

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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Department of
**APPLIED
ECONOMICS**

UNIVERSITY OF MINNESOTA

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College of Food, Agricultural
and Natural Resource Sciences
UNIVERSITY OF MINNESOTA

Outline

Thinking and acting for the long run

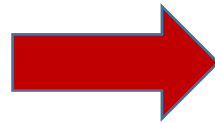
- Food and Agricultural Futures
 - Changing Agricultural Demand Realities
 - Changing Agricultural Supply (Production and Productivity) Realities

- Changing Food and Agricultural R&D Realities

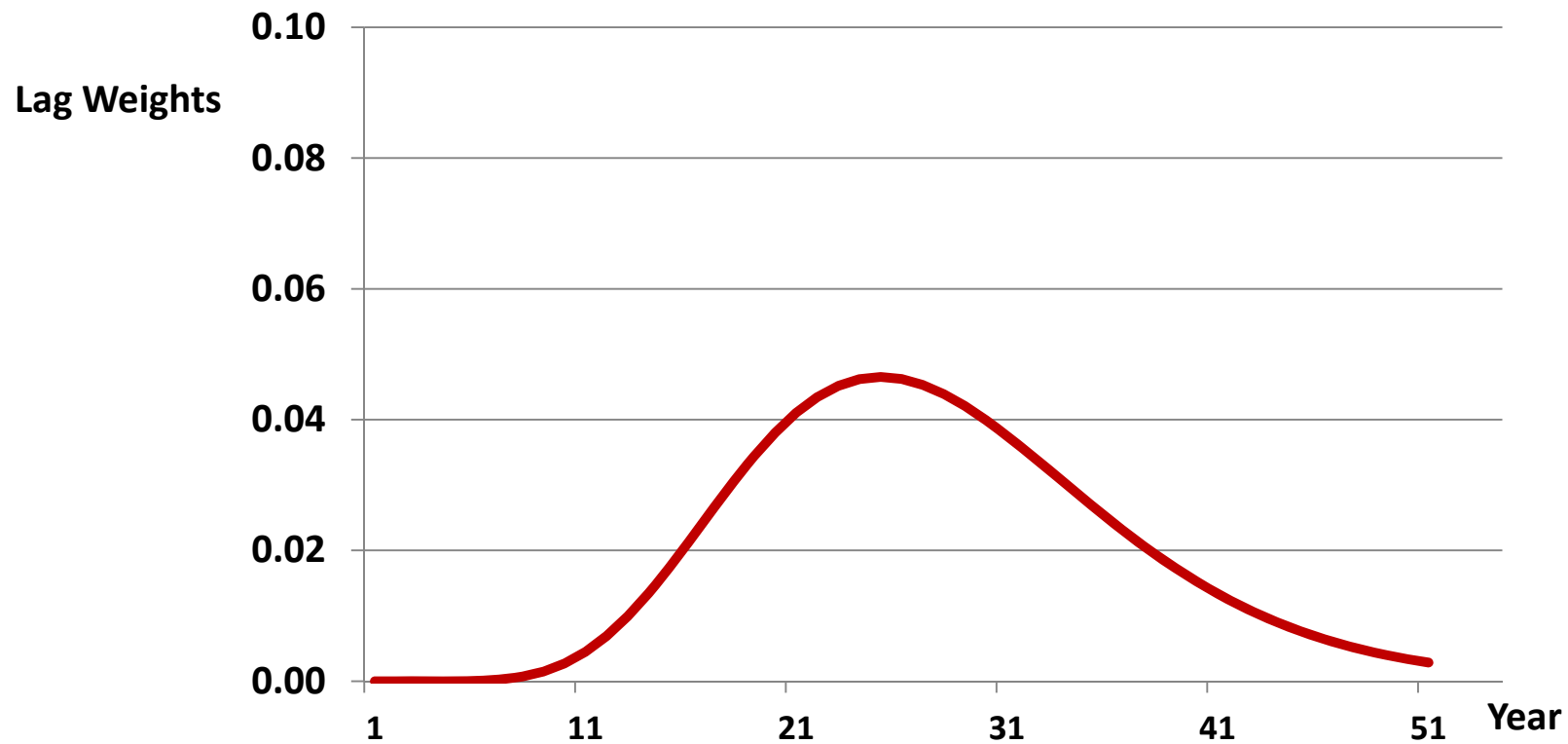
- Implications for Food and Agricultural R&D

