Innovation and Market Structure: The Seed and Chemical Industry

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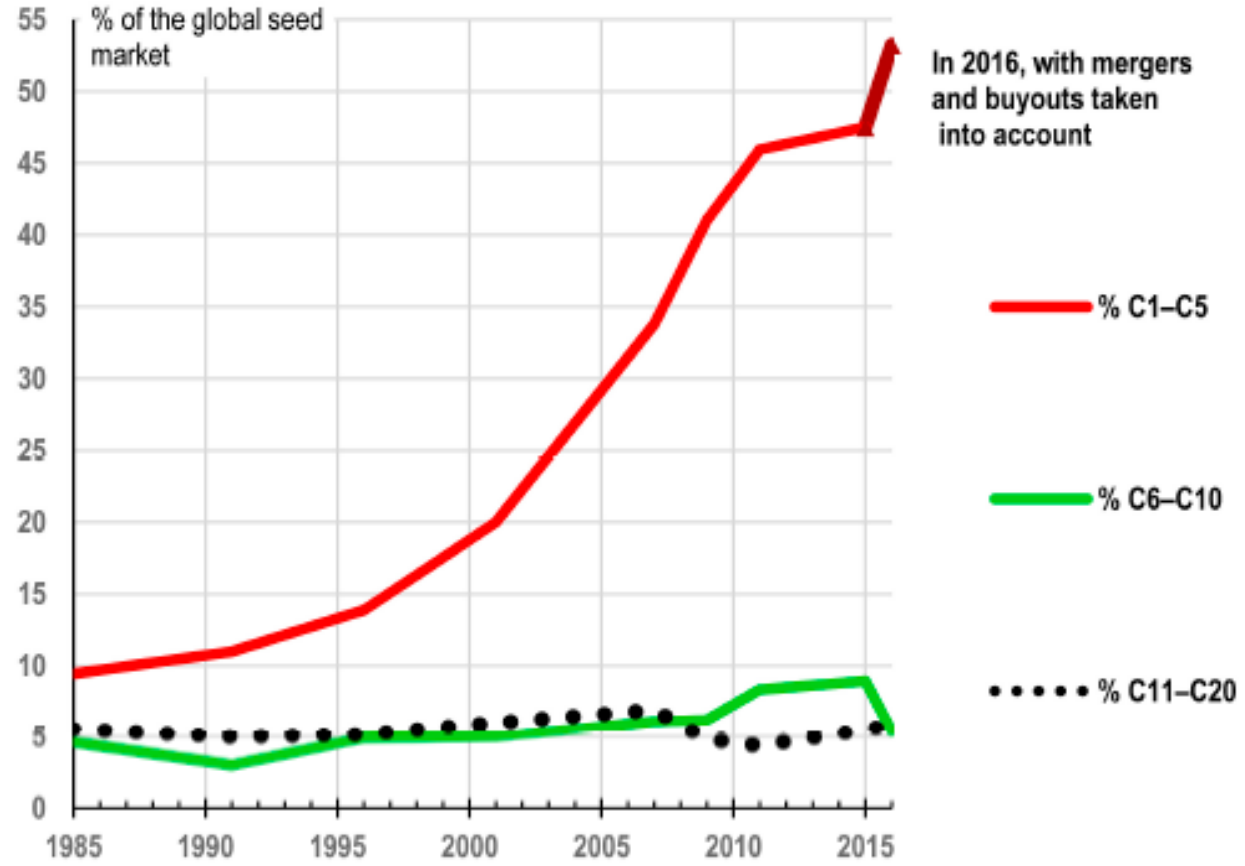
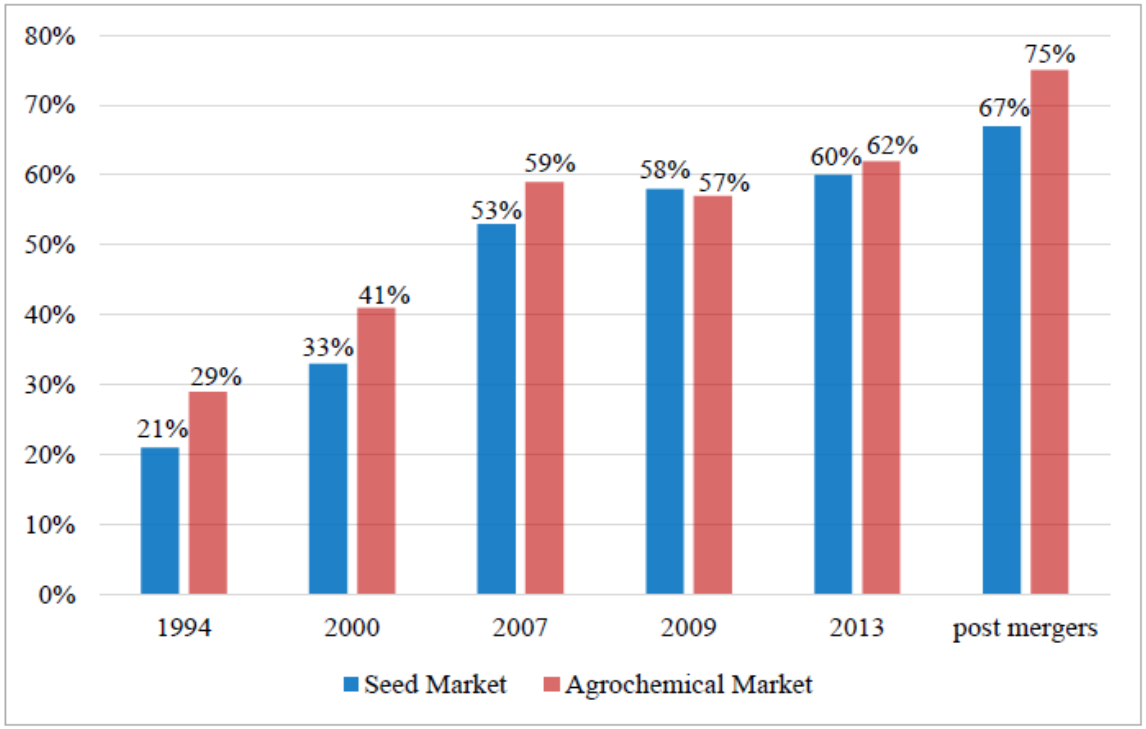
Consolidation and Concentration in Agrochemical and Seed Industries



