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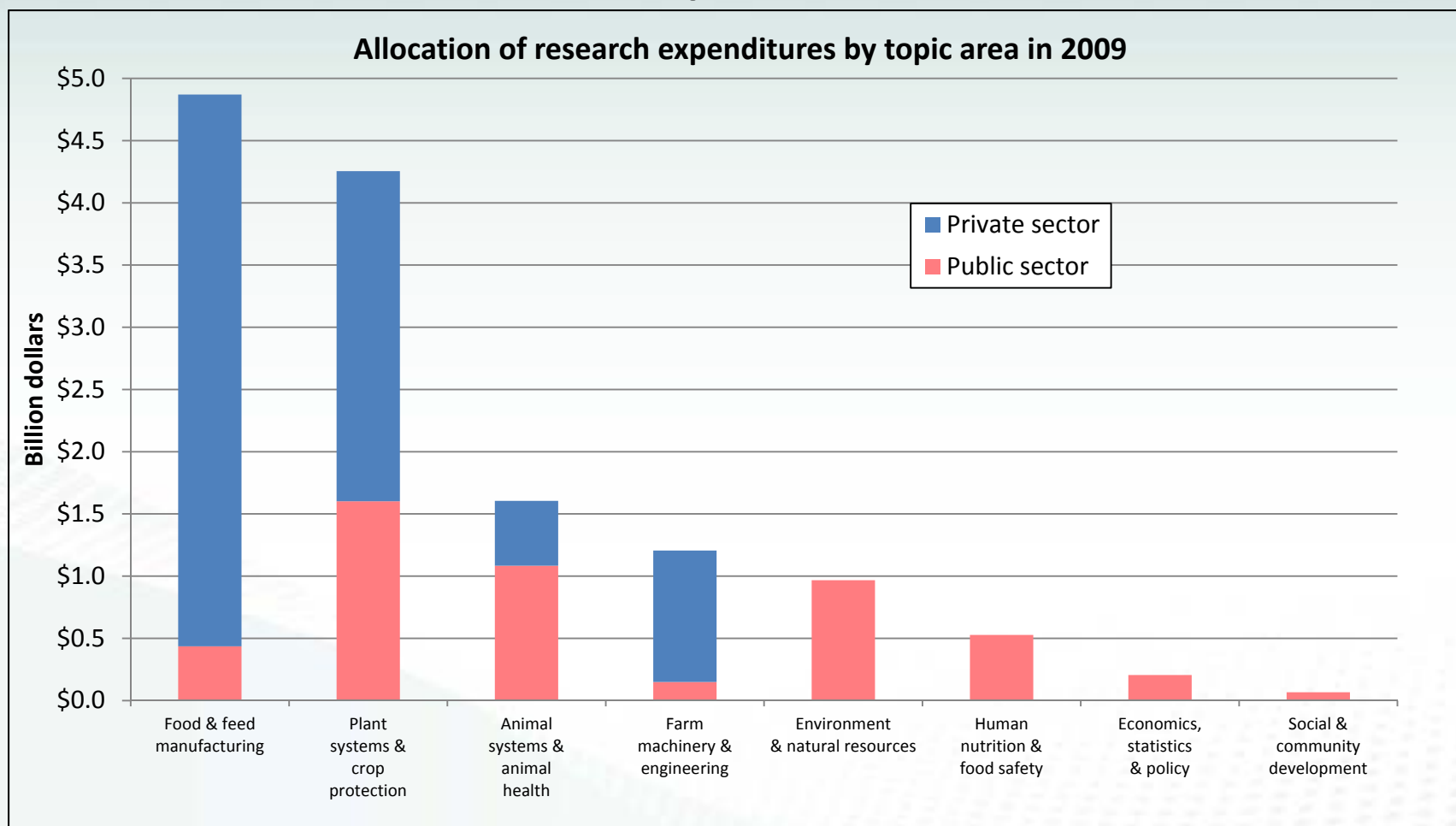
# The Structure of U.S. Agricultural and Food Research, with an Emphasis on Seed/Biotechnology Research

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## Public agricultural research investments are spread across a broader array of topics, but both public and private sectors invest significant amounts in crop related research



