Agricultural and Food Innovation: Europe in a Changing Global Reality

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Designing the Path: A Strategic Approach to EU Agricultural Research and Innovation

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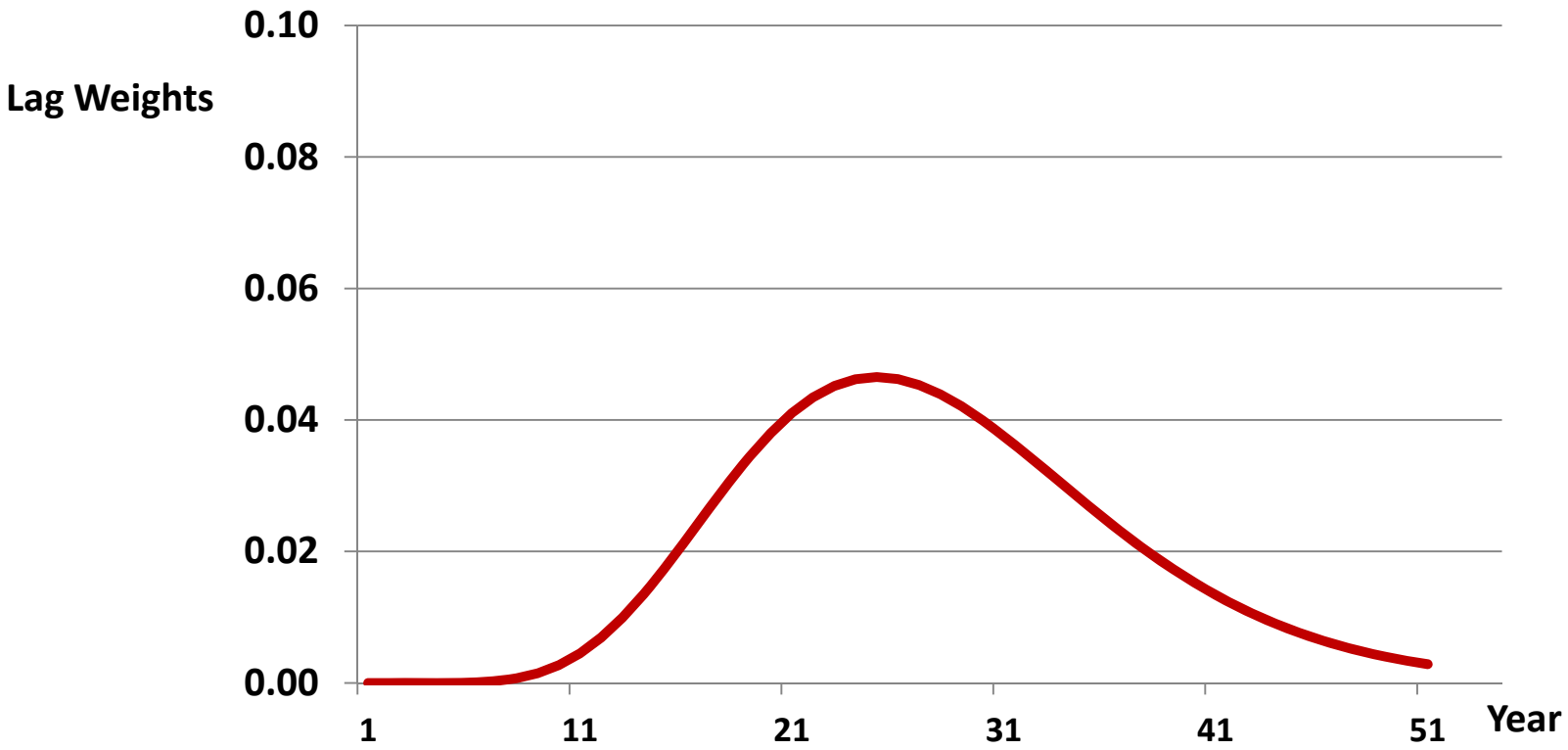
Outline

Thinking and acting for the long run

- Food and Agricultural Futures
  - Changing Agricultural Demand Realities
  - Changing Agricultural Supply (Production and Productivity) Realities
- Changing Food and Agricultural R&D Realities
- Implications for Food and Agricultural R&D

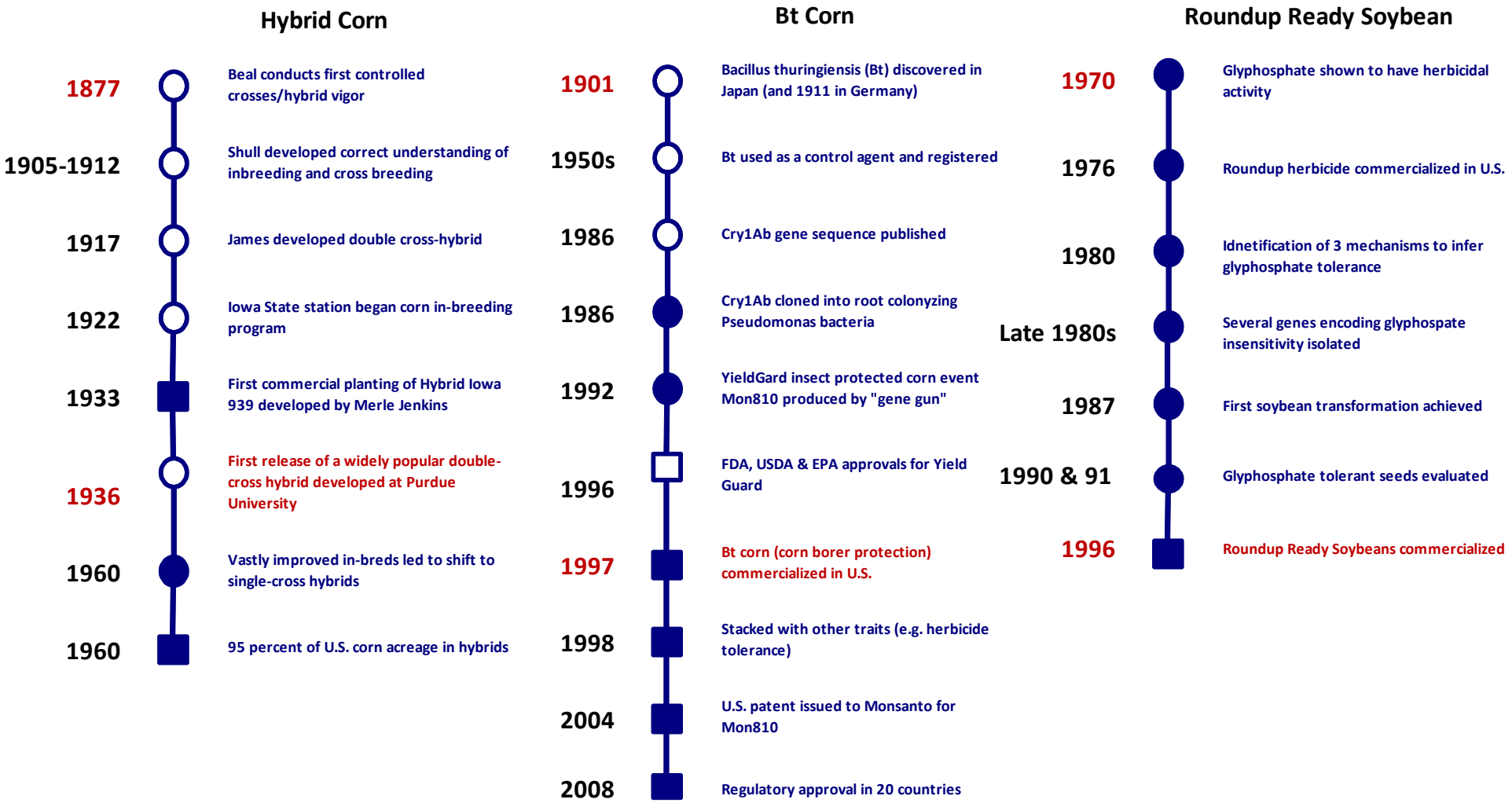
Why the Long Run Matters

R&D Investments → **Farm Productivity Growth**



Source: Alston, Anderson, James and Pardey (2010, 2011)

Illustrative Technology Development Lags (US)



Source: Pardey , Alston and Ruttan (2008) and Alston et al. (2010)

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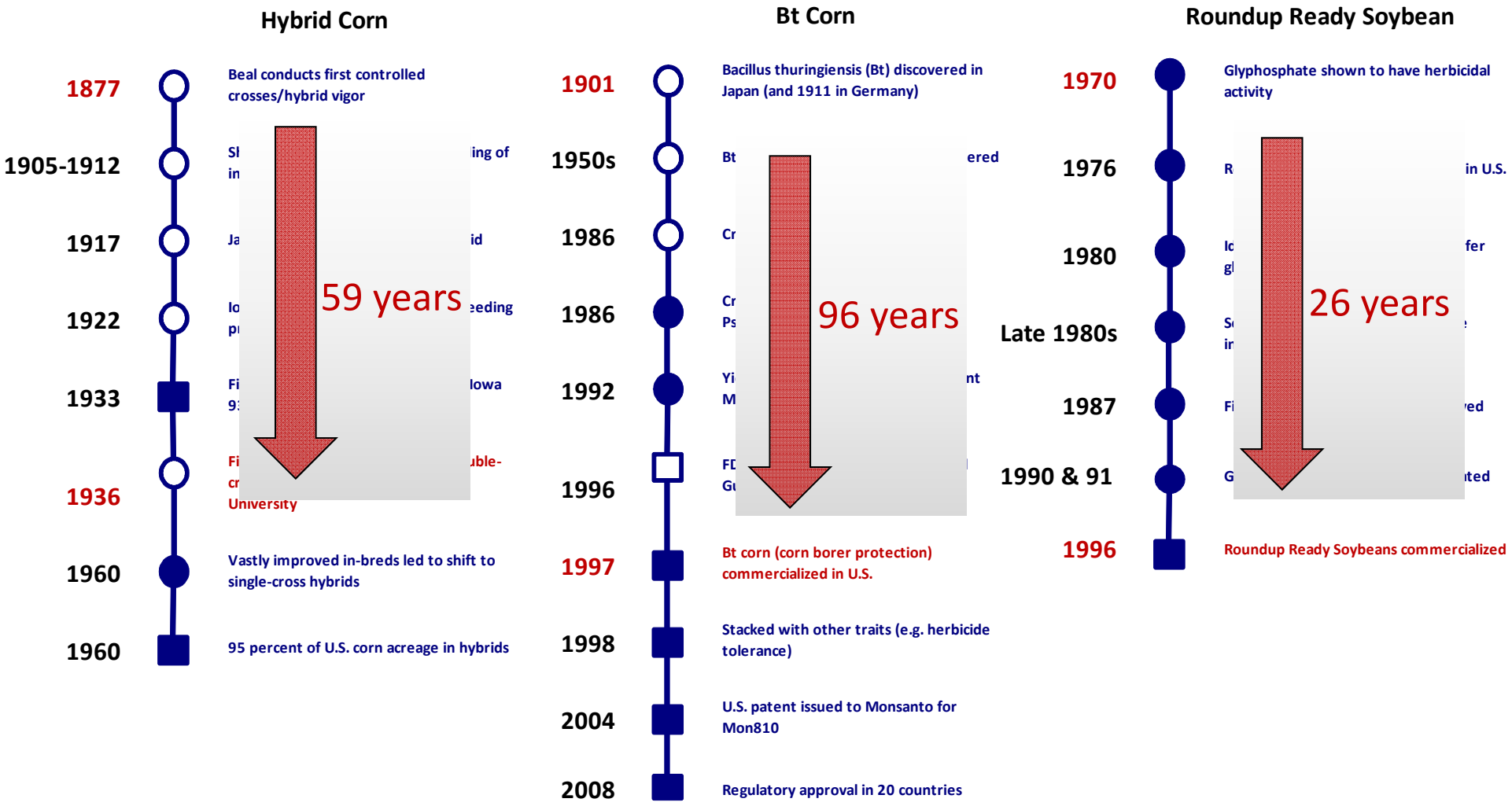

