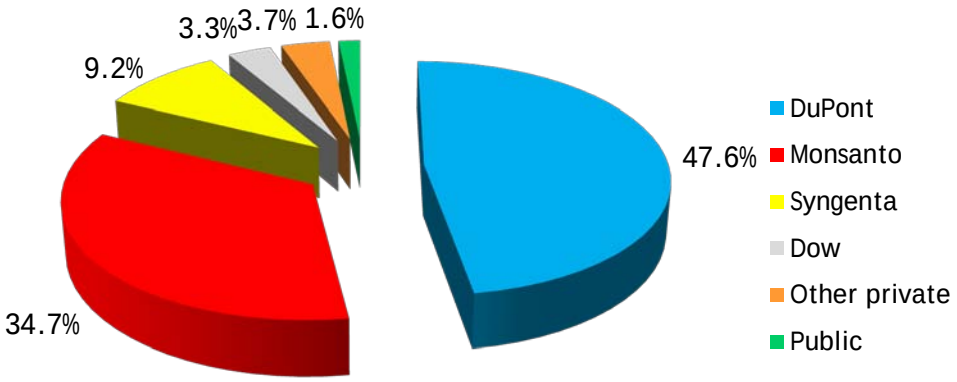
Source: USDA and USPTO

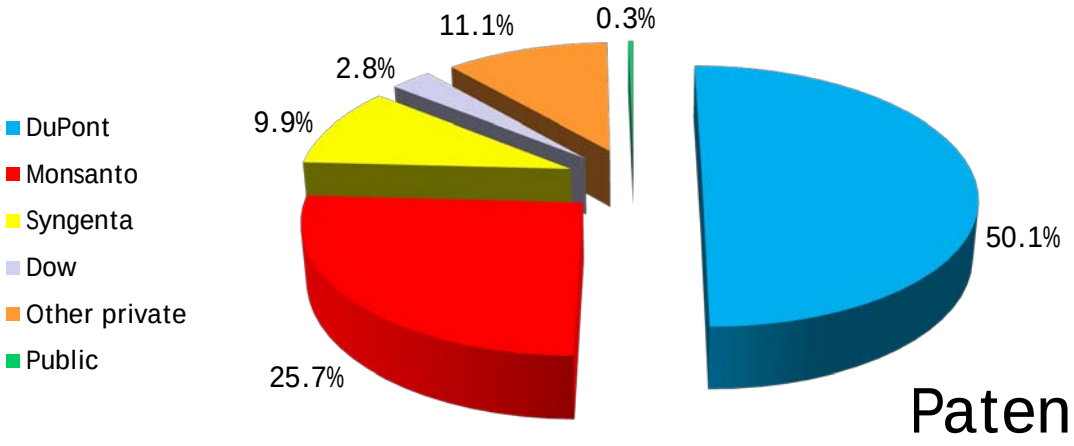


IPRs on Germplasm — Corn,1987-2006

Source: USDA and USPTO

PVPCs



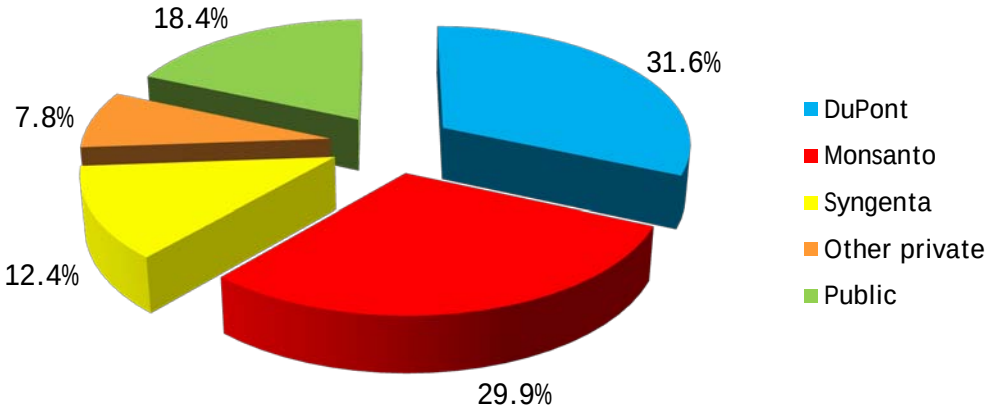