Why the Long Run Matters

**R&D
Investments**

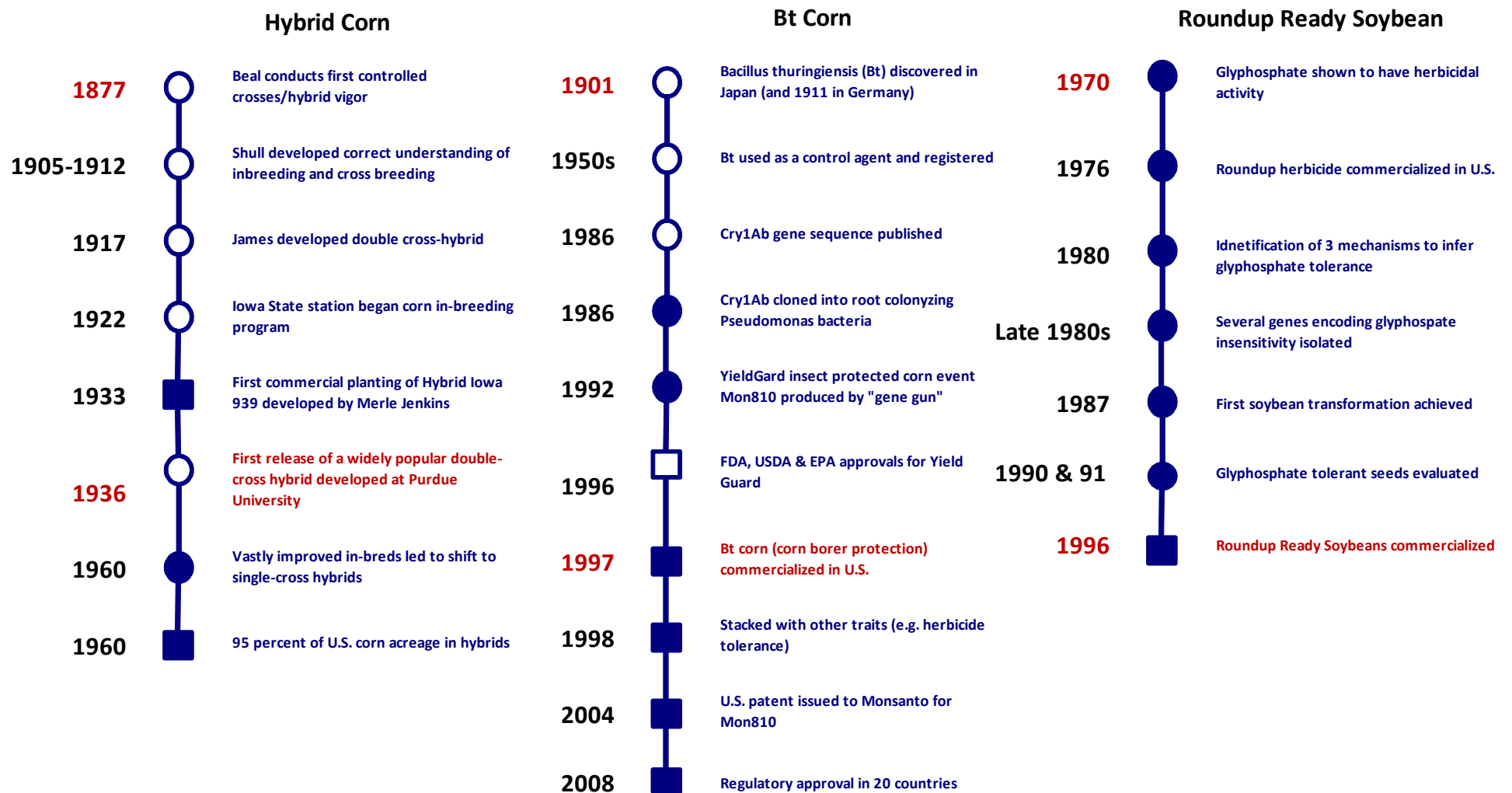


**Farm Productivity
Growth**