Source: Bonny (2017) constructed using data from Dunwell (2016), Fernandez-Cornejo (2004), Fuglie, et al. (2011), Howard (2009), and Howard (2016)

Impact of Mid-2010s Mega-Mergers and Acquisitions

Figure 4: Global CR4 Seeds and Agrochemicals



Sources: Compiled from data in Fuglie 2011; ETC Group reports

Source: Clapp (2017)

Explanations for Observed Consolidation and Concentration

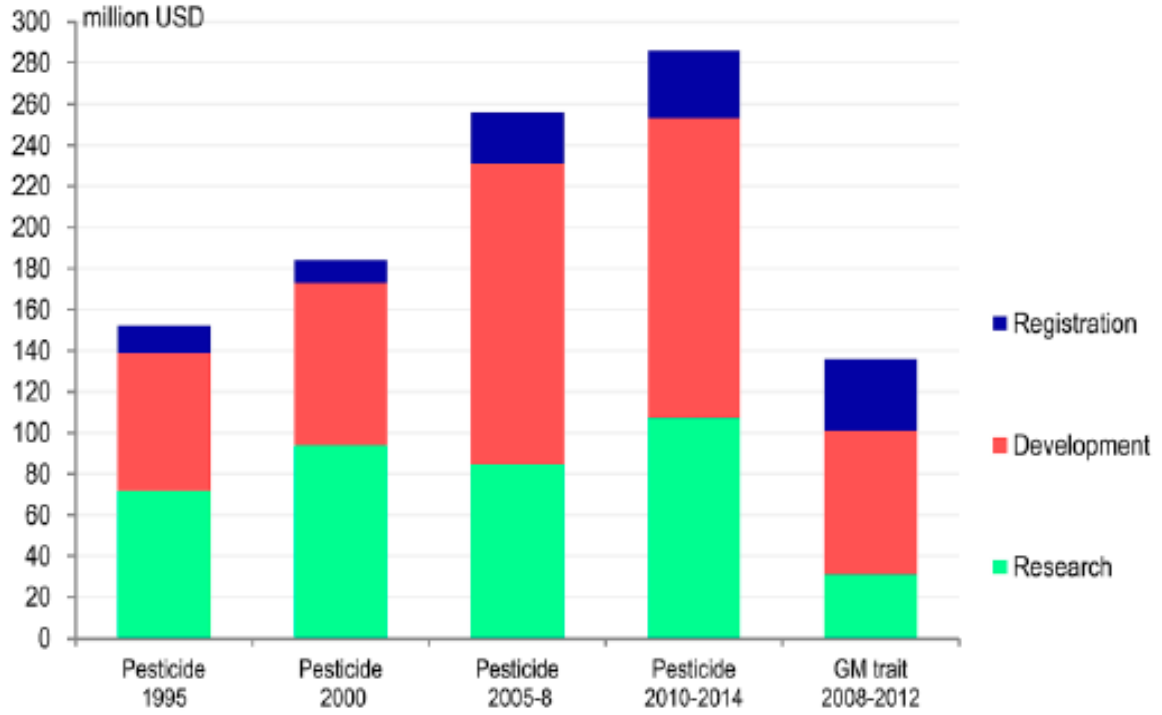
- Anticompetitive behavior
  - Raising prices
  - Bundling of seeds and agrochemicals
  - Reducing varieties and/or limiting farmers' choices

Explanations for Observed Consolidation and Concentration

- Favorable regulatory/legal environment
  - Plant Protection Act (1930)
  - Plant Variety Protection Act (1970)
  - *Diamond v. Chakrabarty* (1980)
    - *Ex parte Hibberd* (1985)
  - *J.E.M. v. Pioneer* (2001)
    - *Bowman v. Monsanto* (2013)

Explanations for Observed Consolidation and Concentration

- Differential returns to or costs of R&D



Source: Bonny (2017) constructed using data from McDougall (2011) and McDougall (2016)

Explanations for Observed Consolidation and Concentration

- Economies of scale
- Economies of scope
- "Synergies"
  - Complementary products/markets
  - Complementary technologies

Innovation in Agrochemical and Seed Industries

Table 1.7
Market concentration and research and development (R&D) intensity in global agricultural input industries

Year	Herfindahl index	4-firm concentration ratio	8-firm concentration ratio	Industry R&D intensity
		Share of market (%)		*R&D/sales (%)*
Crop protection chemicals				
1994	398	28.5	50.1	7.0
2000	645	41.0	62.6	6.8
2009	937	53.0	74.8	6.4
Crop seed and traits				
1994	171	21.1	29.0	11.0
2000	349	32.5	43.1	15.0
2009	991	53.9	63.4	10.5

n.a. = not available.
Source: USDA, Economic Research Service estimates based on firm-level sales and R&D expenditure data collected for this study. See specific chapters for details.