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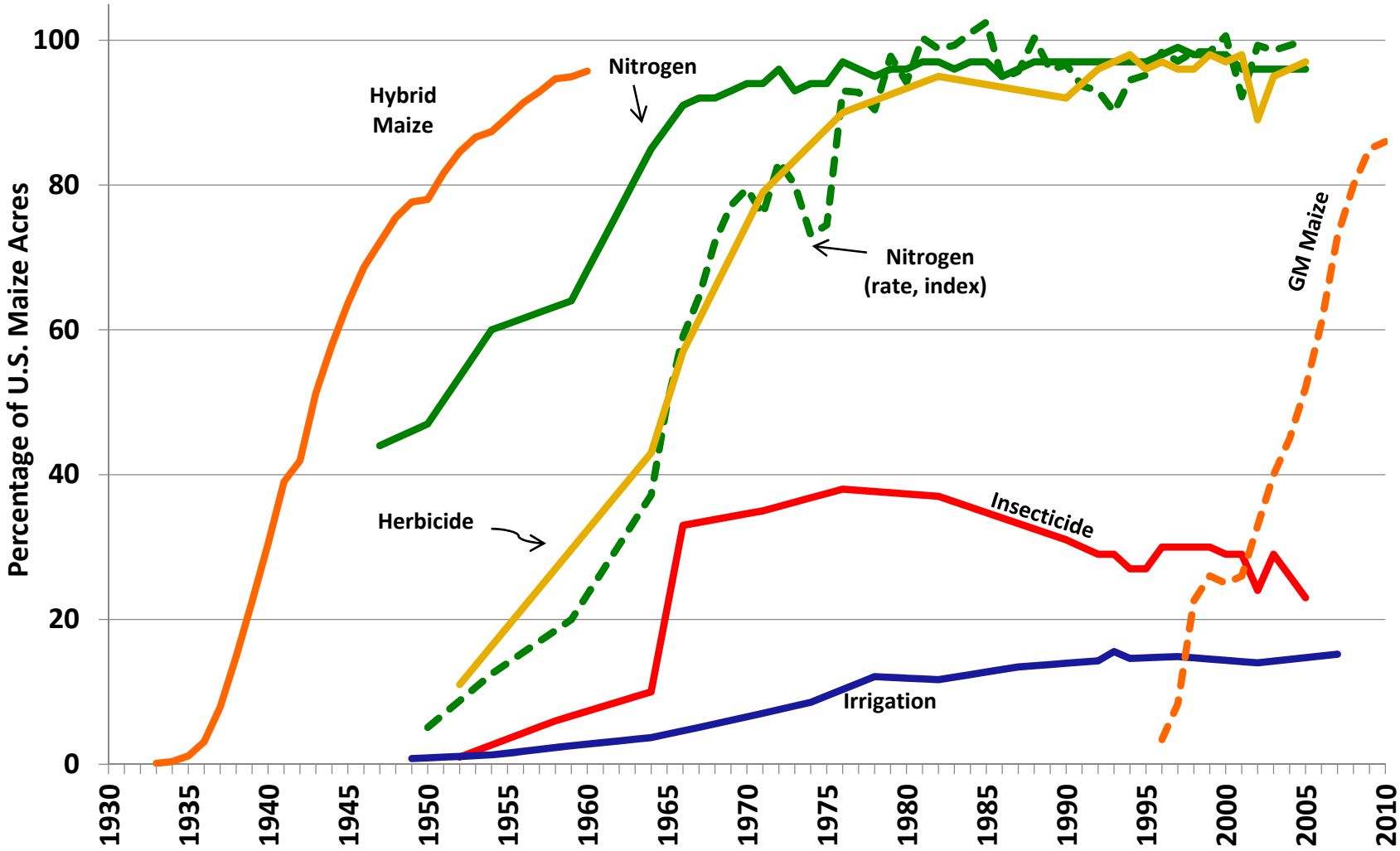
U.S. Maize Technology Adoption Lags



Source: Beddow (2012)

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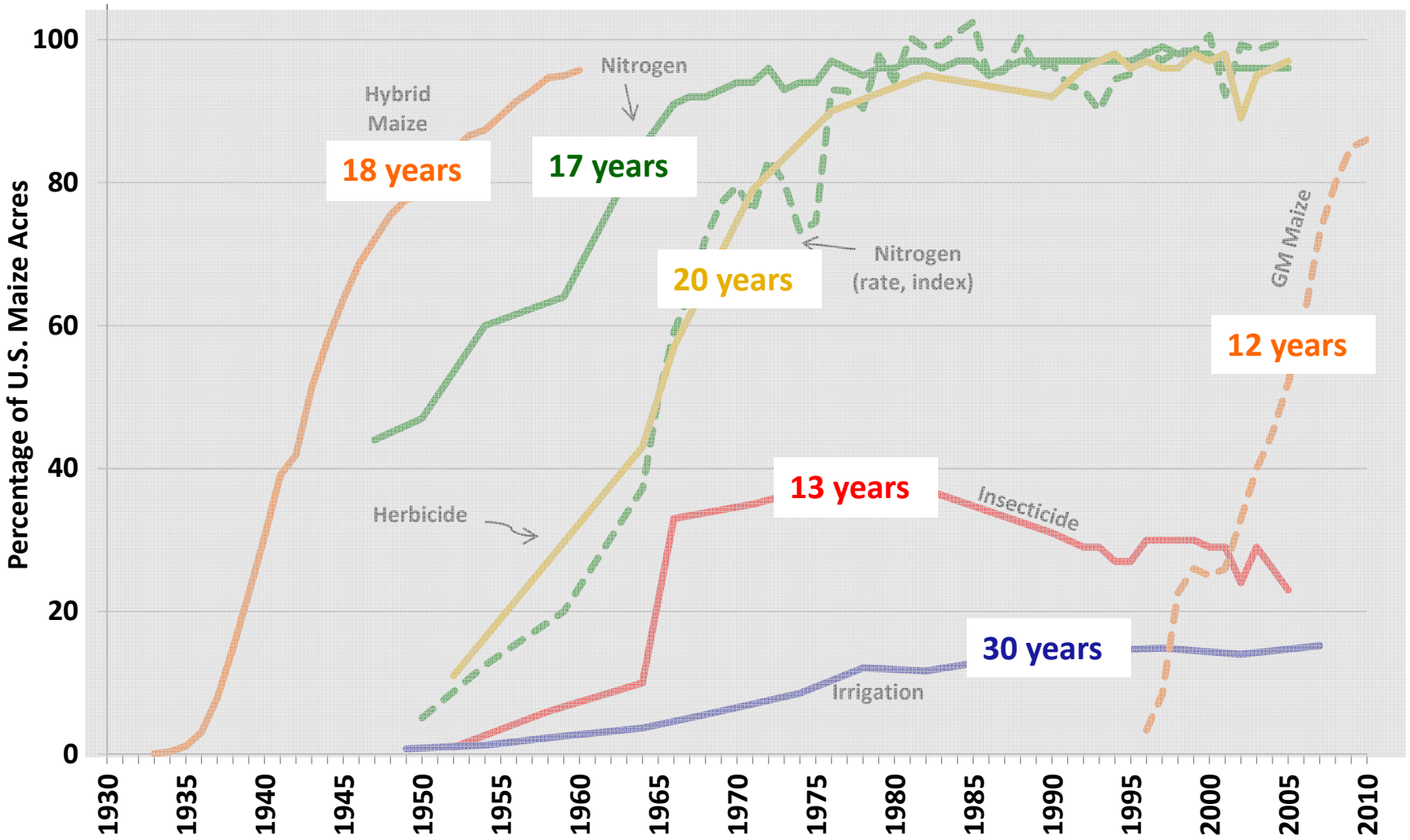


Source: Beddow (2012)