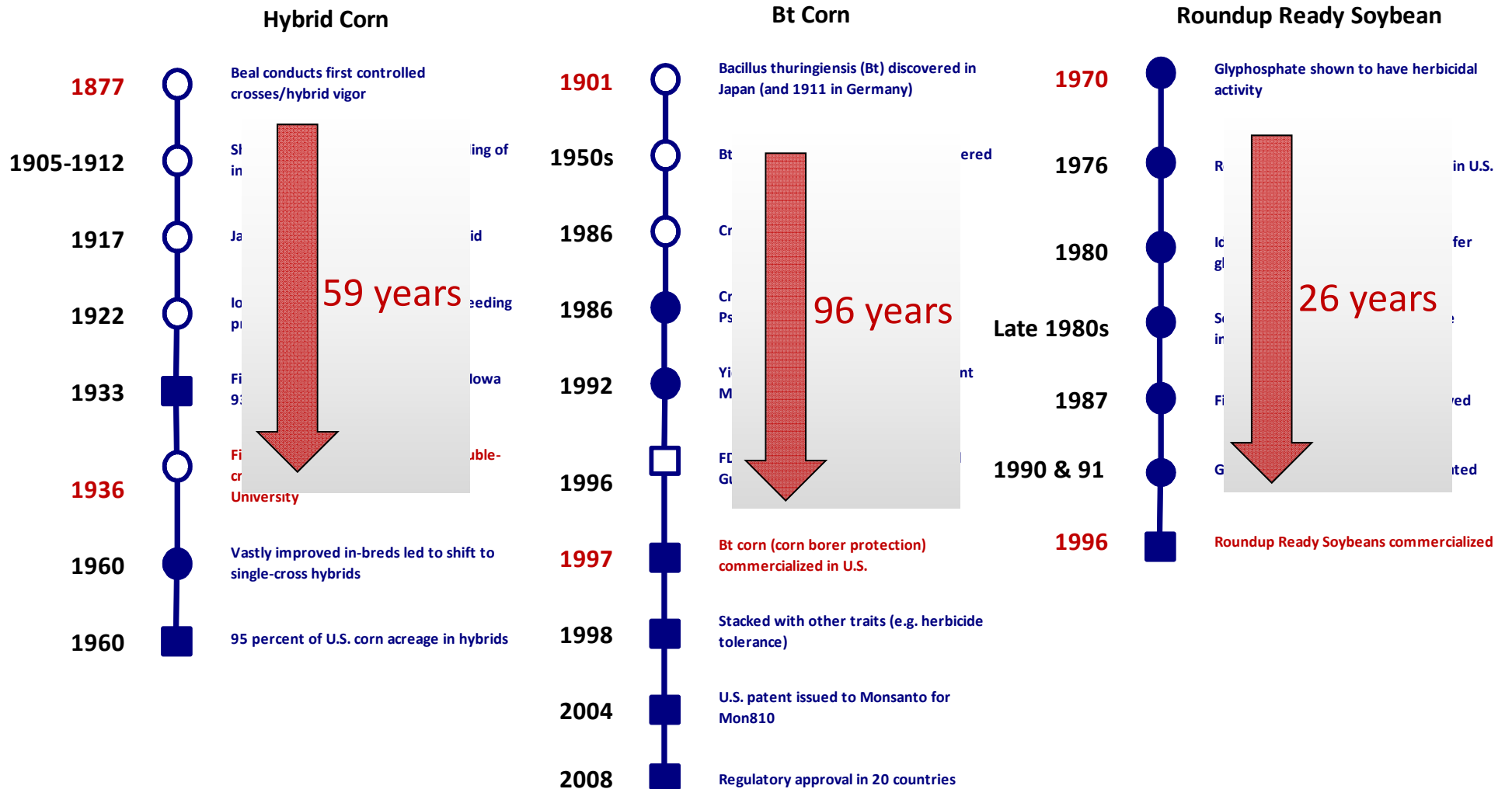
Source: Alston, Anderson, James and Pardey (2010, 2011)

Illustrative Technology Development Lags (US)