Source: Fuglie, et al. (2011)

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Table 1.9
Company size and research and development (R&D) spending in agricultural input industries in 2006

Sector	Companies	Average R&D intensity	Global R&D share	Global market share
	Number		*Percent*	
Crop protection chemicals				
Large discovery companies (>$2 billion sales)	5	9.0	74.1	57.4
Second-tier discovery companies (<$2 billion sales)	17	7.3	19.6	18.7
Other manufacturers	23	2.3	7.7	23.9 est.
Crop seed and biotechnology				
Large seed companies (> $600 million sales) + BASF	8	15.8	75.6	48.8
Midsize seed companies ($50-600 million sales)	29	7.3	13.7	19.2
Other seed companies	n.a.	2.0	3.1	16.0 est.
Agricultural biotechnology companies	58	42.1	7.6	1.8

est. = authors' estimate. n.a. = not available.

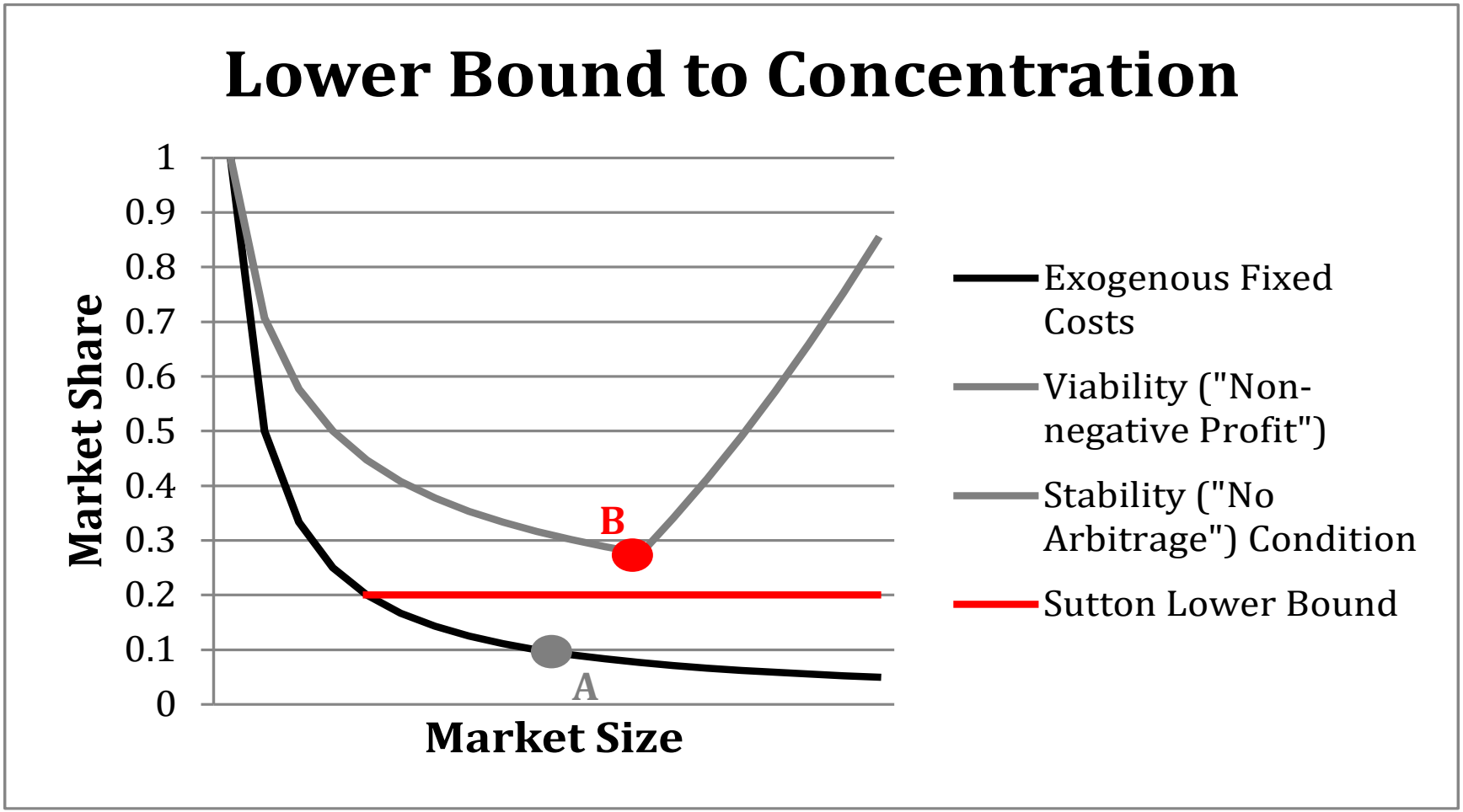
Source: USDA, Economic Research Service. See chapters for specific sources and methods.