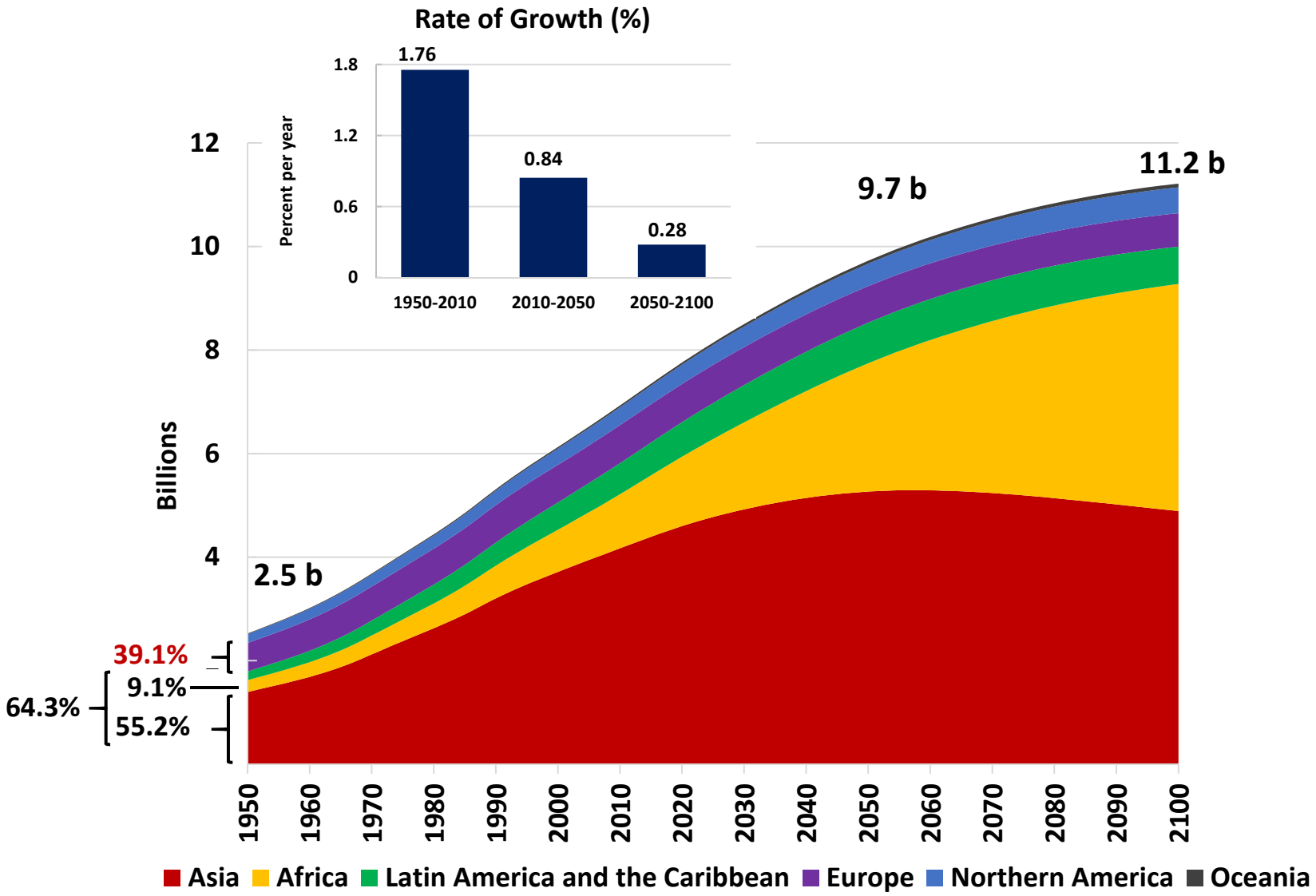
Changing Agricultural Demand Realities

Population continues to grow, as will per capita incomes

BUT

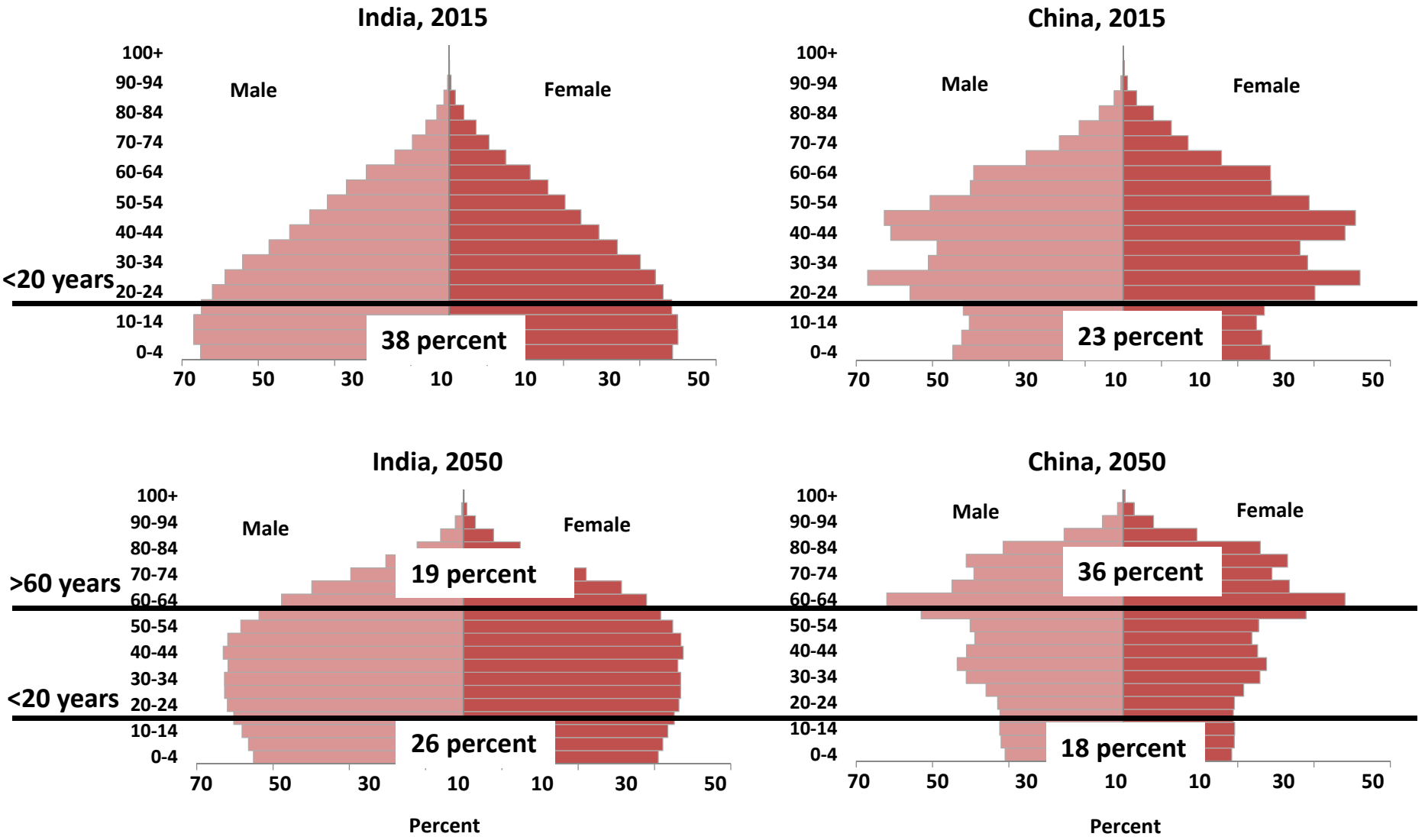
In important respects agricultural demand futures will not be like the past

Population Projections, 1950-2100



Source: UN Population Division (2015).

Age Pyramids



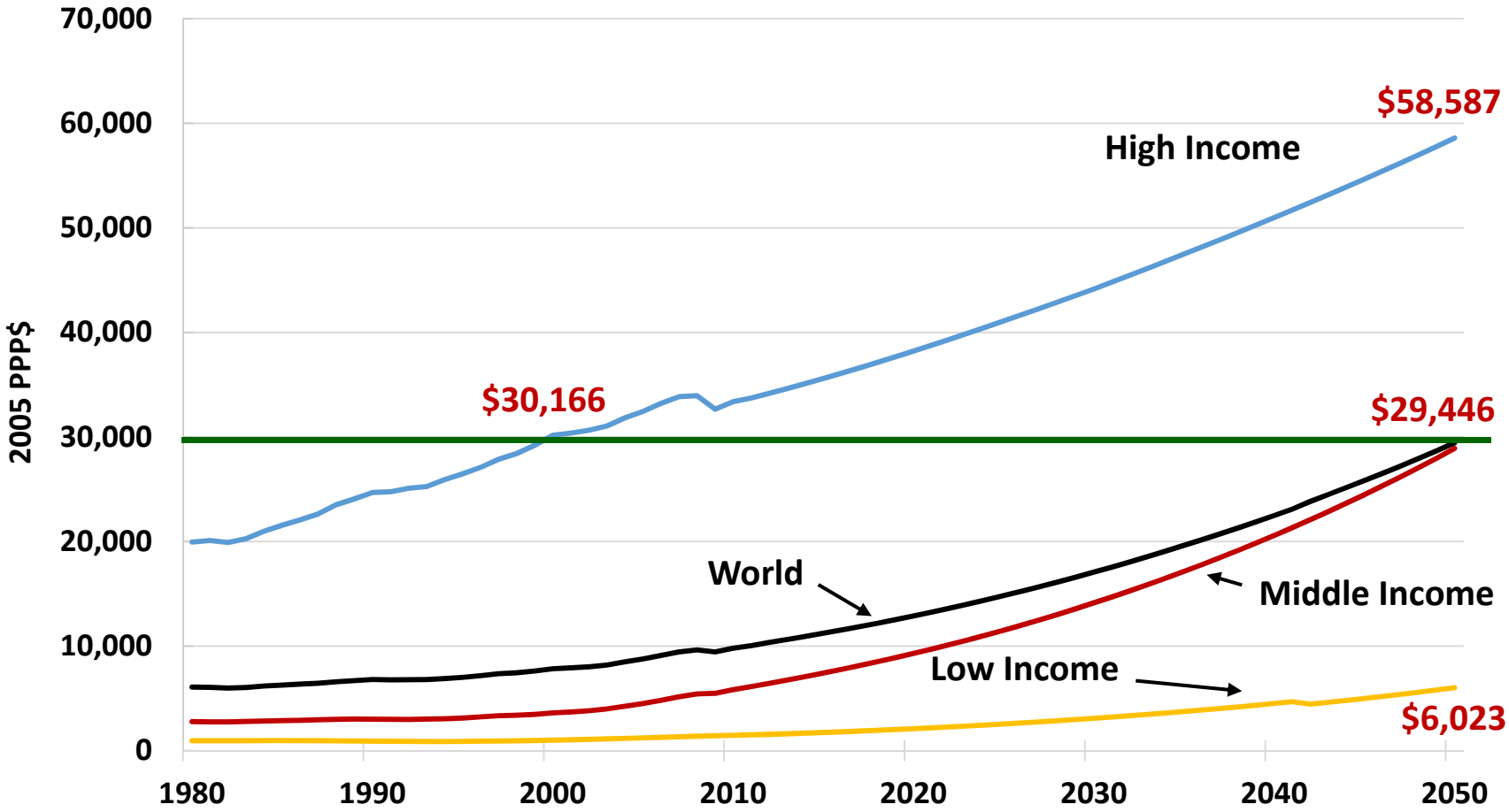
Source: UN Population Division (2015).

Behind the Aggregate Population Numbers

- Between 2015 and 2050
  - More than half the projected global population growth will occur in Africa
  - More than half the growth will occur in just nine countries (India, Nigeria, Pakistan, DR Congo, Ethiopia, Tanzania, United States, Indonesia and Uganda)
- Global life expectancy is expected to rise from 70 years in 2010-15 to 77 years in 2045-50, and 83 years in 2095-2100
  - The number of people aged 60 or more is projected to be 1.4bill. by 2030, 2.1bill by 2050, and 3.2bill by 2100.