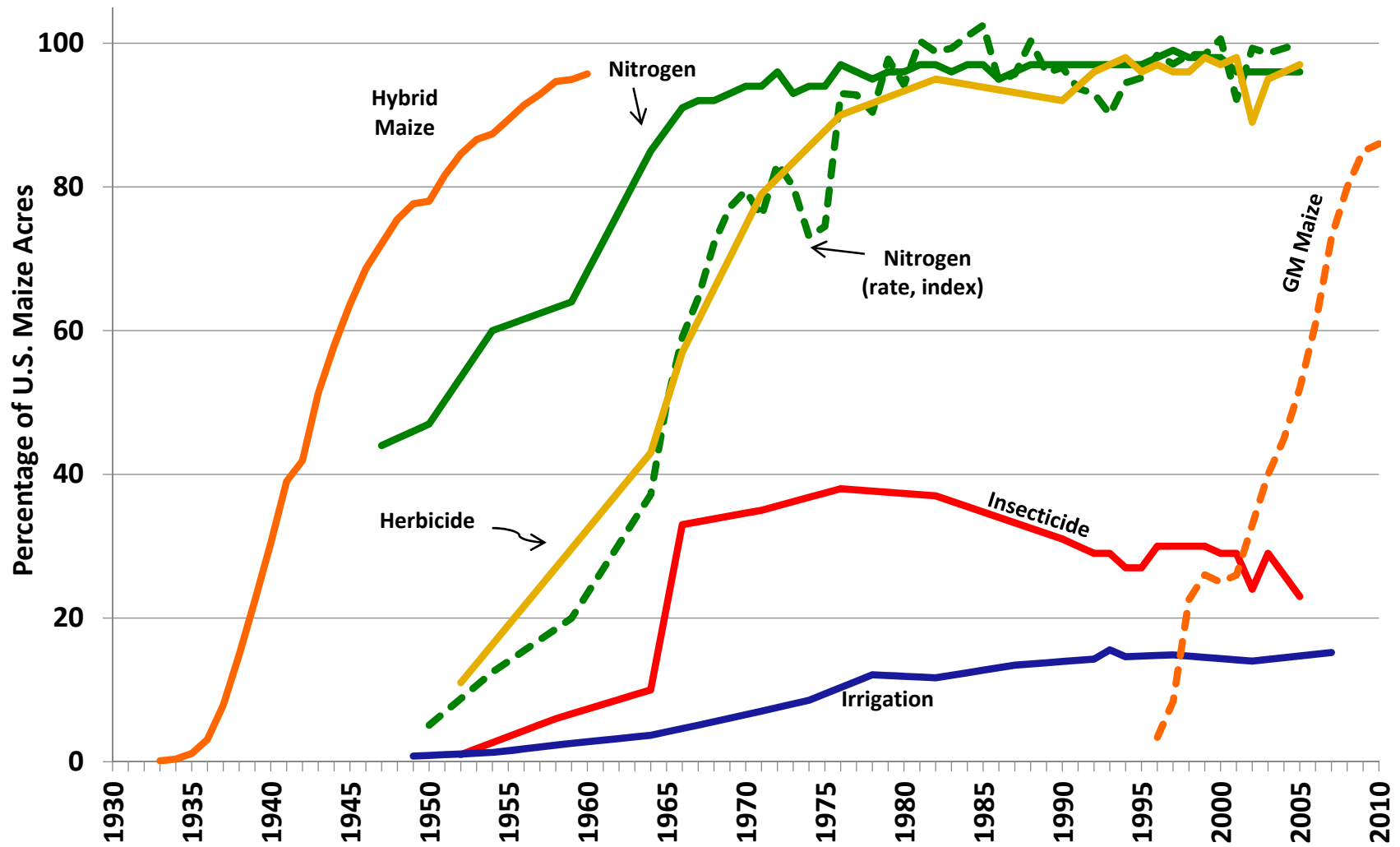
Source: Pardey , Alston and Ruttan (2008) and Alston et al. (2010)

Illustrative Technology Development Lags (US)