Source: Fuglie, et al. (2011)

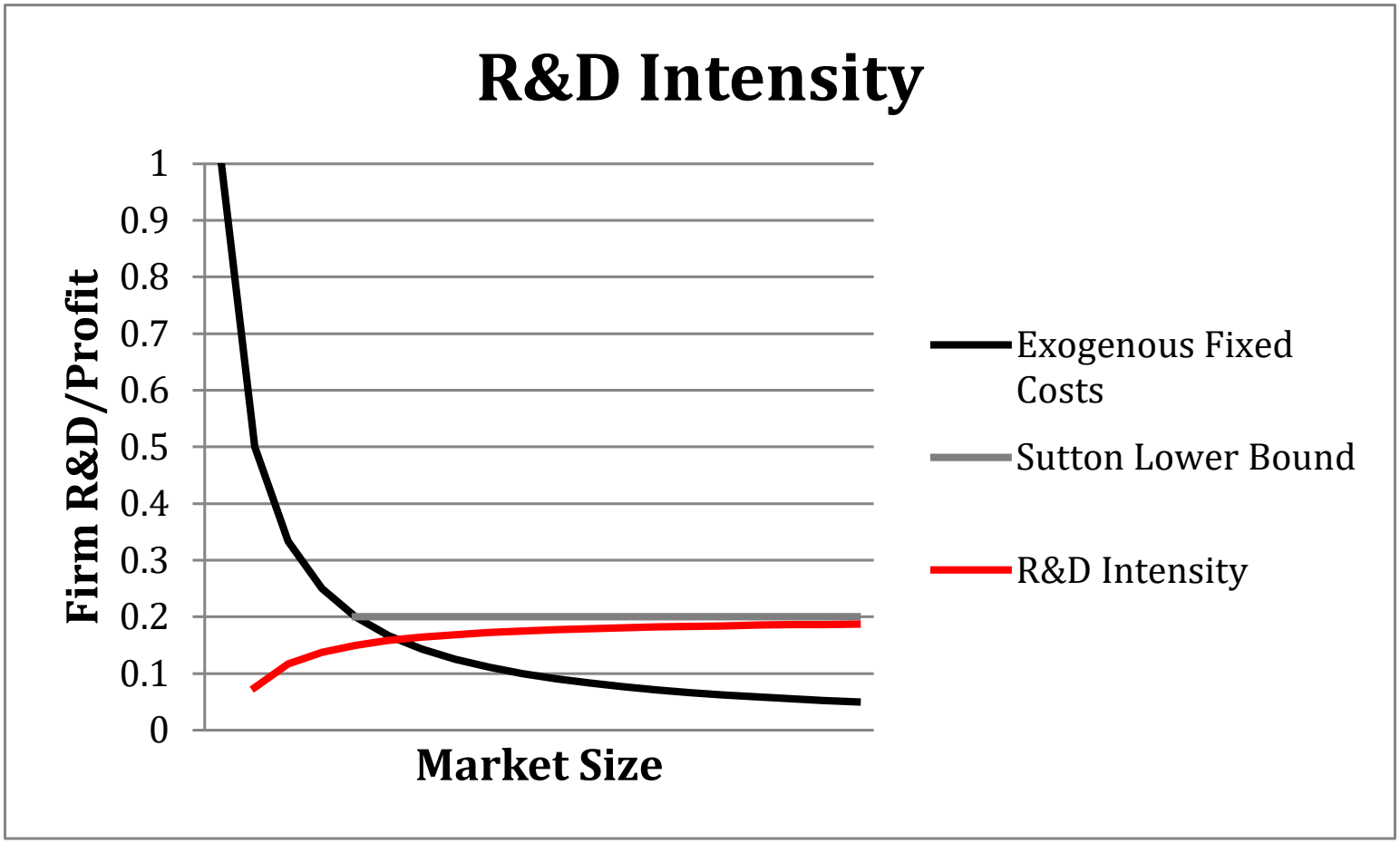
Innovation in Agrochemical and Seed Industries

- Schimmelpfenig, et al. (2004)
- Brennan, et al. (2005)
- Magnier, et al. (2010)
- Charlot, et al. (2015)
- Deconinck (2018)
- Silva, et al. (2018)
- Régibeau and Rockett (2021)