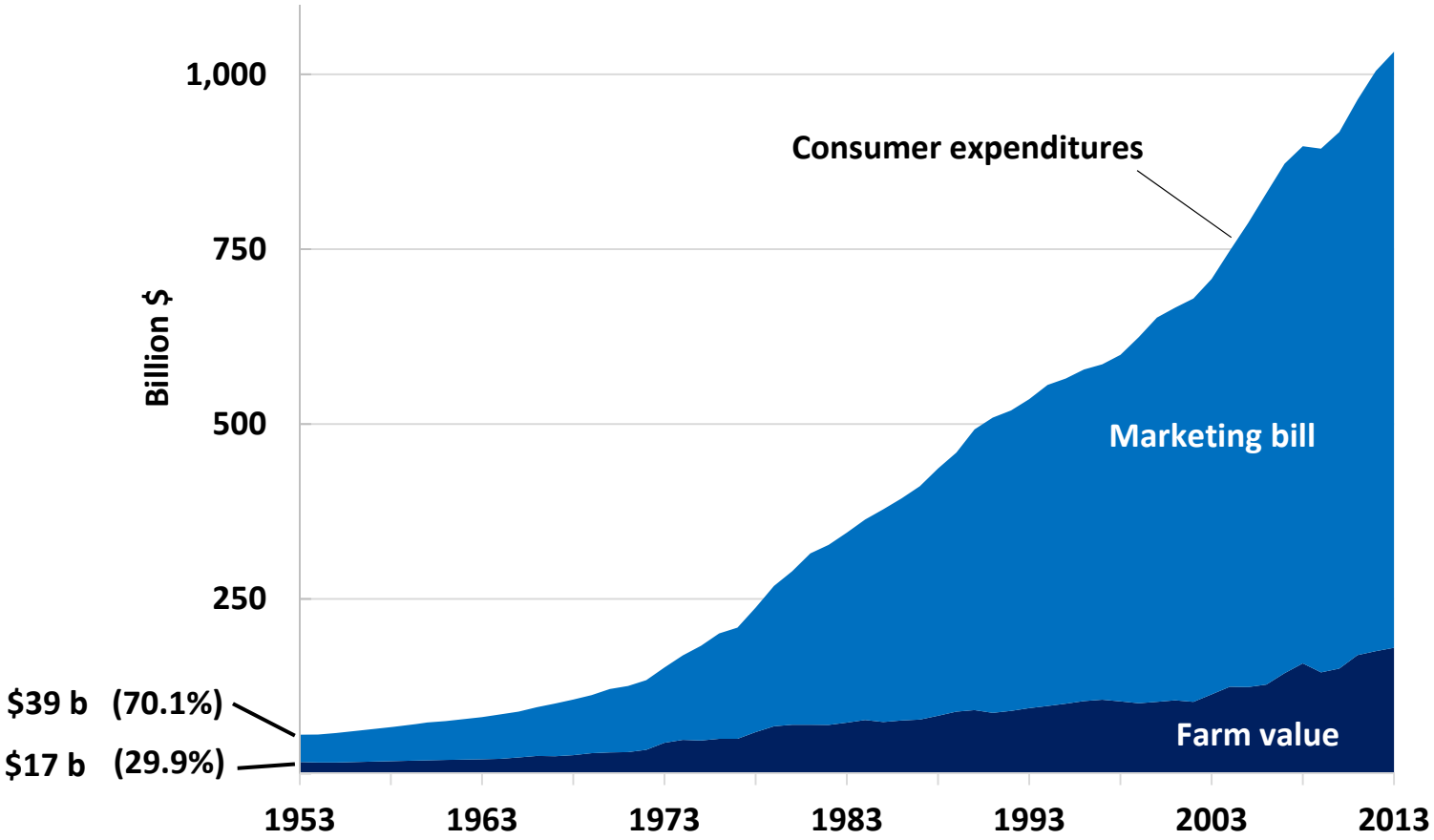
    (The projected slowdown in population growth arising from a reduction in fertility is due to aging)

GDP Per Capita, 1980-2050 (2005 PPP$)



Source: CEPII projections (Foure et al. 2012).

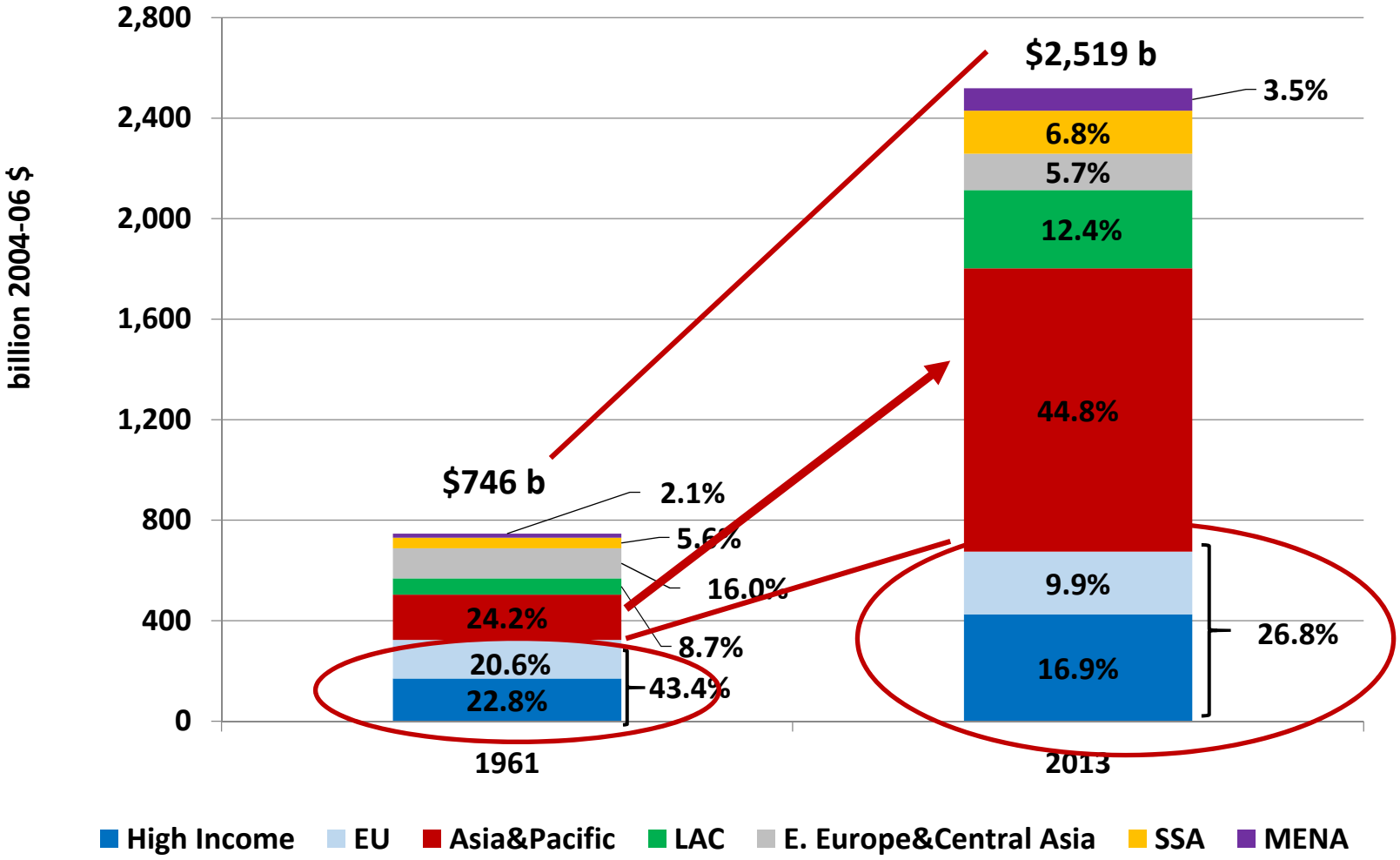
Food Costs -- Farm vs Post-Farm Shares



Source: Author with data from USDA-ERS (2016)

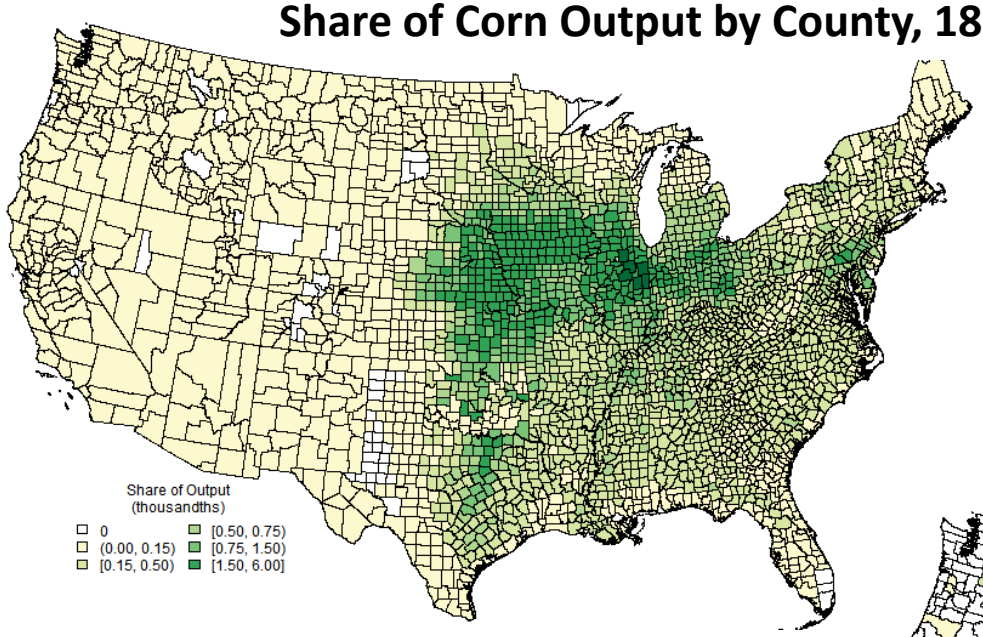
Changing Agricultural Production and Productivity Realities

Changing Location of World Agriculture, 1961 vs 2013

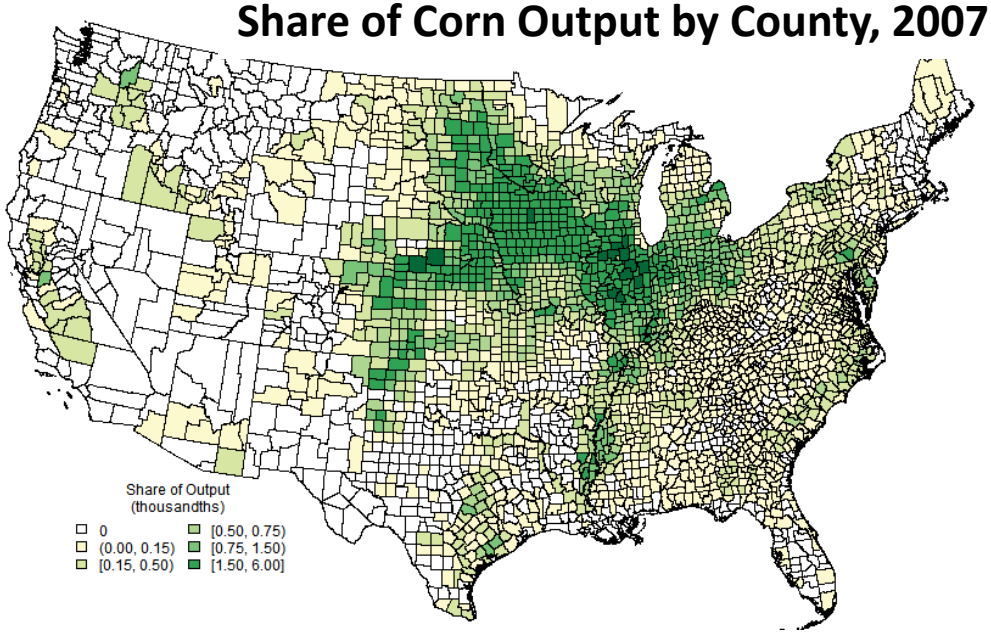


Corn Movement in the U.S., 1899-2007

Share of Corn Output by County, 1899



Share of Corn Output by County, 2007



Source: Beddow and Pardey (2015)