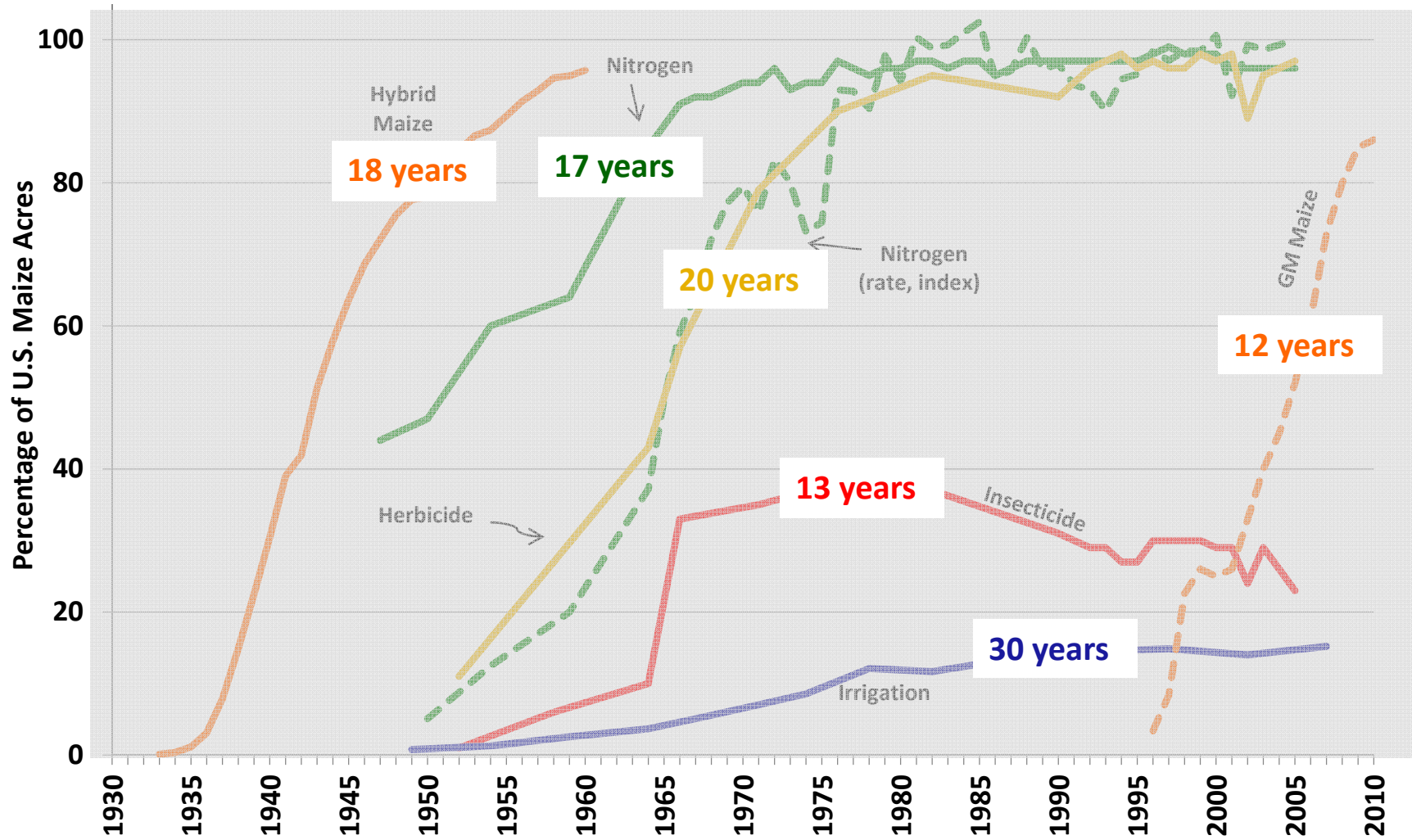
Source: Pardey, Alston and Ruttan (2008) and Alston et al. (2010)

U.S. Maize Technology Adoption Lags



Source: Beddow (2012)

U.S. Maize Technology Adoption Lags



Source: Beddow (2012)