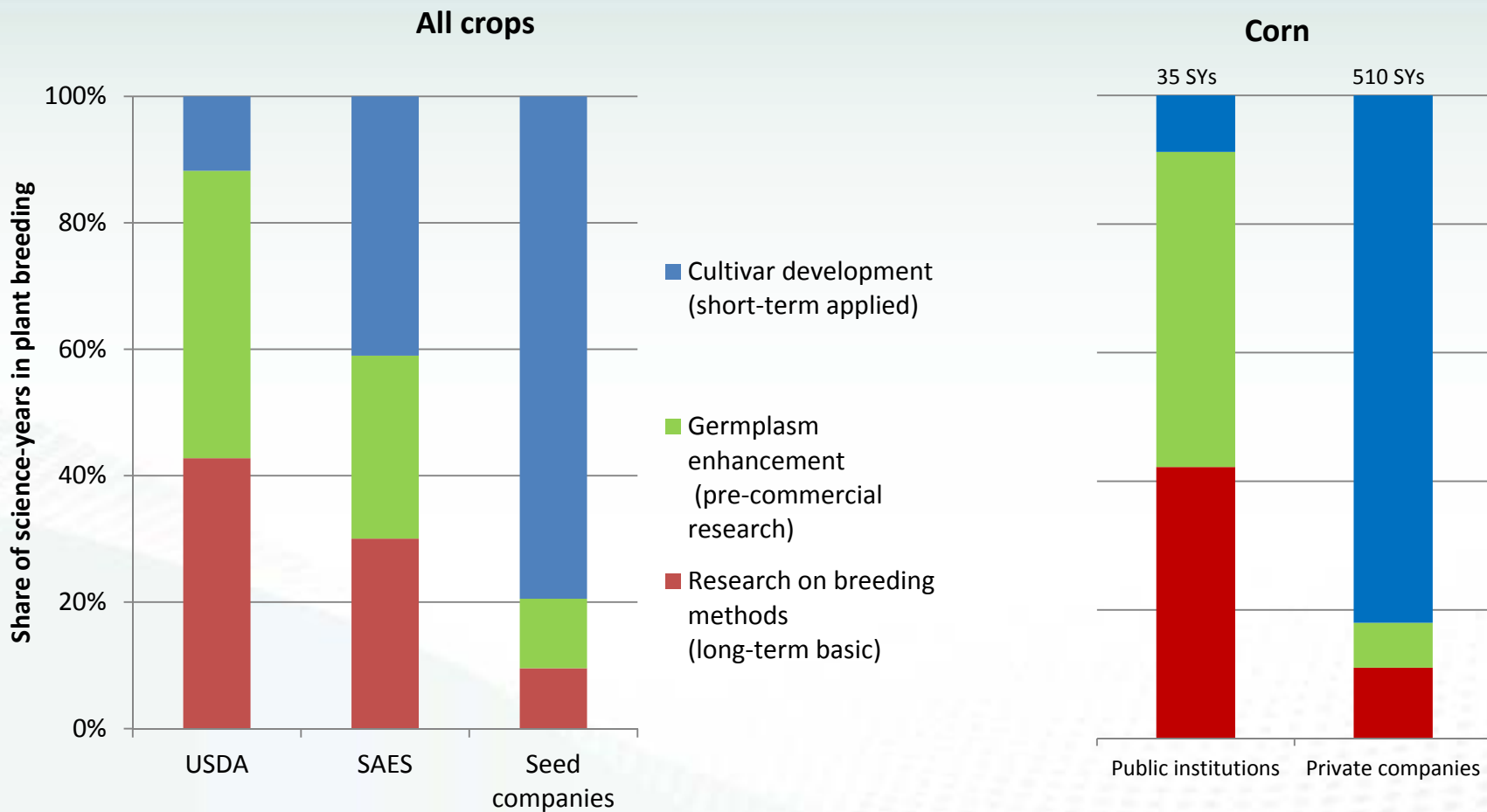
Source: ERS based on Current Research Information System and Fuglie et al. (2011)



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# Across all crops, plant breeding activity allocation differs between the public and the private sector (National Plant Breeding Study, 1994)



Source: Calculated from Frey (1996)

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## Public and private corn research the U.S. has co-evolved, as has crops research in general