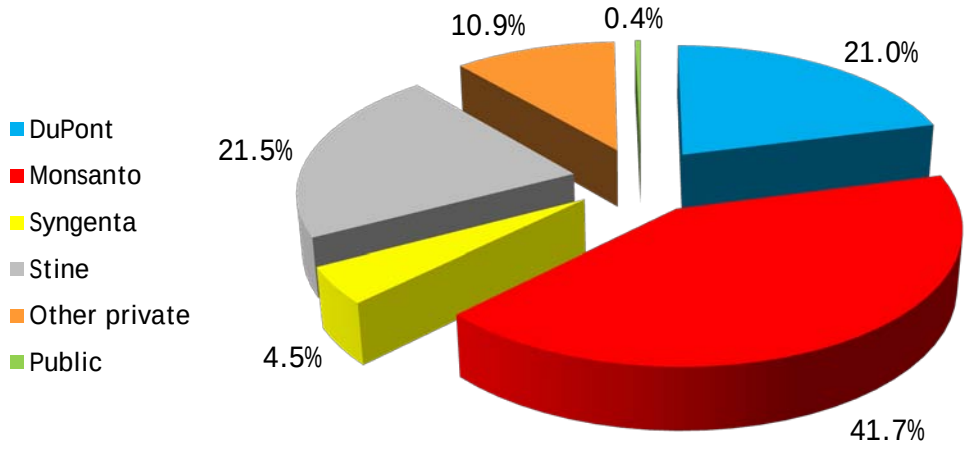
Patents

IPRs on Germplasm — Soybean, 1987-2006

Source: USDA and USPTO

PVPCs





Patents

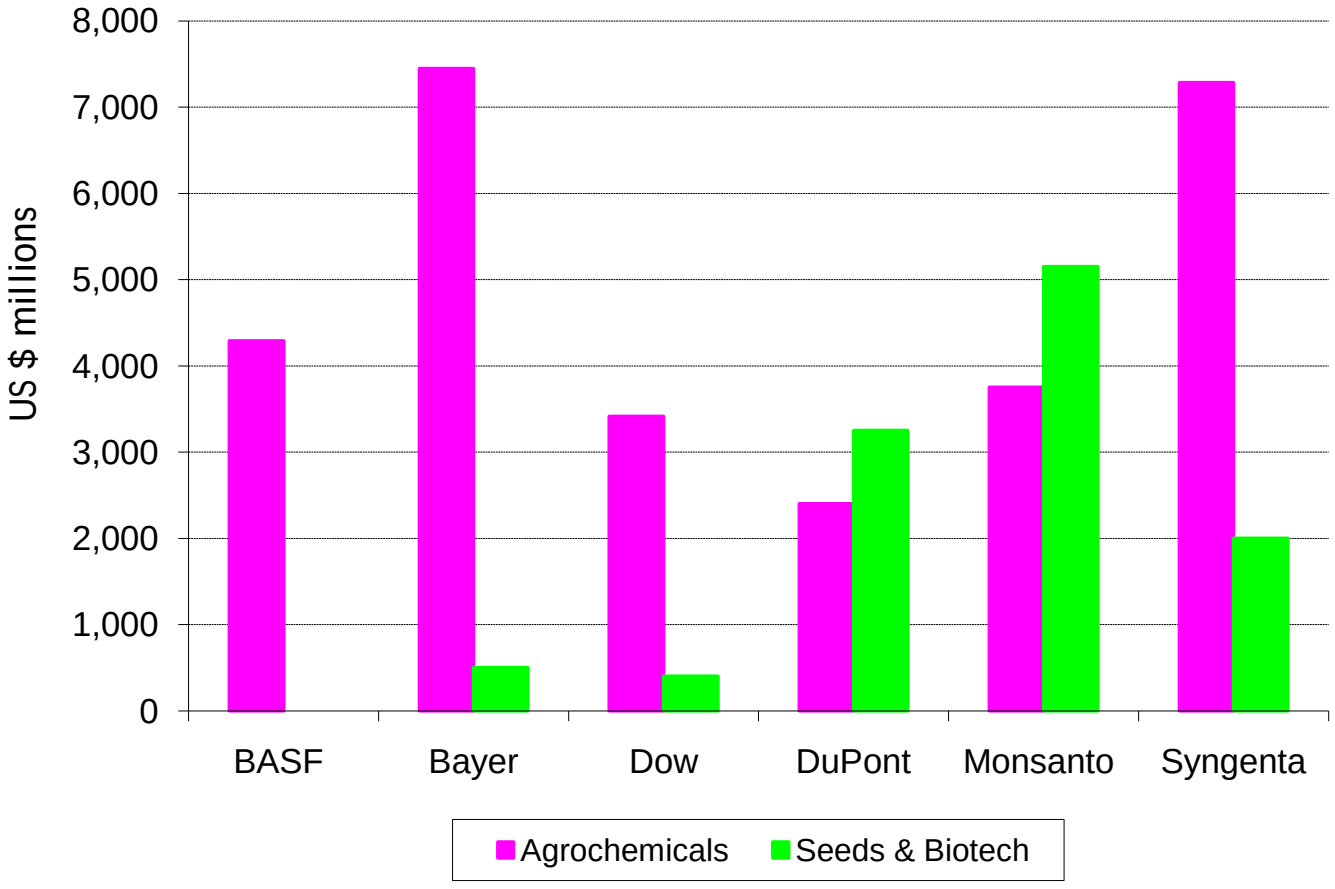
Global market shares, agrochemical and seed industries