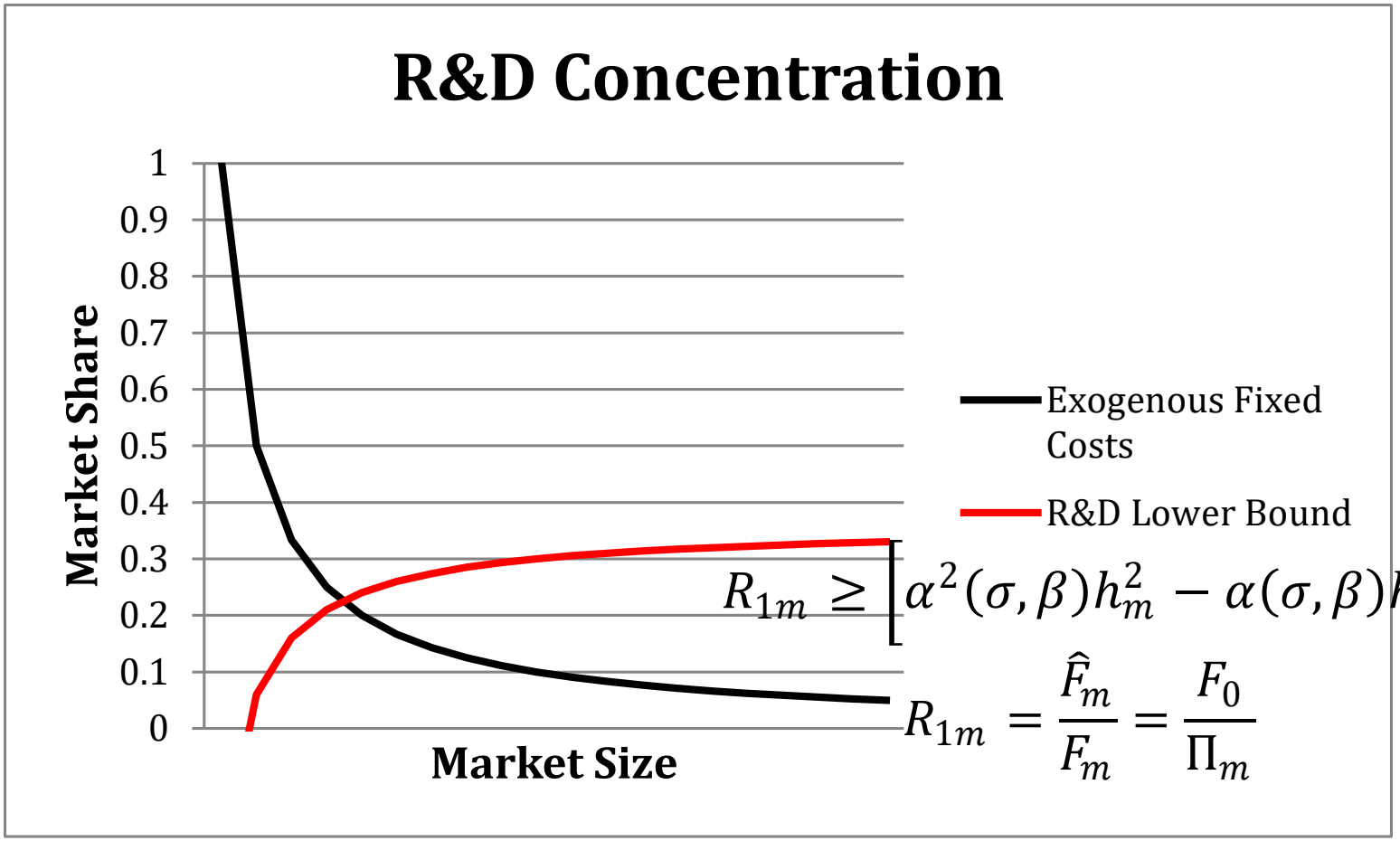
Lower Bound to Concentration – Sutton (1991, 1998, 2007)