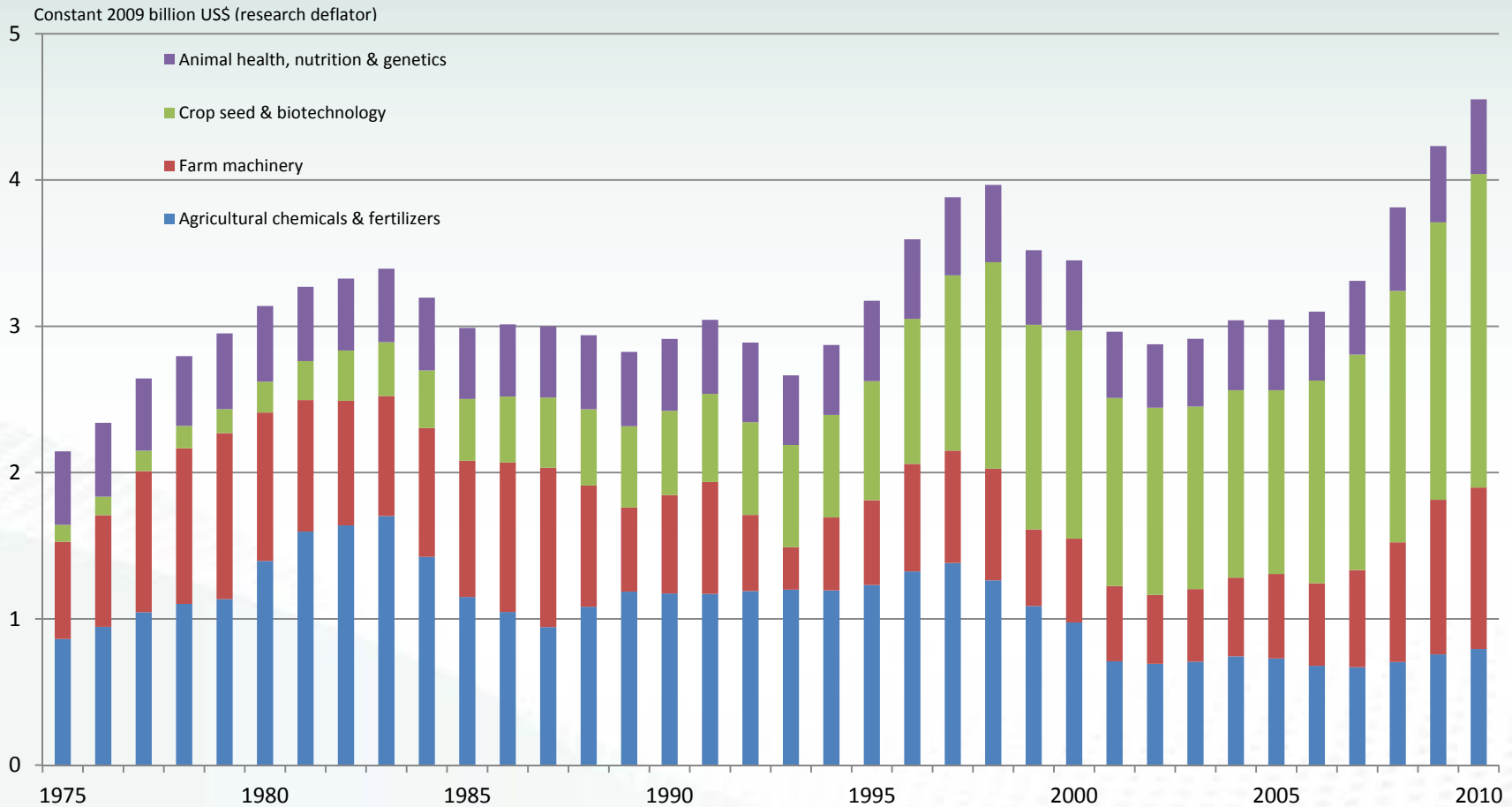
- 1930s—beginning of the diffusion of hybrid corn
- Early 1960s—hybrid corn approaches 100% of the U.S. corn area
- About 1970—half the U.S. corn area is still planted to hybrids with at least one public sector inbred parent
- About 1980—all of the U.S. corn area is now planted to hybrids with no public sector parents
- 1994—Frey (National Plant Breeding Study) finds about 35 scientist years in public sector plant breeding activities in corn; about 510 scientist years in the private sector
- Today (informal information)—four plant breeders for field corn still at the State Agricultural Experiment Stations?
  - North Dakota—new environment, about ready to hand over to the private sector
  - Wisconsin and New York—breeders focused on dairy silage
  - North Carolina—program focused on germplasm development through the introduction of exotic genetic material