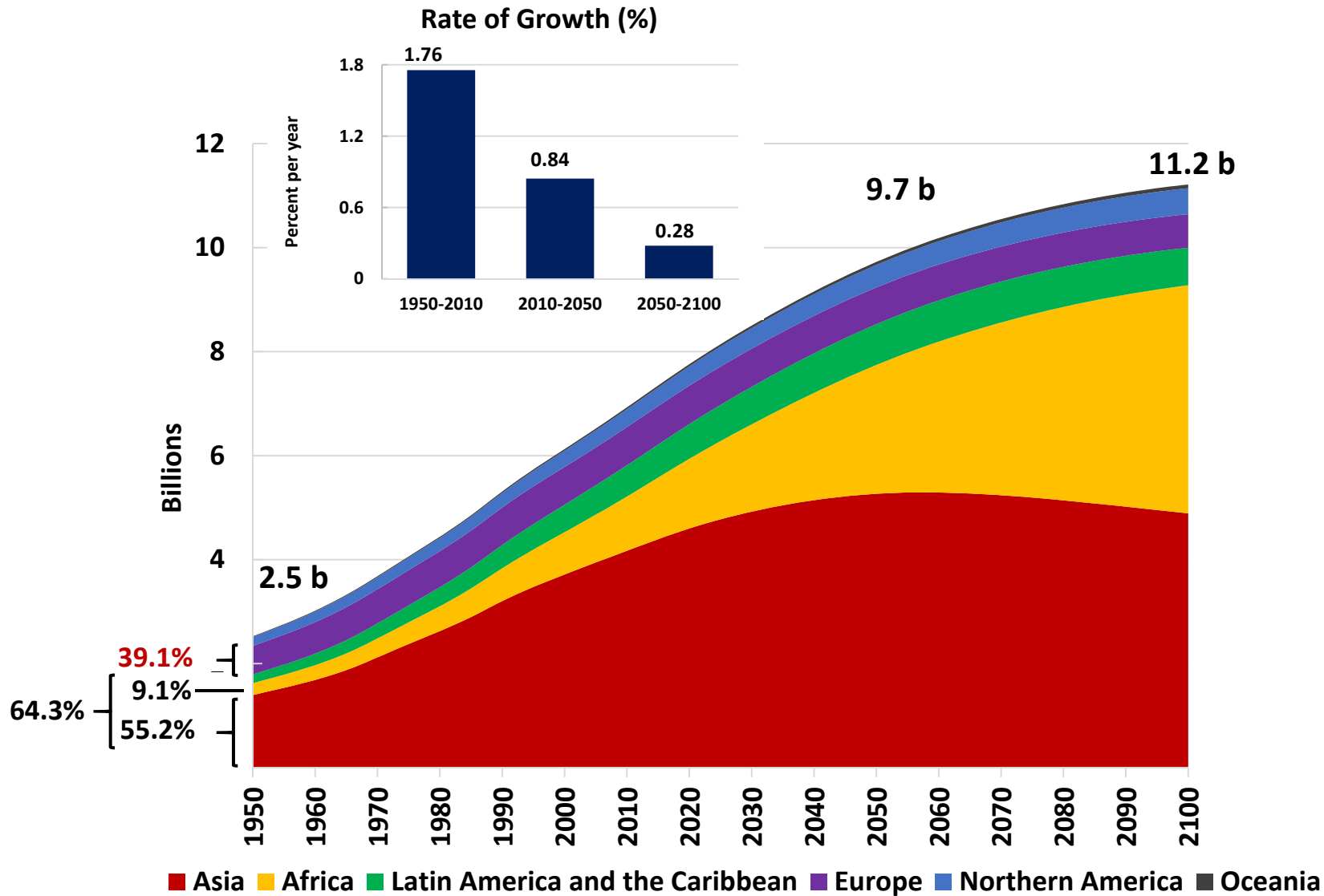
Changing Agricultural Demand Realities

Population continues to grow, as will per capita incomes