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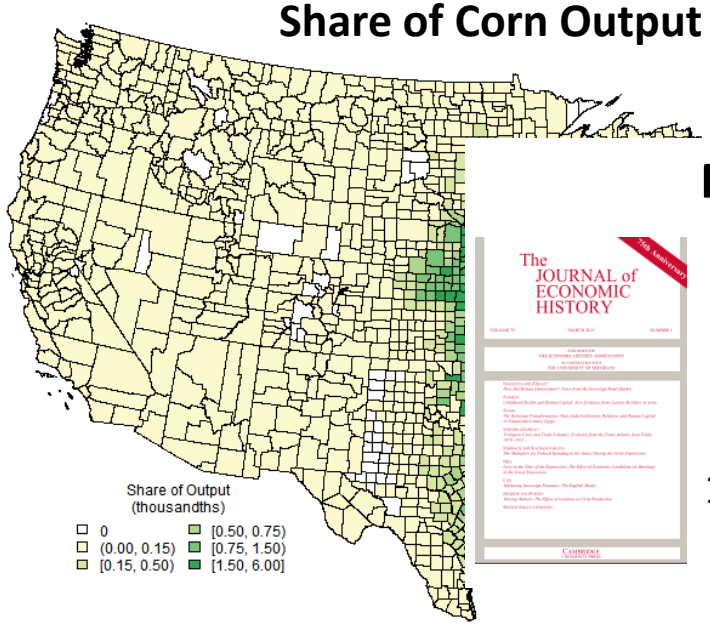


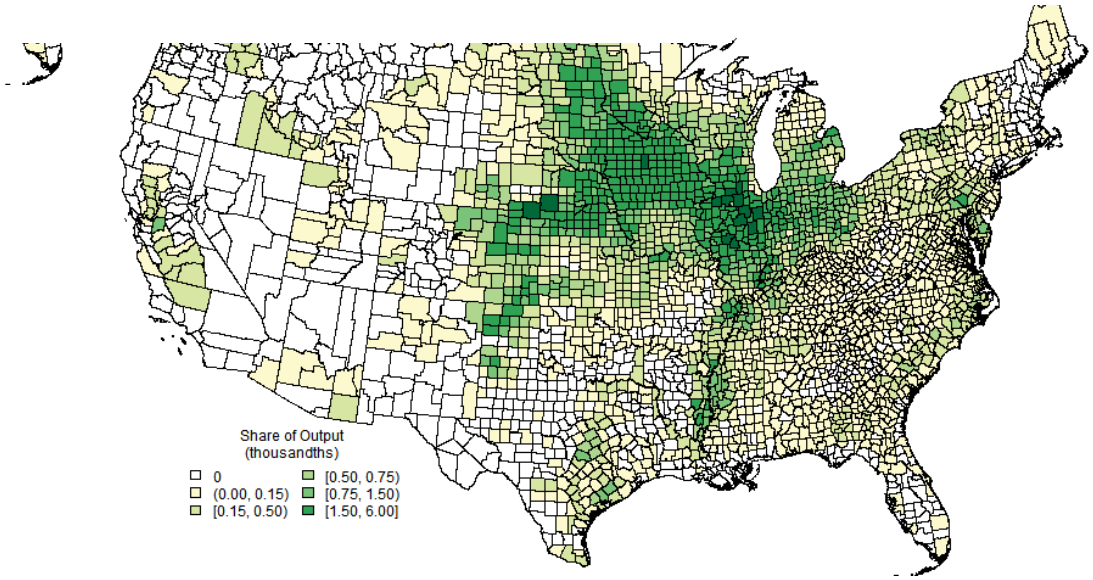
Moving Matters

279 kilometers north

342 kilometers west

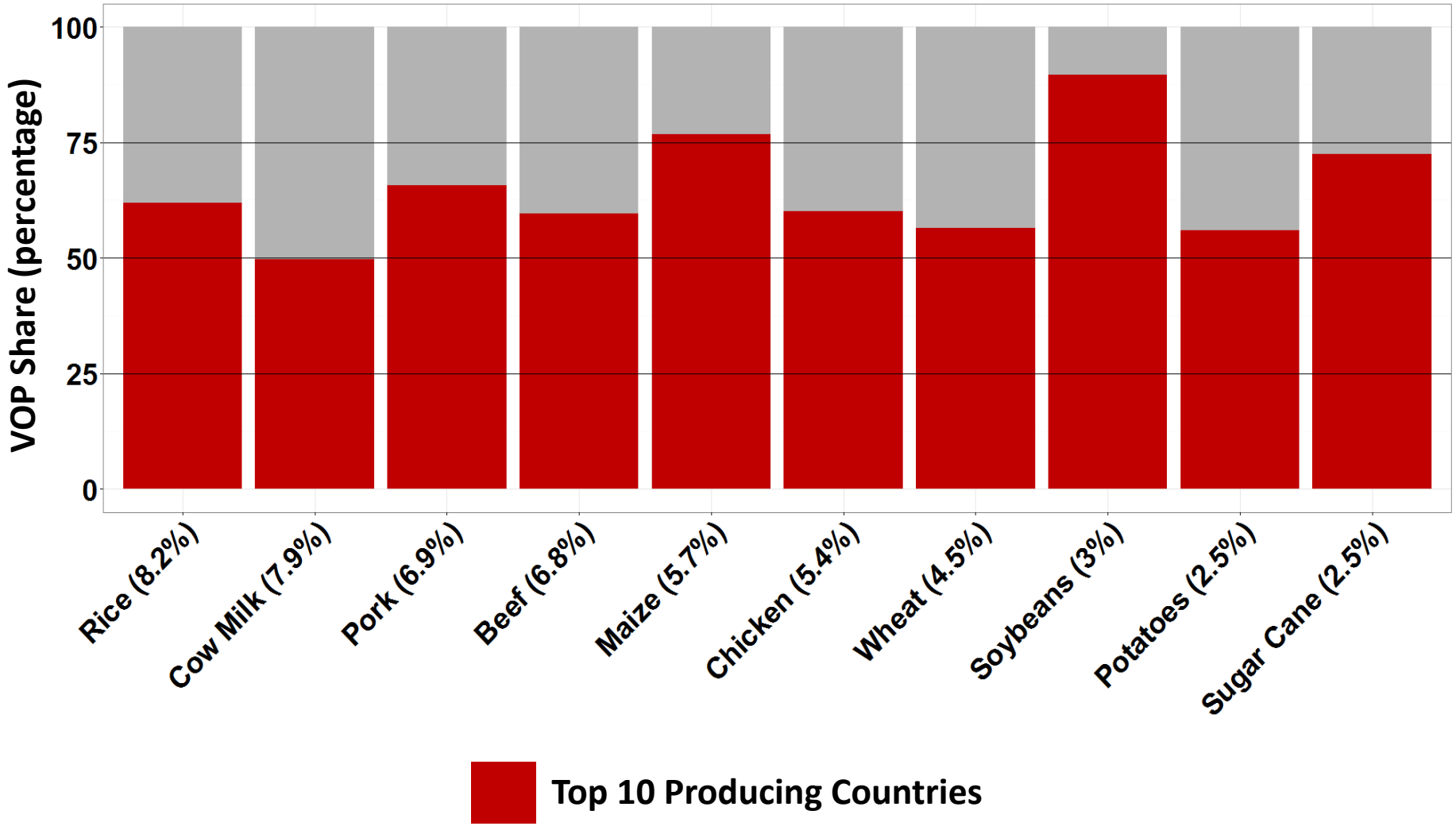
16 to 21 percent of corn output growth

ut by County, 2007

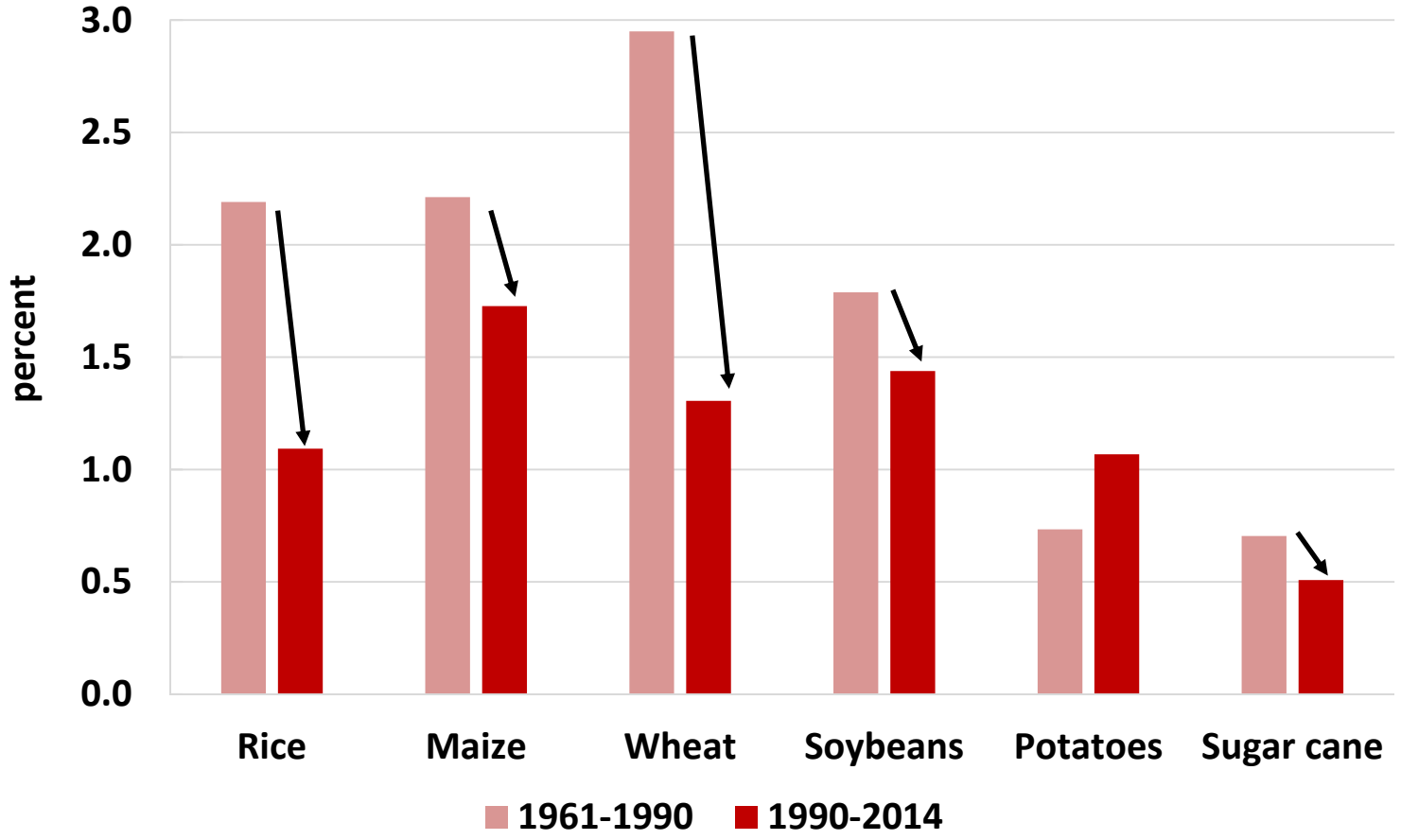


Source: Beddow and Pardey (2015)