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# Seed/biotechnology research has been the growth component of all U.S. private sector agricultural research



Source: Fuglie et al. (2011)



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## Market concentration is rising in the global crop seed and biotechnology industry

Year	Four-firm concentration ratio	Eight-firm concentration ratio
	Share of global market (percent)	
1994	21.1	29.0
2000	32.5	43.1
2009	53.9	63.4

Source: ERS based on Fuglie et al. (2011)



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## Different measures of research output or new product commercialization reflect high concentration ratios in the seed-biotechnology industry

Measure of research output or new product commercialization	Share held by “Big 6” companies (including subsidiaries and acquisitions)
U.S. patents issued for all crop cultivars, 1982-2007	76
U.S. patents issued for agricultural biotechnology, 1976-2000	64
Field trials of genetically modified (GM) plants in the U.S., 1985 to mid-2008	62
GM crop approvals for planting or environmental release globally, 1985 to 2007	87
Market share for U.S. corn seed, 2007	70
Market share for U.S. soybean seed, 2007	55
Market share for U.S. cotton seed, 2007	92
Market share of trait-acres* for GM corn, soybeans, cotton, and canola worldwide in 2007	>95
Market share of trait-acres* for GM corn, soybeans, and cotton in the U.S. in 2009	>95 (90% held by top firm)

\*A “trait-acre” is the area sown to GM crops, where stacked GM traits are counted as multiple acres, depending on the number of traits stacked in a single seed.