(Source: ETC group)

Year 2007	Agrochemicals		Seeds
Bayer	19.3%	Monsanto	22.6%
Syngenta	18.9%	DuPont	15.0%
BASF	11.1%	Syngenta	9.2%
Dow	9.8%	Limagrain	5.6%
Monsanto	9.3%	Land O'Lakes	4.2%
DuPont	6.1%	KWS	3.2%
Market size (US $mil)	38,600	Market size (US $mil)	22,000

Agrochemicals and seeds global sales, 2007

Source: Phillips McDougall



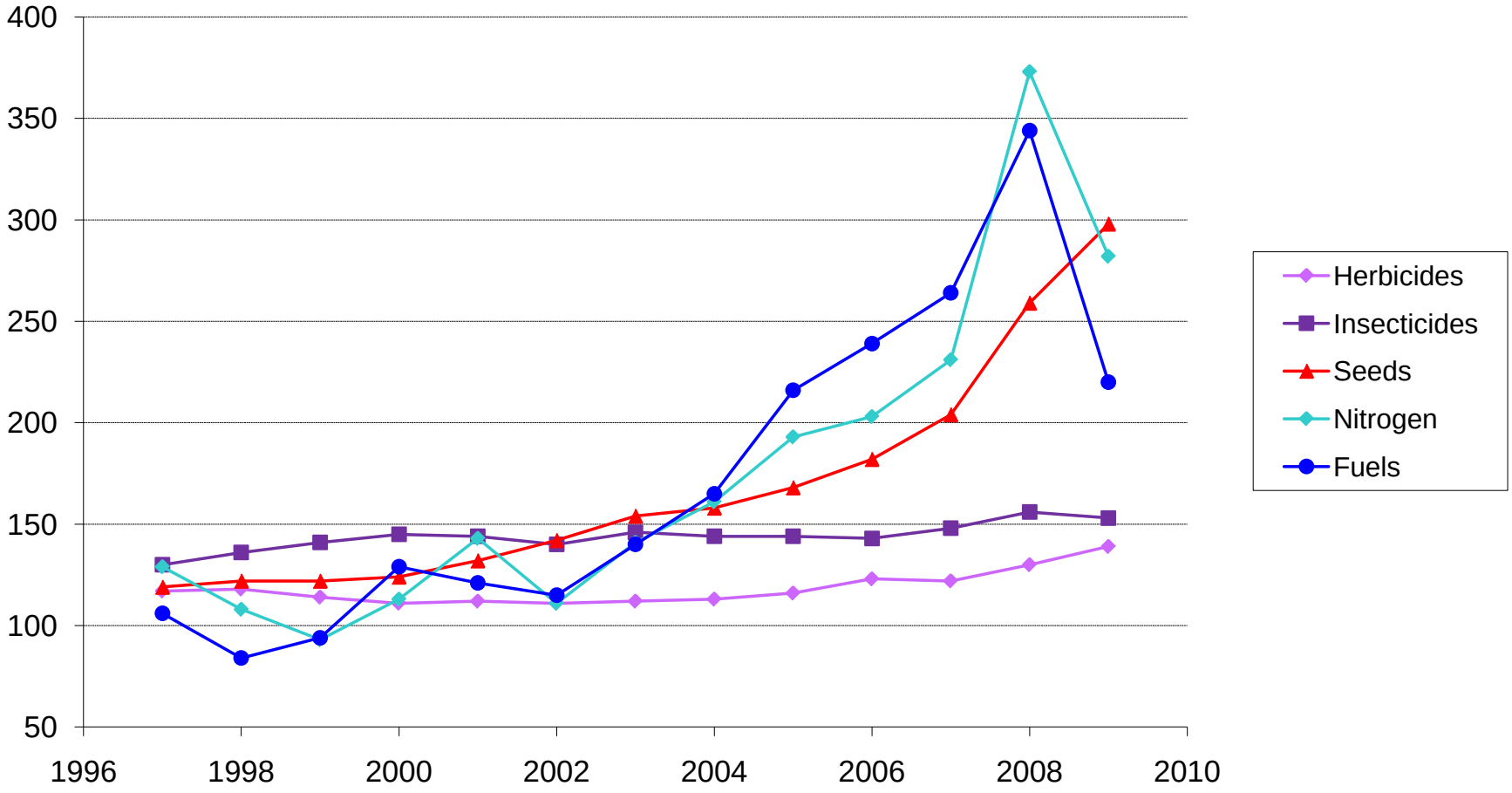
A look at prices

- Seed prices have increased more than prices of (some) other inputs
- The farmers' "**demand**" side:
  - GM varieties pack more than improved germplasm into seeds
  - expected yields and per-acre costs are the critical parameters
    — e.g., cost of Bt seed vs. cost of traditional seed + insecticide
  - trend in stacked GM traits
    — e.g., value of germplasm + herbicide tolerance + insect resistance
- The seeds "**supply**" side:
  - IPRs provide market power positions that seed companies exploit
  - Other anticompetitive issues?