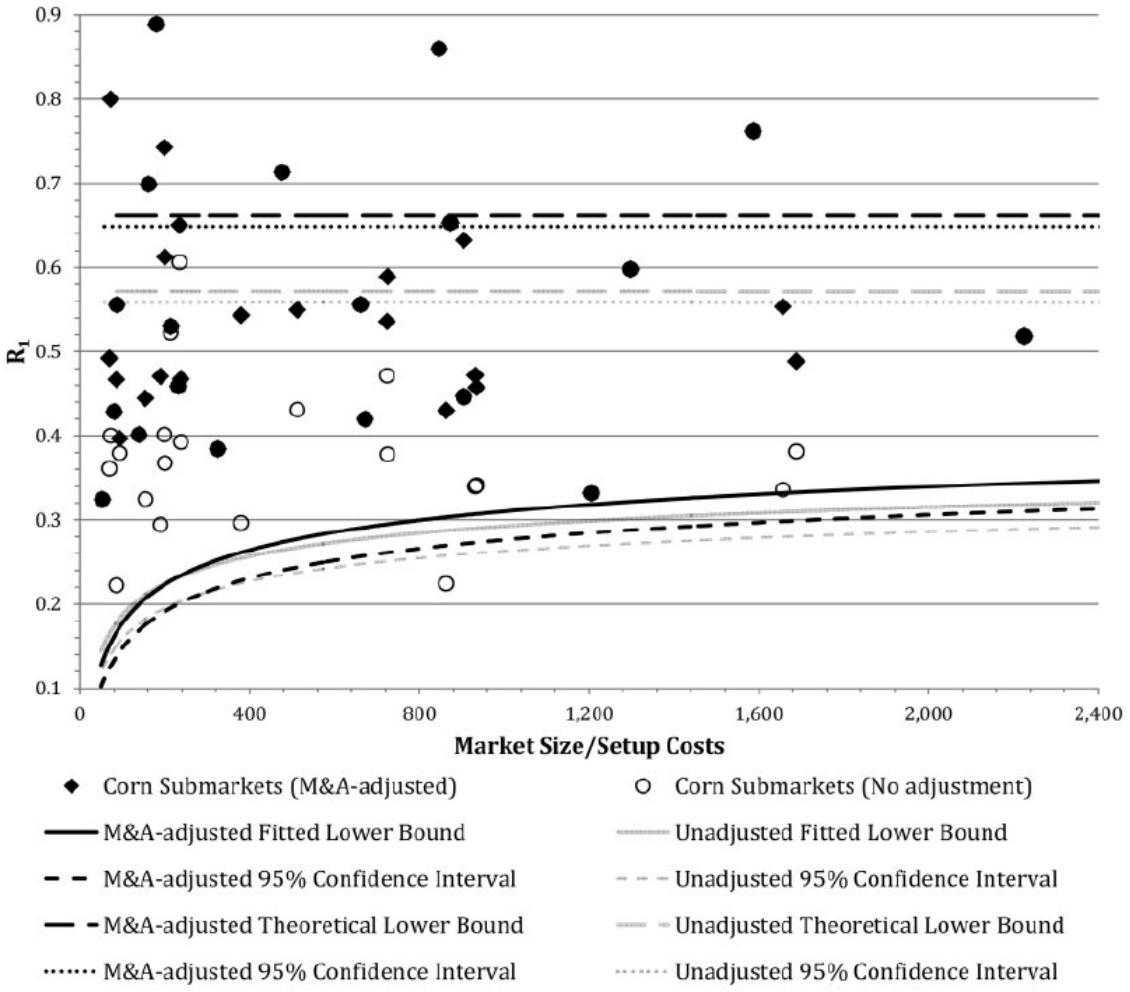
R&D Intensity Lower Bound



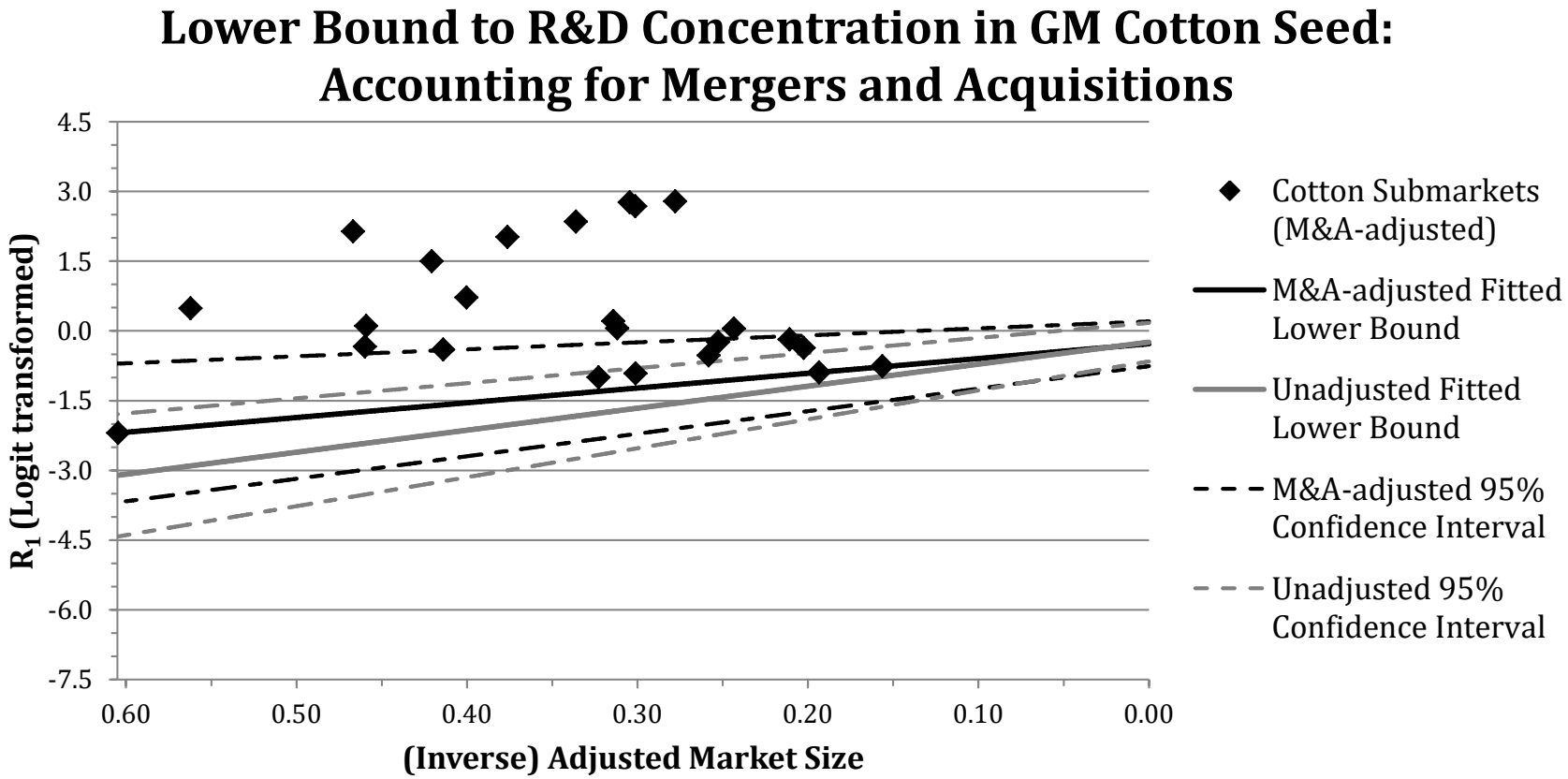
Lower Bound to R&D Concentration – Anderson and Sheldon (2017)