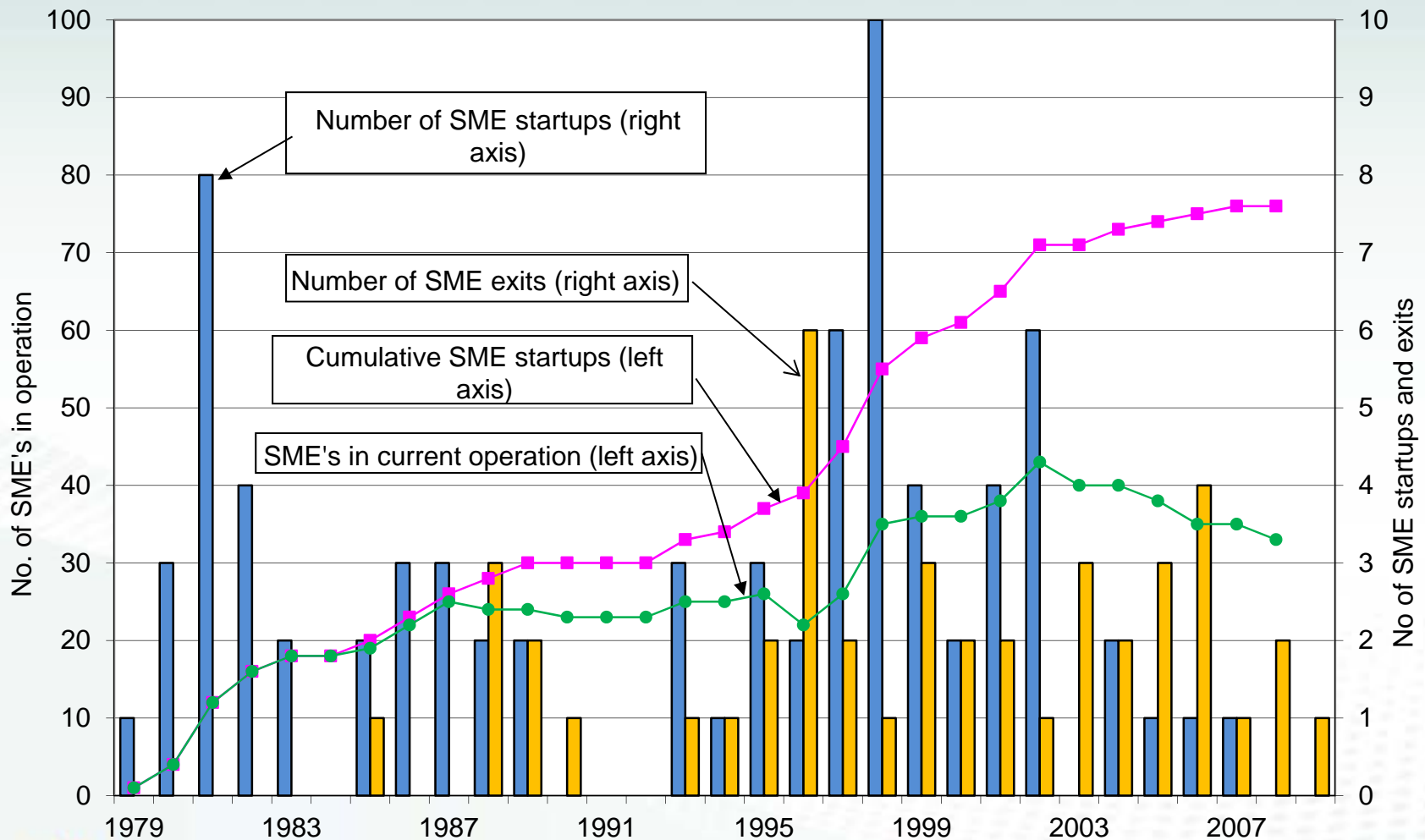


Source: ERS, using Fuglie et al. (2011) and Moschini (2010)

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## In recent years startups and total firms in the small and medium agricultural biotechnology sector appear to have declined



Source: Fuglie et al. (2011)

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Thank you!

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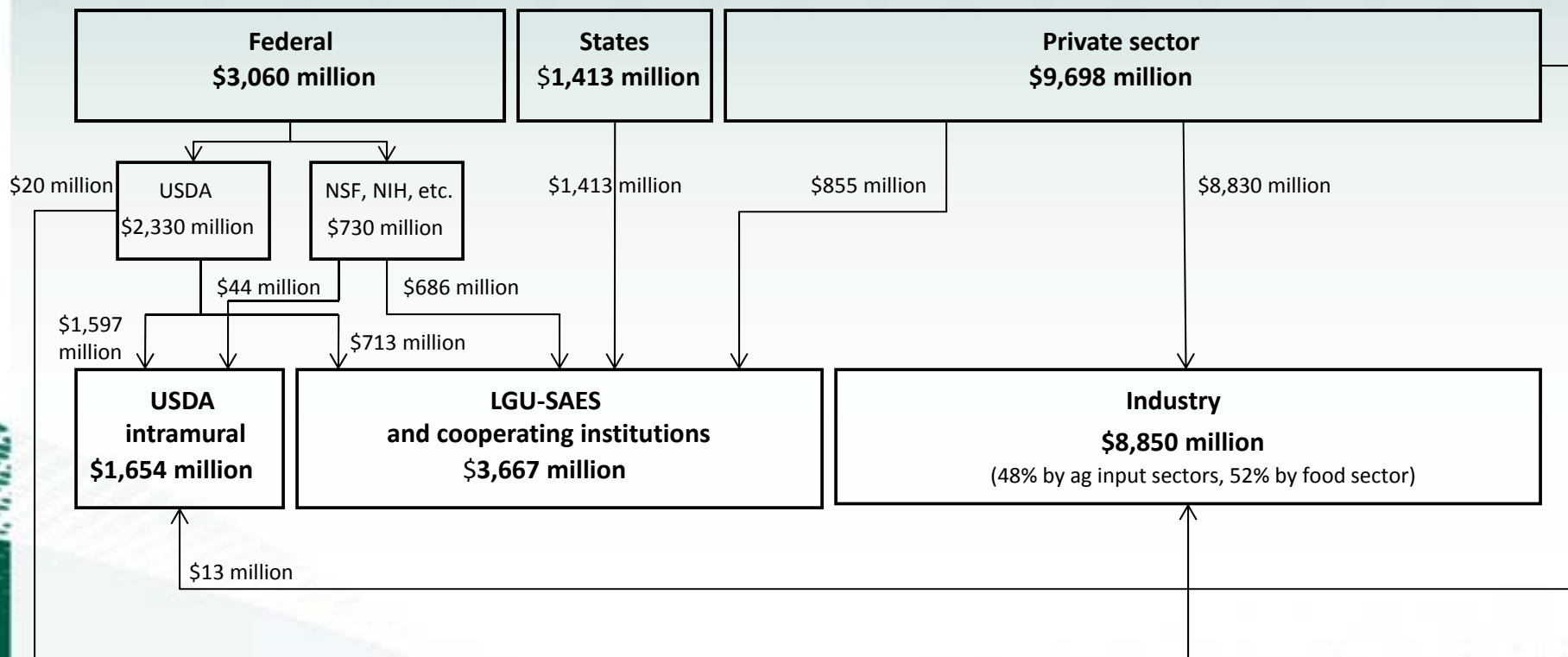
## Additional slides