Indices of prices paid by US farmers, 1997-2009

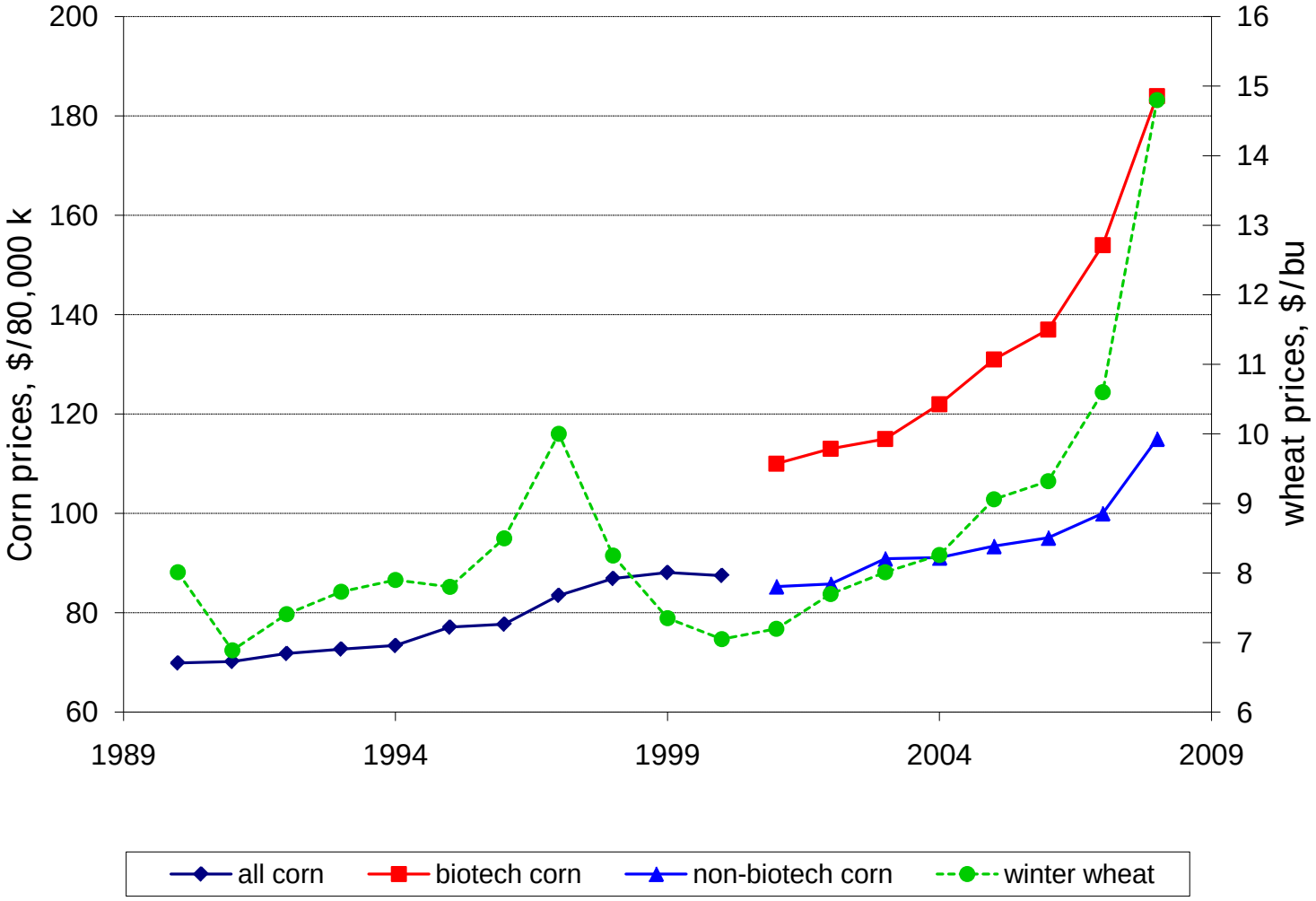
1990-92 = 100

Source: USDA



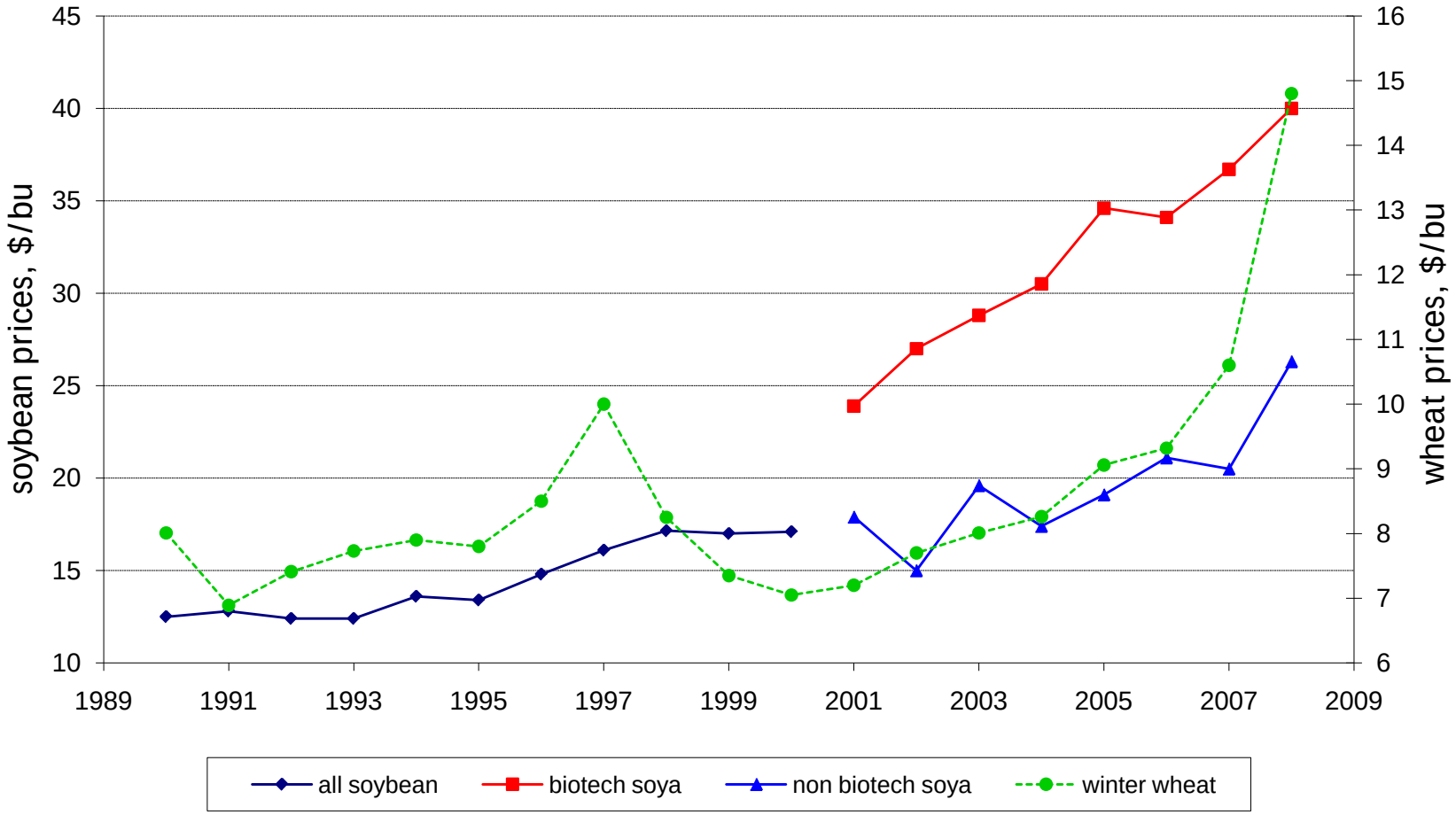
US hybrid corn seed prices, 1990-2008

Source: USDA



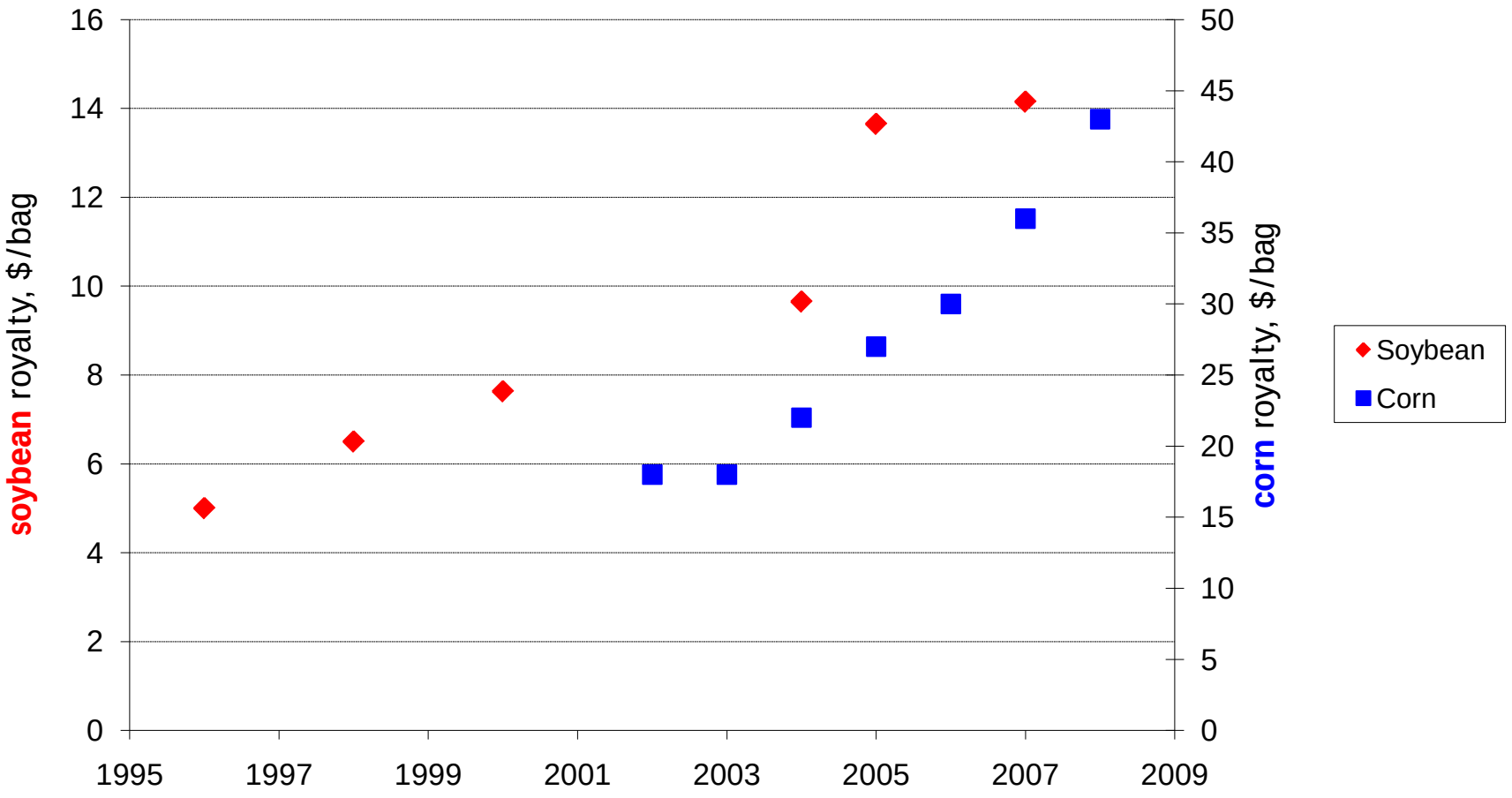
US soybean seed prices, 1990-2008

Source: USDA



Estimated Roundup Ready royalties, soybean and corn

Source: The Context Network



Competition and the seed industry

- Extensive **M&A activities** have resulted in a very concentrated seed industry
  - Modern seeds require two essential complementary assets for competitiveness: Germplasm and GM traits
  - Access is a real issue for all but a few companies
  - Barriers to entry are high
    - R&D is expensive, development times are long, meeting regulatory requirements is costly, …