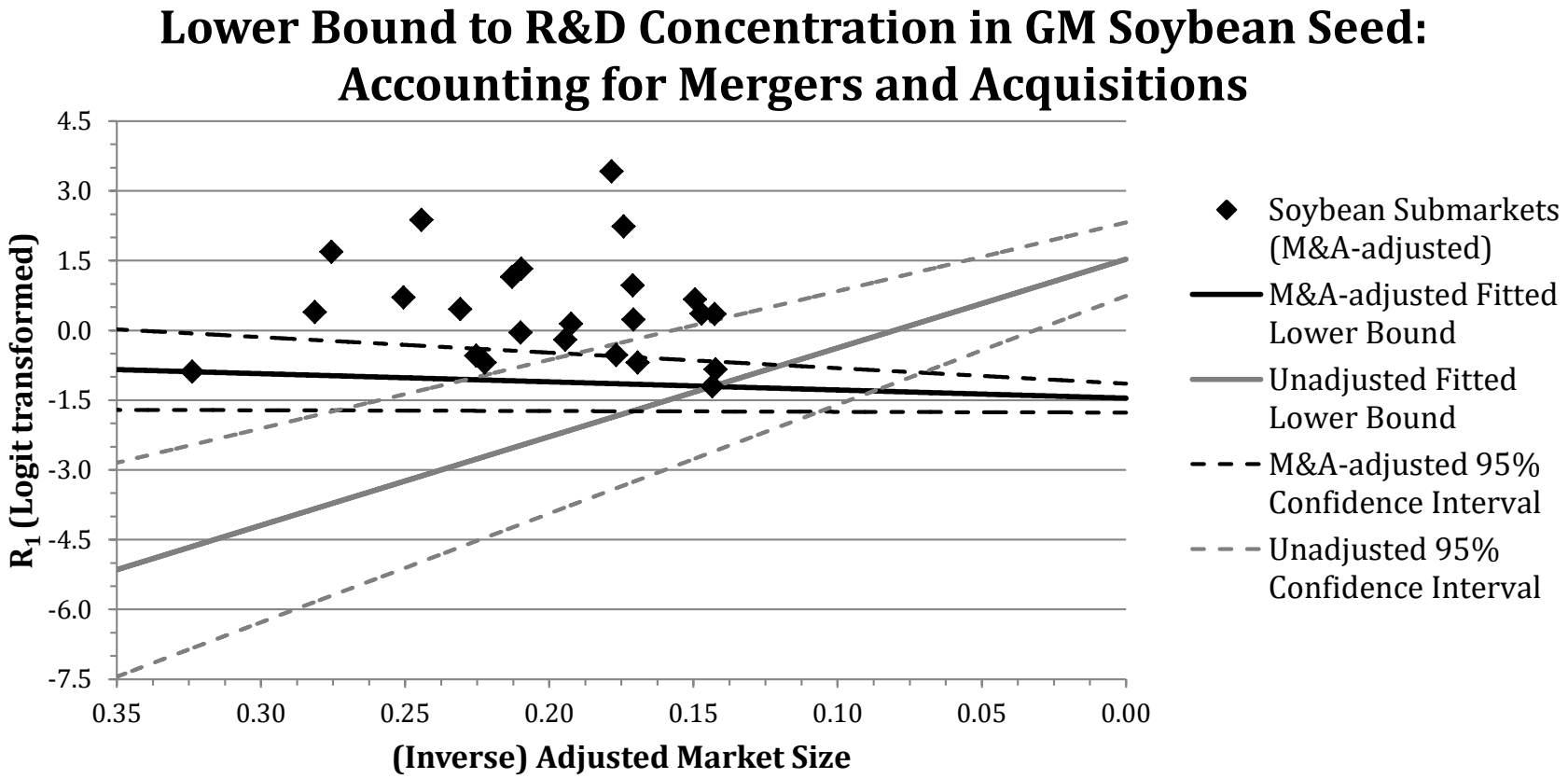
Lower Bounds to R&D Concentration in GM Corn Seed



Lower Bounds to R&D Concentration in GM Cotton Seed



Lower Bounds to R&D Concentration in GM Soybean Seed



M&A Antitrust Enforcement and Innovation

- Régibeau and Rockett (2019)
  - Concentration alone is insufficient to show diminishing incentives to innovate
  - Divestment may be sufficient to address innovation effects in addition to price effects
- Whither recent mega-mergers/acquisitions?
  - Bayer-Monsanto
  - Dow-DuPont
  - ChemChina-Syngenta

Concluding Thoughts

- "Welfare effects" vs. "public policy effects"
  - Food security, biodiversity, and/or biased selection of potential research projects
  - Research foreclosure and control of IPR
  - Regulatory burden, fixed costs, and market and R&D concentration
- Hovencamp and Shapiro (2018)

Régibeau and Rockett (2019)