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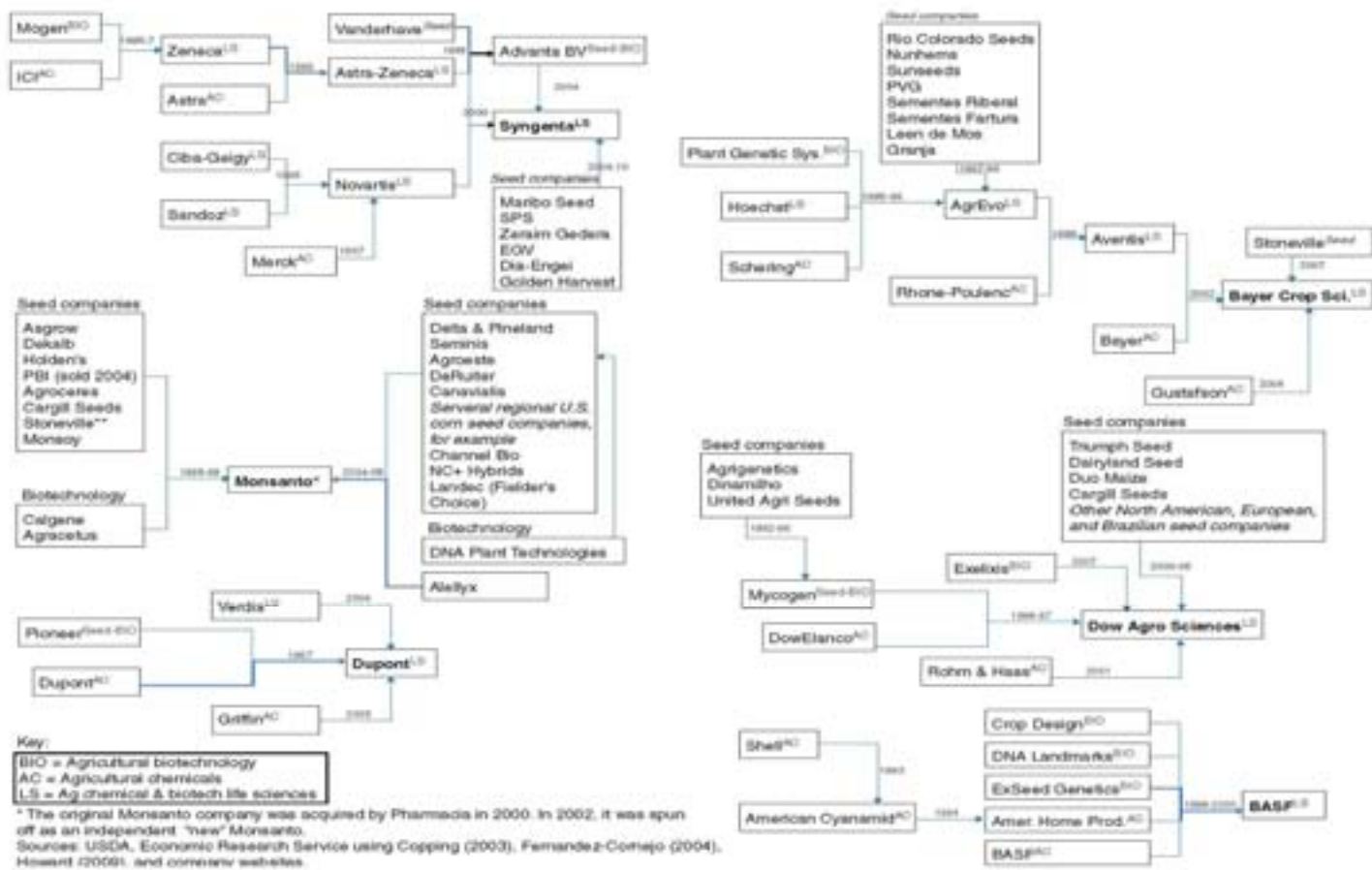
# Funders and performers of U.S. agricultural and food research, 2009