Spatial Concentration in Production



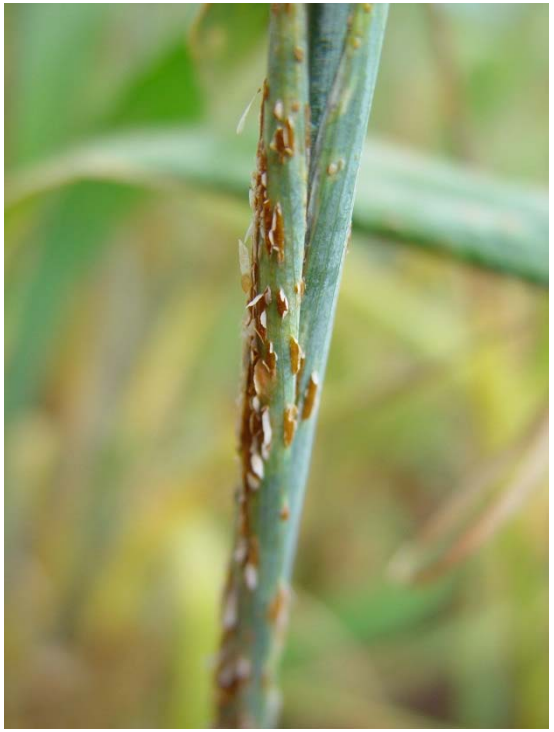
Past and Projected Global Average Crop Yield Growth



Source: Authors' calculation based on FAOSTAT (2015)

Productivity Maintenance – The Case of Wheat Rusts

Running hard to stand still!

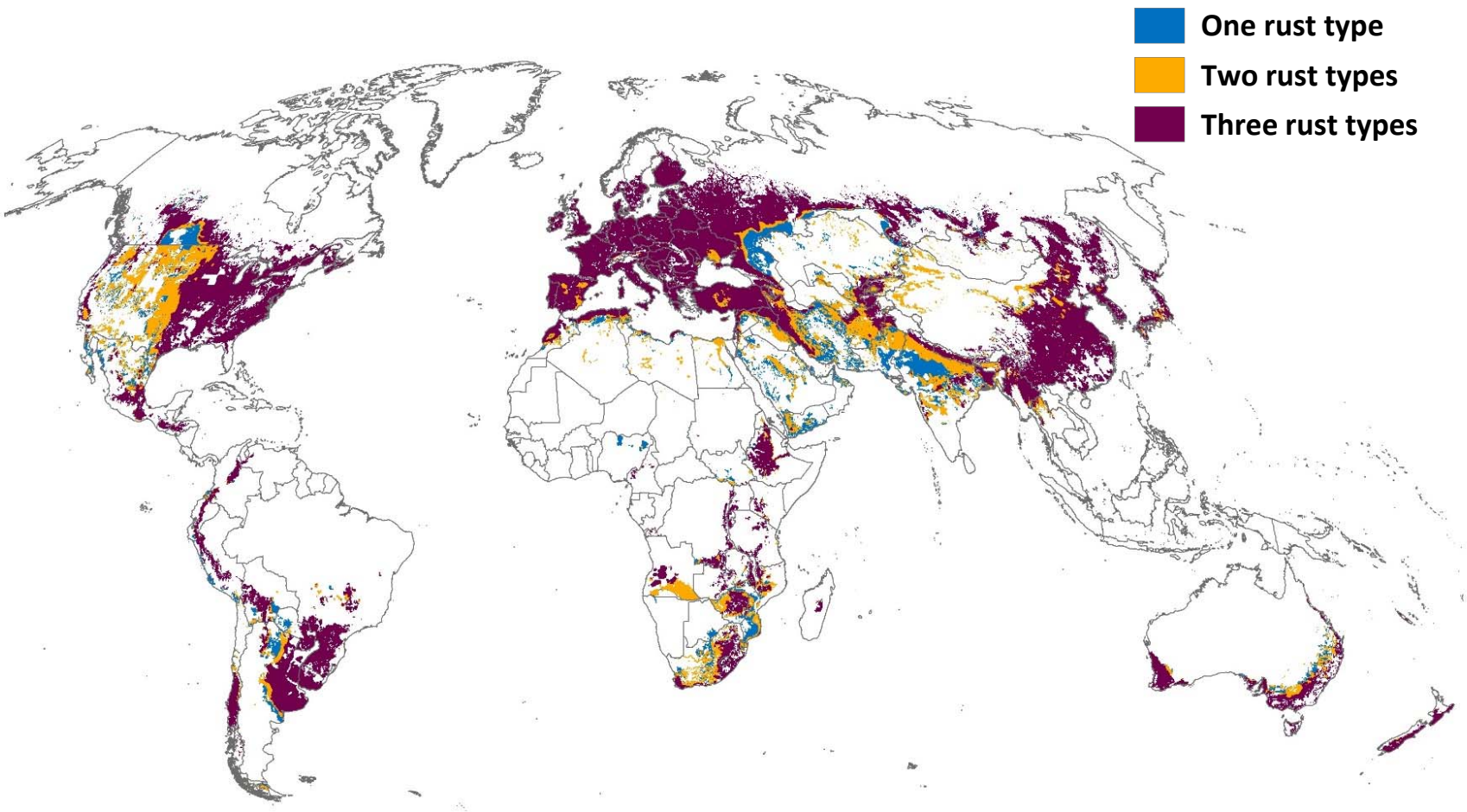


Stem Rust

Stripe Rust

Leaf Rust

Three Rusts—Seasonally Vulnerable



Note: Suitability prediction based on growth index (GI) values from the CLIMEX model

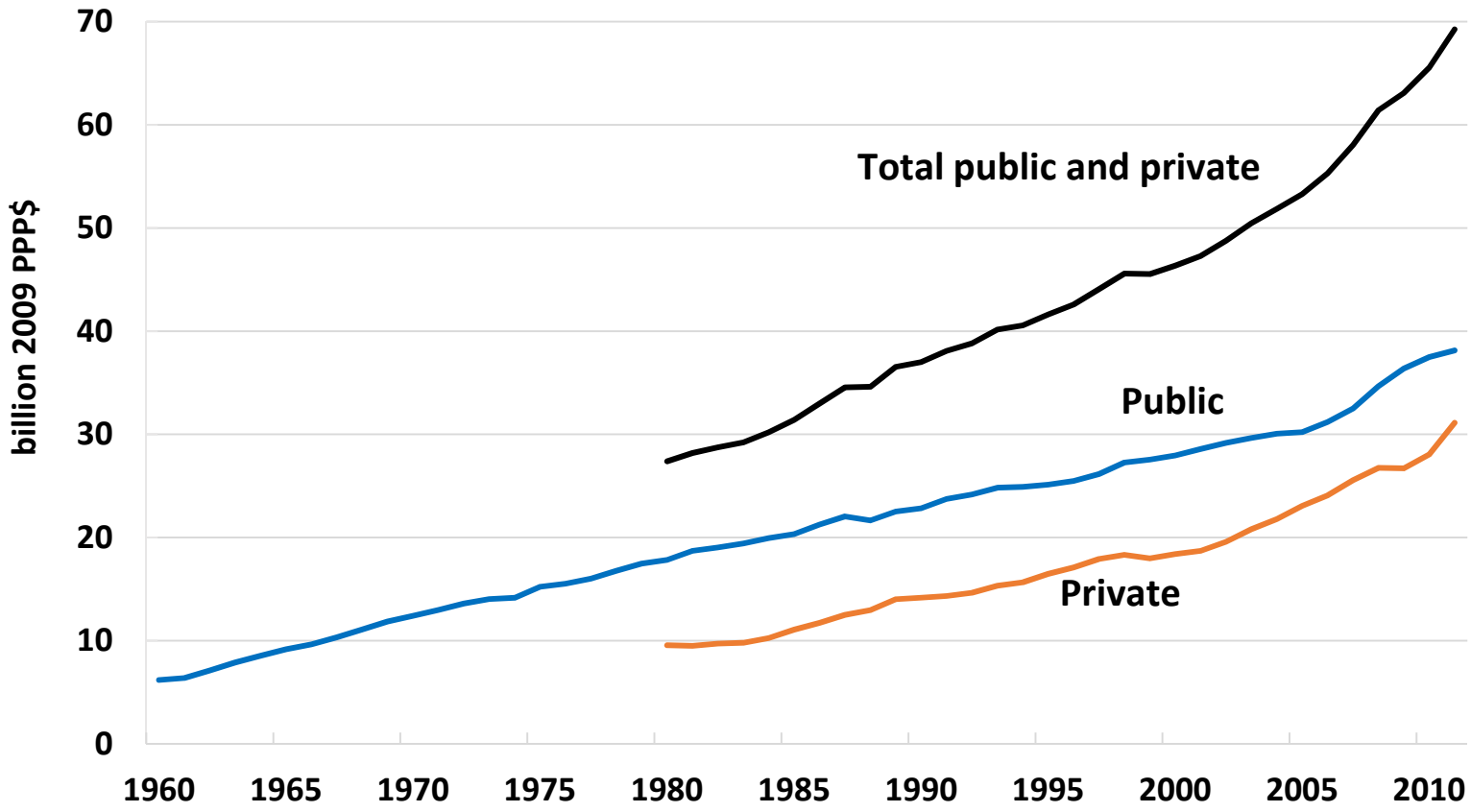
Vulnerability to Wheat Rusts Worldwide

	Stem, Leaf and Stripe Rust Vulnerability			
	None	Only One	Only Two	All Three
	(Percentage of output, all farms)			
Western Europe	0.0	0.0	0.7	99.2
North America	2.2	12.5	37.1	48.3
Australia	0.0	10.3	17.8	71.9
Sub-Saharan Africa	11.0	3.6	13.9	71.6
China	0.0	0.0	11.5	88.5
India	6.3	18.8	72.5	2.5
World	3.2	6.9	27.1	62.7