- Numerous **licensing agreements** by dominant firm in GM traits have facilitated spread of GM varieties but might carry restrictive conditions that limit firms' future R&D and commercial actions

Tension between IPR law and antitrust law

- IPR law aims at increasing welfare by **promoting innovation**
  - grant of **exclusivity is crucial** to provide incentives for private R&D
  - exclusive control of an innovation necessarily confers some **market power**

- Antitrust law aims at increasing welfare by **promoting efficiency**
  - monopolistic positions are not prohibited per se, but certain activities that lead to the acquisition or exercise of market power are banned

- Efficiency considerations in an innovation context are subtle
  - ***ex ante*** vs. ***ex post*** perspectives
    - the IPR tradeoff: static efficiency losses vs. dynamic innovation gains

Open Issues: Licensing of GM traits

- The need to combine GM traits and germplasm for commercially successful seeds has resulted in widespread licensing of GM traits
  - nonexclusive licensing generally viewed as **procompetitive**. But:
  - dominance of GM traits, and the do-it-alone threat made credible by early acquisitions (e.g., Dekalb, Holden), give Monsanto strongest bargaining position

- What constitutes an anticompetitive licensing restriction?
  - DOJ "*Antitrust Guidelines for the Licensing of Intellectual Property*"
    - owner of IPR not required to create competition in own technology. But …
    - a number of licensing clauses might be **anticompetitive**, e.g.,
      - — anti-stacking restrictions (vis-à-vis other companies' GM traits)
      - — exclusive arrangements that penalize licensee for dealing with competitors
      - — exclusionary provisions

Other Open Issues

- Transition to "generic" GM seed varieties as GM traits go off patent
  - uncharted territory
  - role of existing licensing agreements — who controls the GM seed (germplasm + GM traits) after patents expiration?
  - role of regulation
- Research Joint Ventures (cooperation among competitors)
  - e.g., $1.5 billion R&D collaboration between Monsanto and BASF (2007)
- Vertical integration and the loss of small independent seed companies
- Price tag passed on to farmers: SmartStax or SmartsTax ?

Conclusion

- The critical role played by IPRs makes competition issues in the seed industry somewhat unique vis-à-vis other agricultural industries

- Innovation is of critical importance in this context
  - evidence suggests that biotechnology is increasing the pace of innovation
  - IPRs are essential for biotechnology R&D investments

- Concentration and restrictive licensing practices remain real concerns
  - need for further scrutiny and economic research

Thank you