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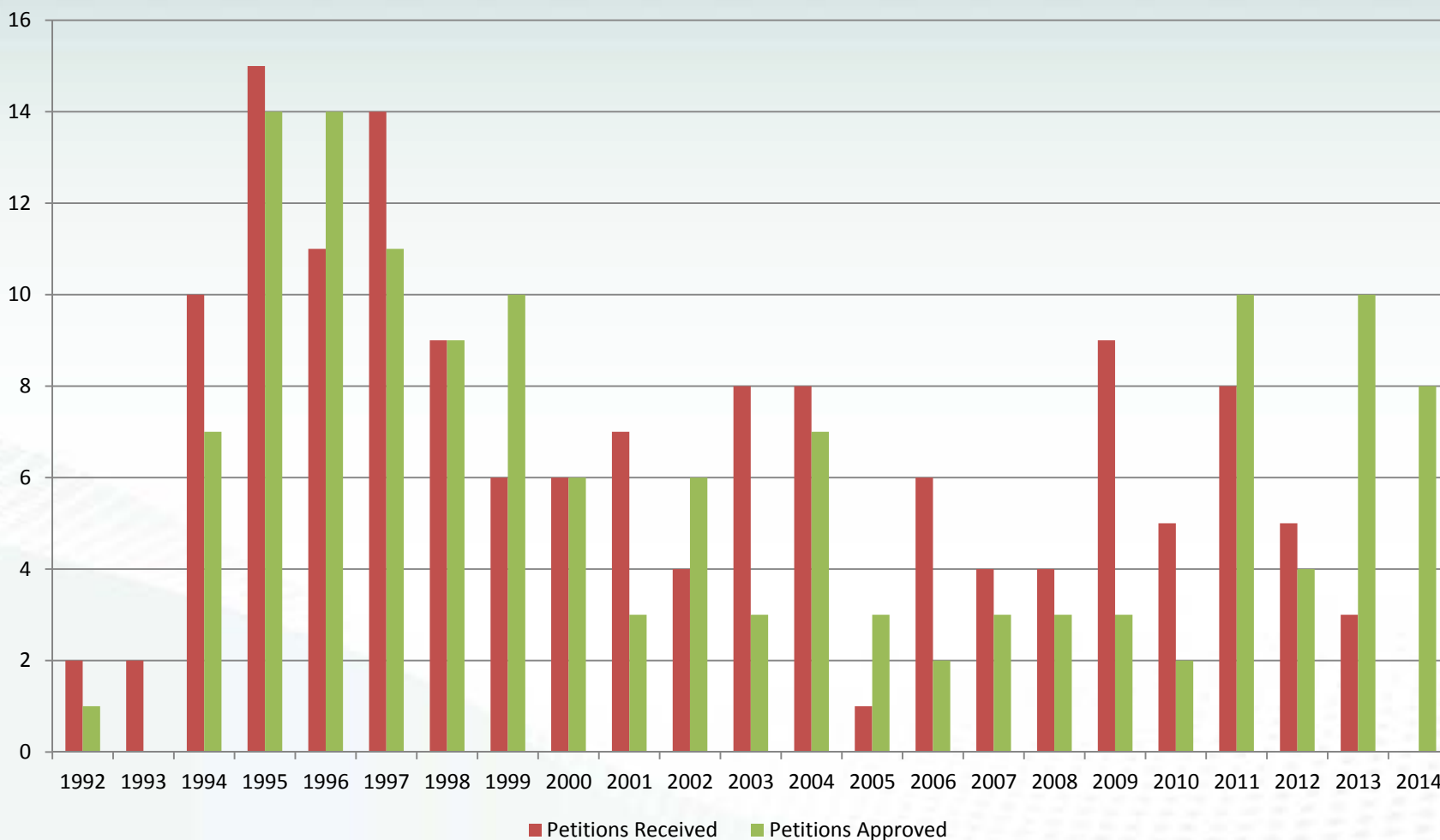
# Formation of the “Big 6” seed-biotechnology-chemical companies



Source: Fuglie et al. (2011)  
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## Petitions to USDA for deregulation of GM crops were highest in the mid-1990s, more variable since



Source: Calculated from Information Systems for Biotechnology (ISB) database, Virginia Tech

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