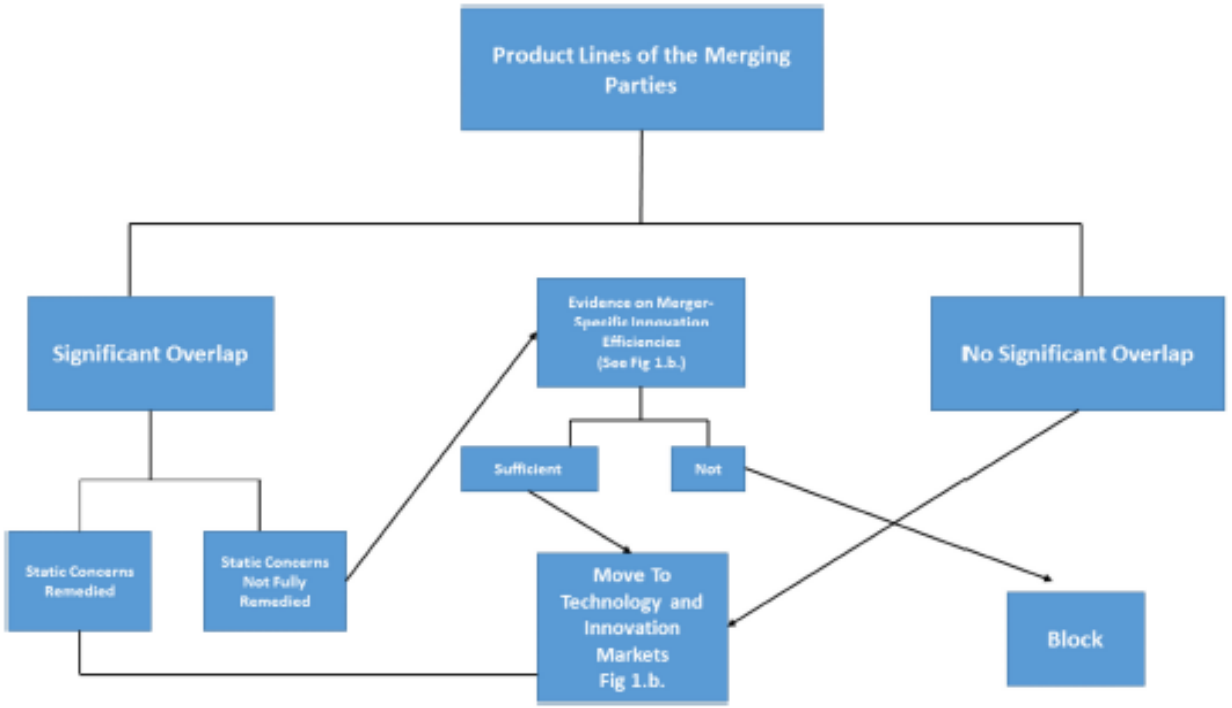


Figure 1.a. Product market analytical structure.

Source: Régibeau and Rockett (2019)

Régibeau and Rockett (2019)

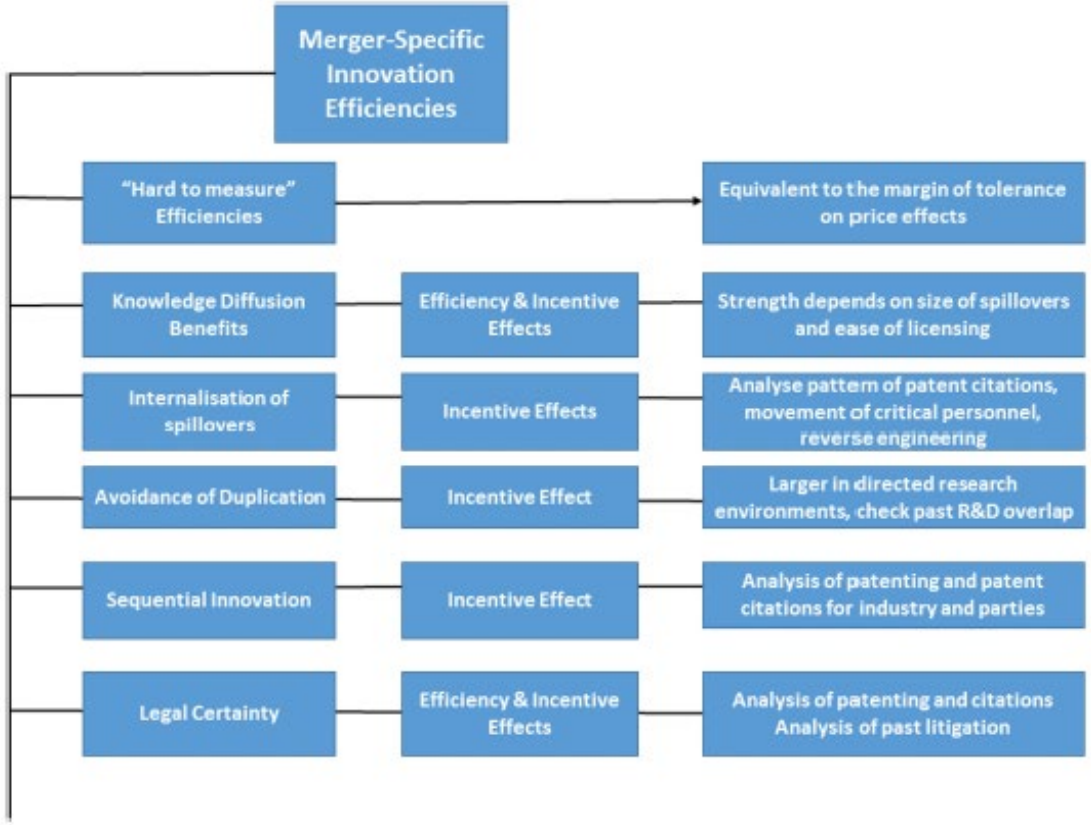


Figure 1.b. Product market analytical structure: sources of efficiencies.

Source: Régibeau and Rockett (2019)