Shifting Ground

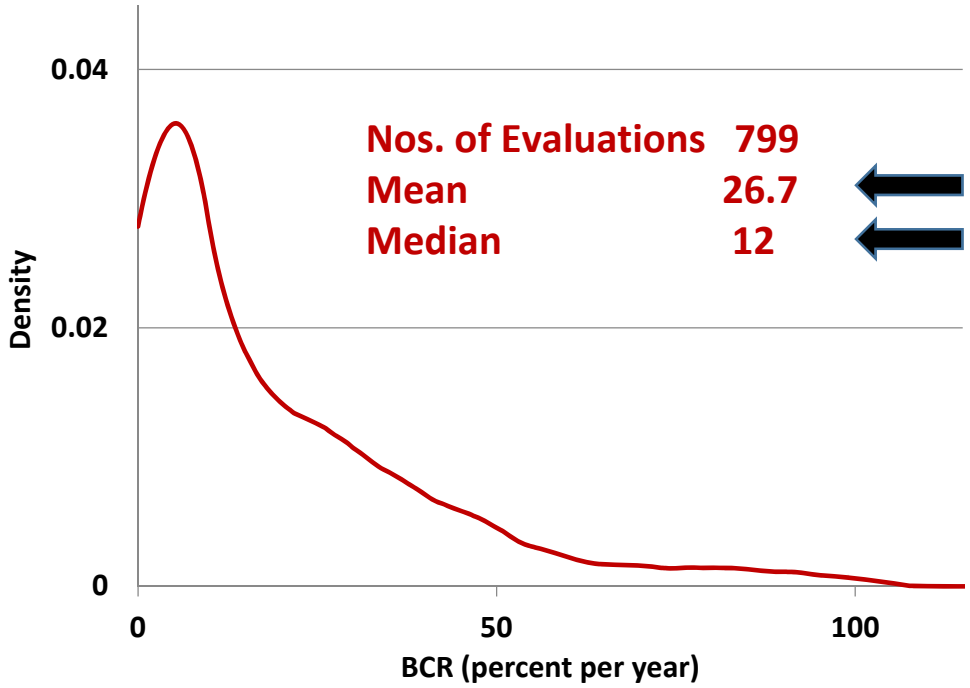
The Global Food and Agricultural R&D Landscape

Global Public and Private Food & Agricultural R&D, 1960-2011



Source: Pardey, Chan-Kang, Beddow and Dehmer (2016, in process)

The Social Payoffs to Agricultural R&D



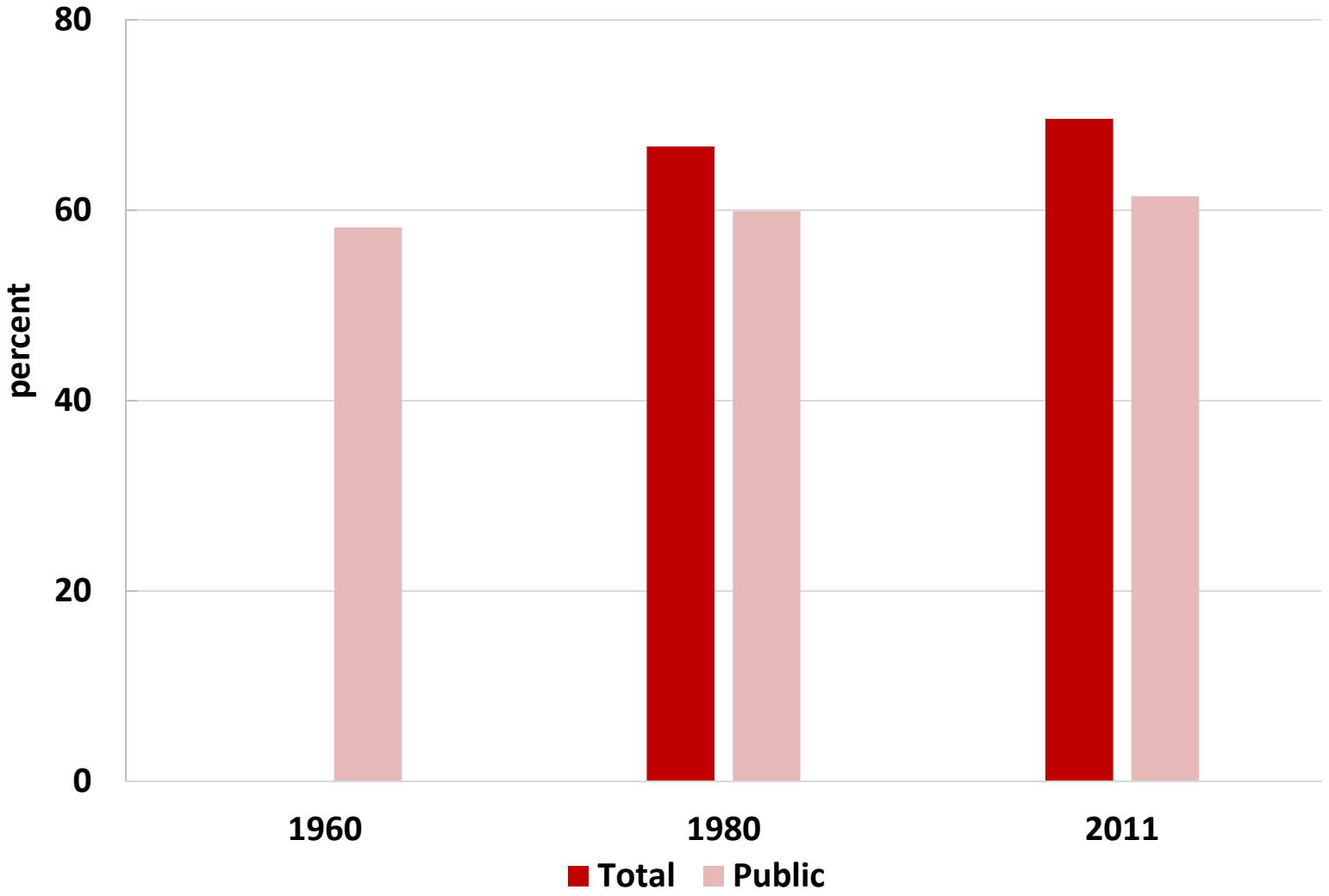
Have the returns to R&D declined over time?

- 2,829 IRR evaluation estimates from 492 separate studies
- Preliminary result: No evidence of a change in the returns to agricultural R&D over time

Behind the Aggregate R&D Numbers

- Agricultural R&D spending still highly concentrated spatially
  - But big changes in the (rank order) of top 10 spenders

Spatial Concentration -- Top 10 Country Share



Behind the Aggregate R&D Numbers

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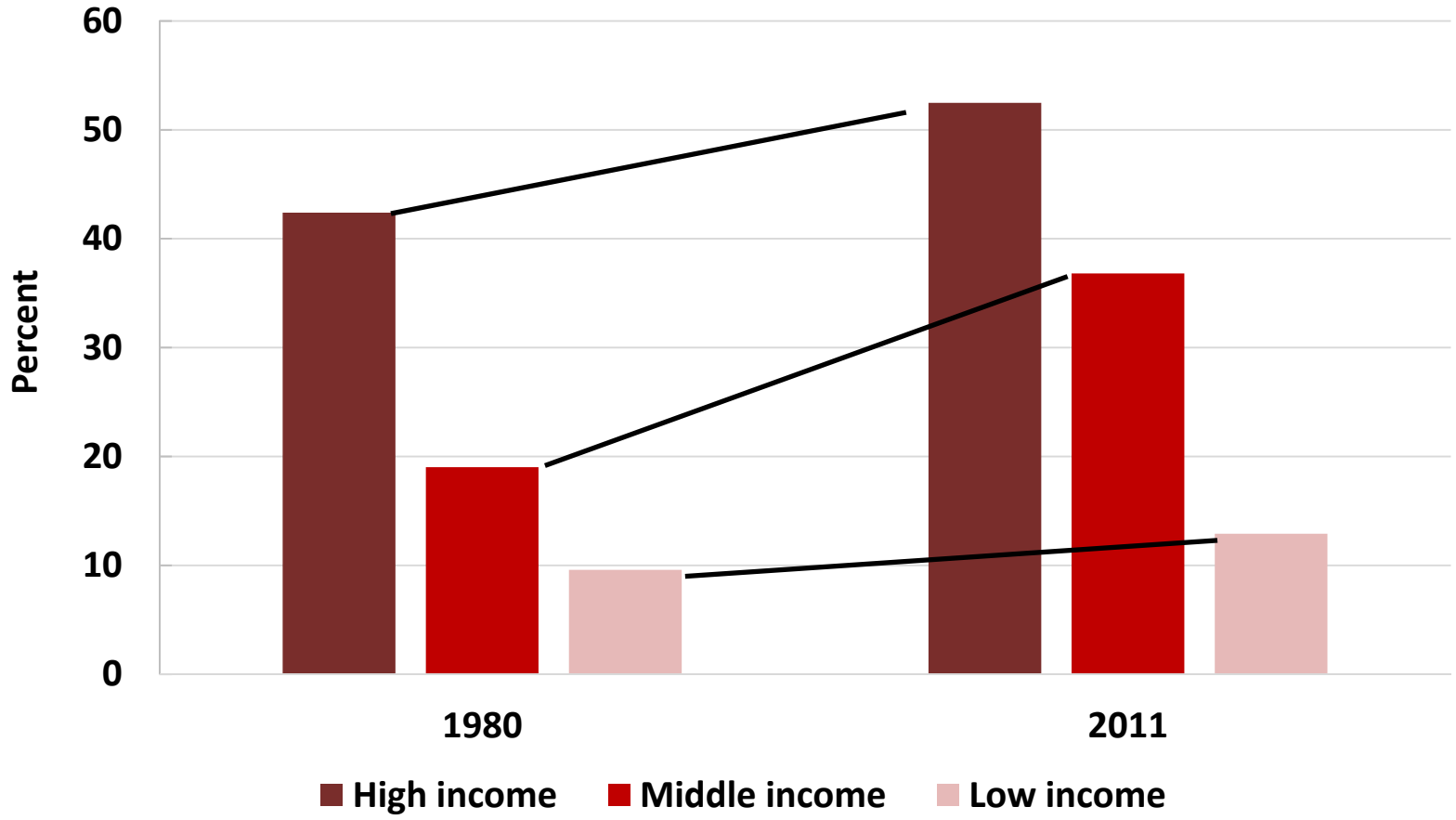
- Shift to more private performance
  - But private spending is mainly concentrated in the rich (58.2%) and faster growing middle income countries (BIC 35.7%)

Private Share of Total Agriculture & Food R&D



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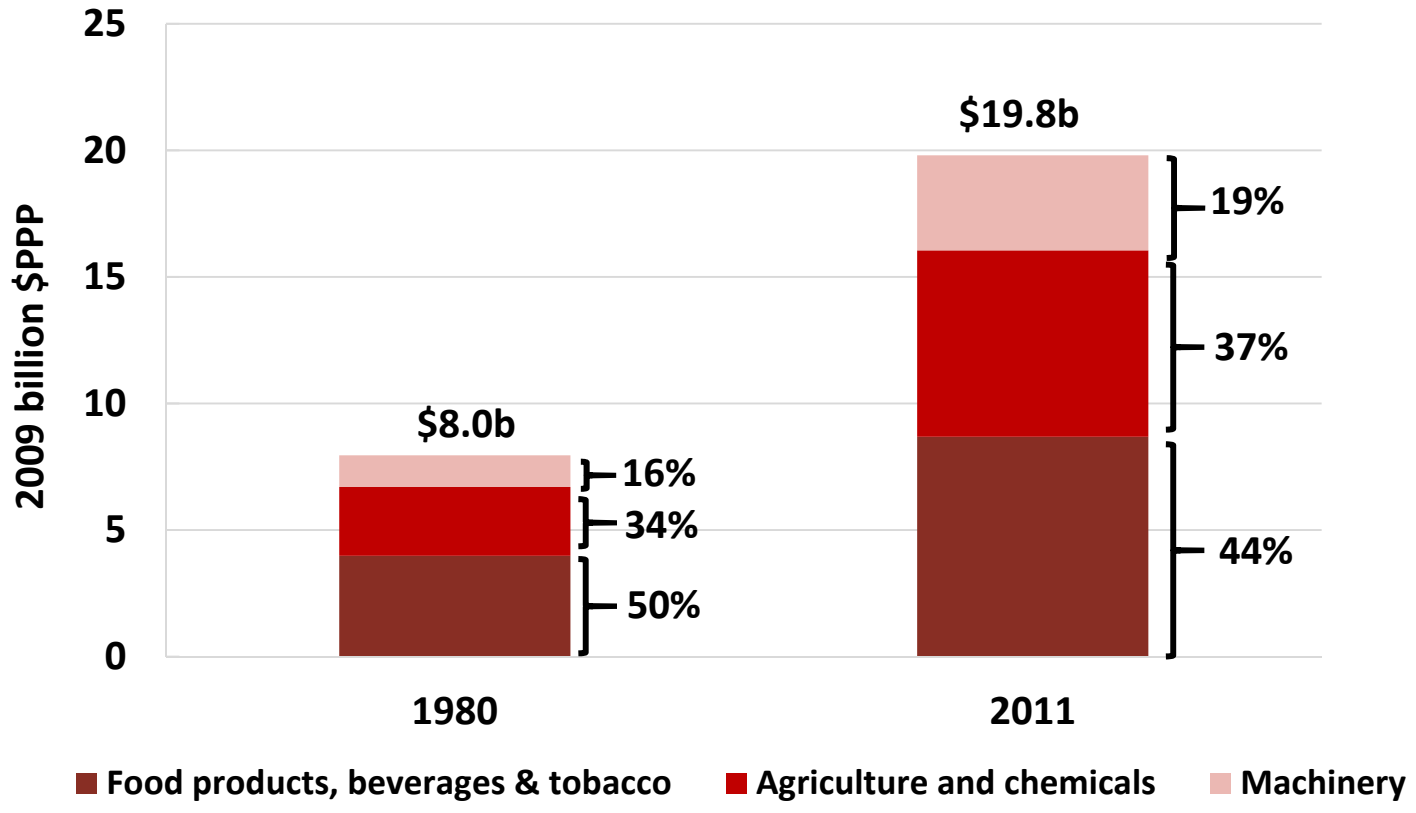
Private Food and Agricultural R&D in Rich Countries



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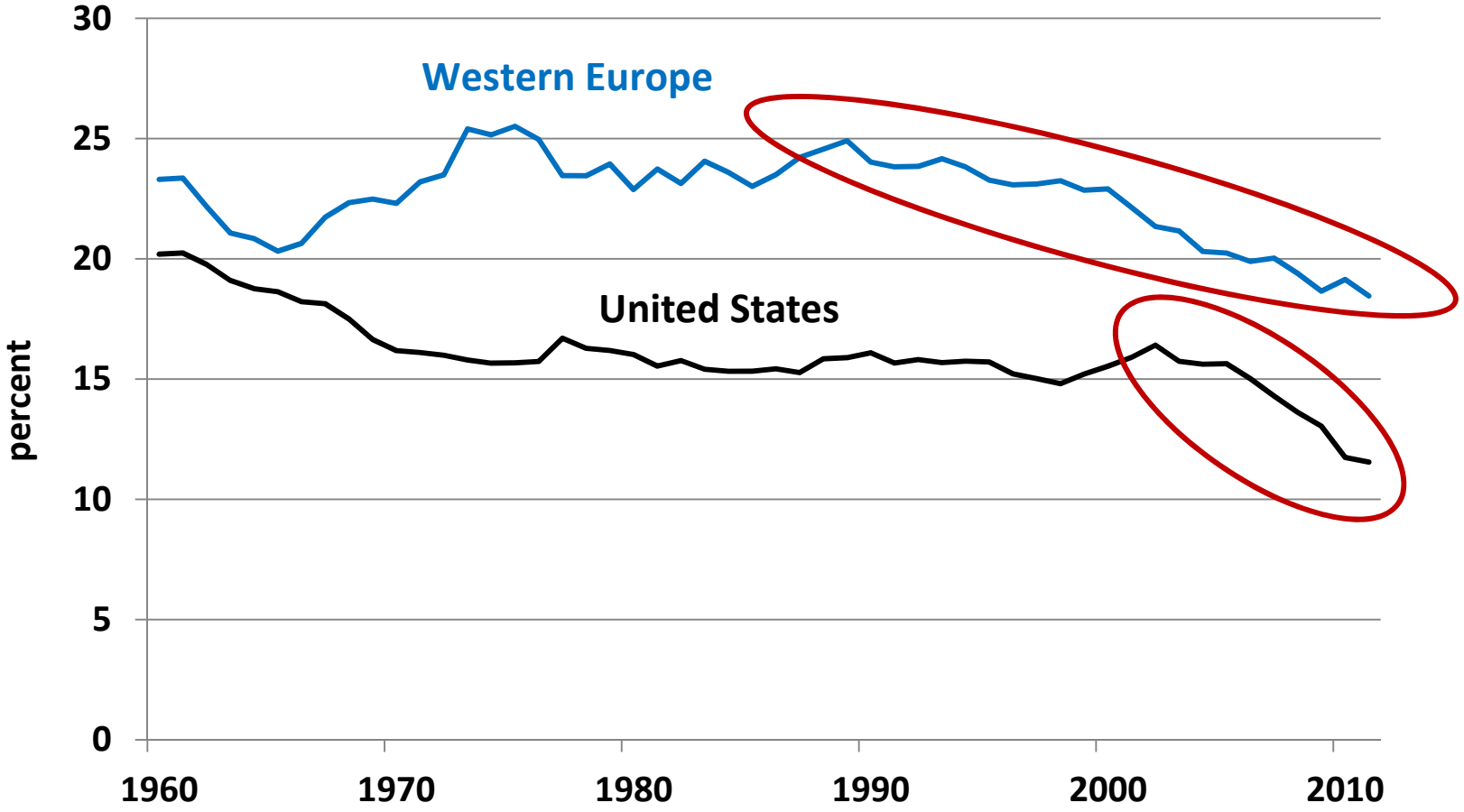
Behind the Aggregate R&D Numbers

- Agricultural R&D spending still highly concentrated spatially
  - But big changes in the (rank order) of top 10 spenders
- Shift to more private performance
  - But private spending is mainly concentrated in the rich (58.2%) and faster growing middle income countries (BIC 35.7%)
- A stark and growing global divide

Shifting Global Shares of Public Food & Ag R&D, 1960-2011



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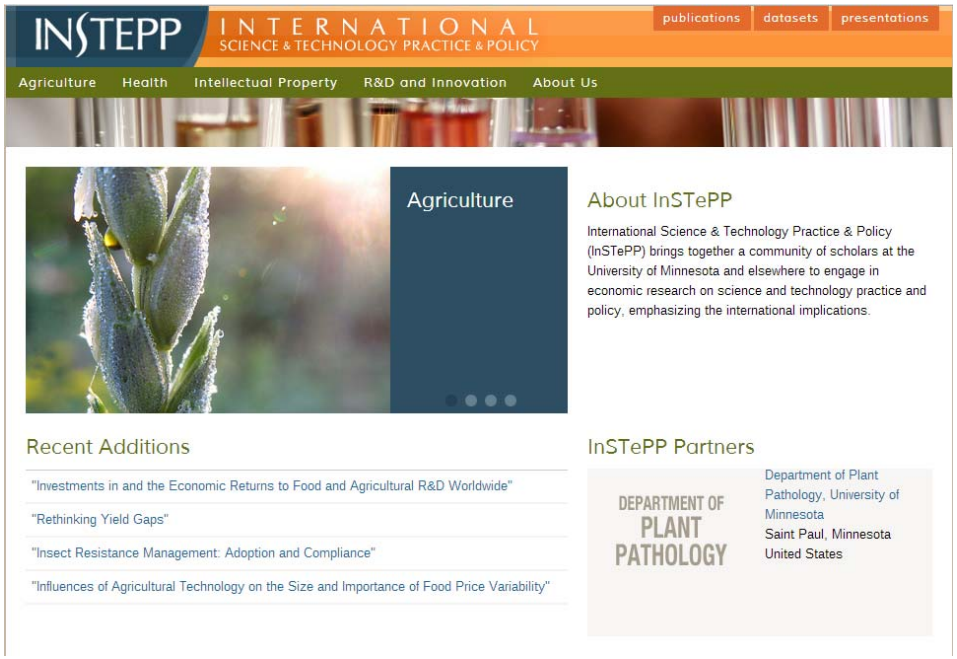
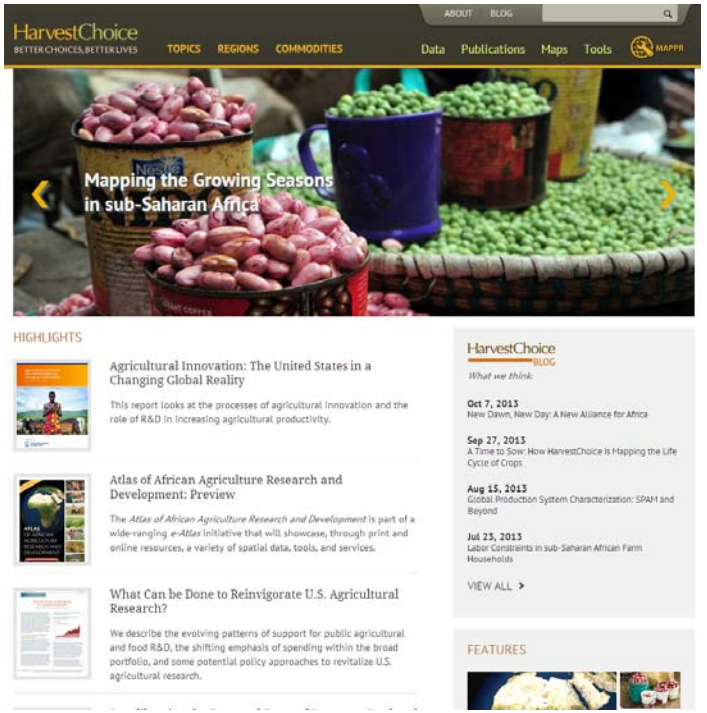
Concluding Remarks

- Food demand largely follows population, which will continue to shift to Asia and, especially, Africa
- R&D likely to remain highly spatially concentrated
  - A growing disconnect between the geography of agricultural demand and the location of agricultural R&D performance
- Shift towards more contestable and project-oriented (often shorter-term) funding of public science
  - The problems are just as hard as they ever have been
  - The present returns are just as high (pointing to persistent underinvestment)
- Accountability for sure, but with a firm and focused eye to the long-run nature of the problems and the innovation processes in play

Thanks!





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