BUT

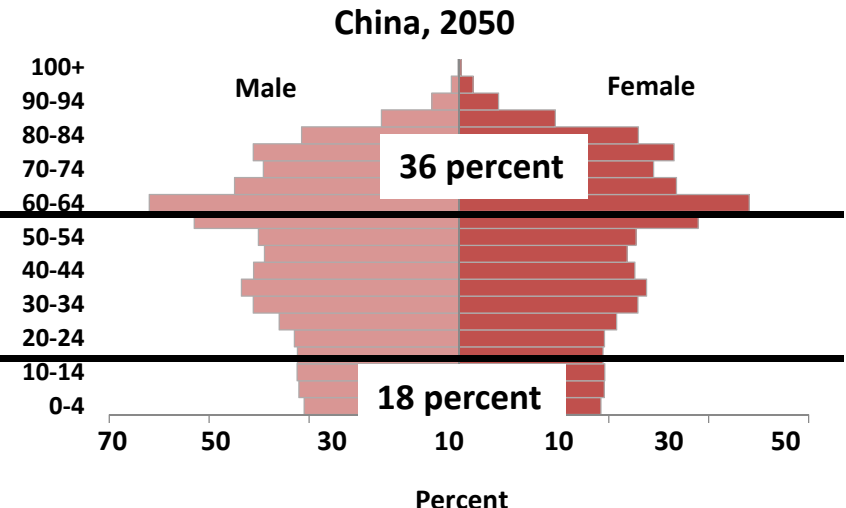
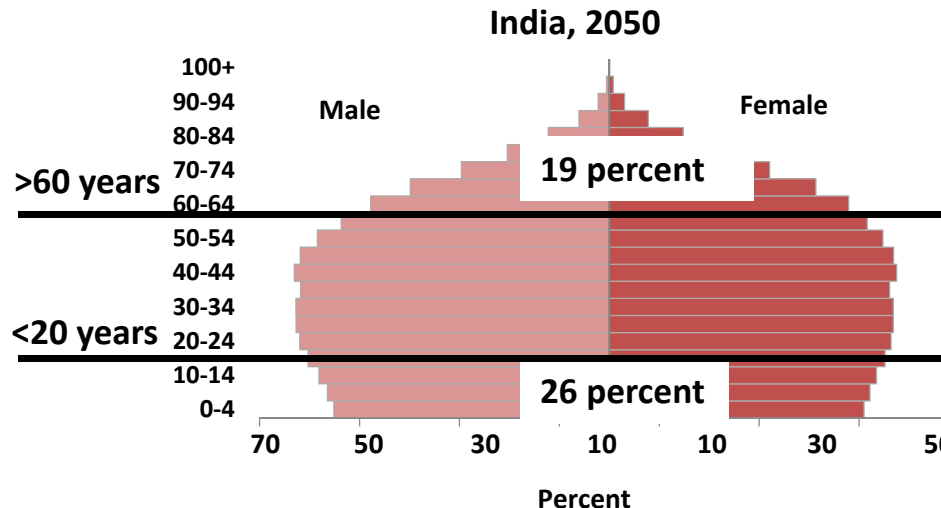
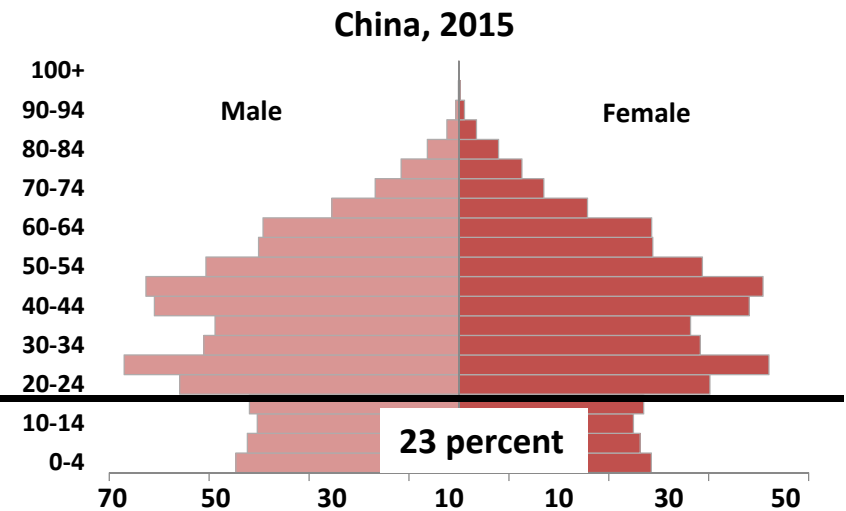
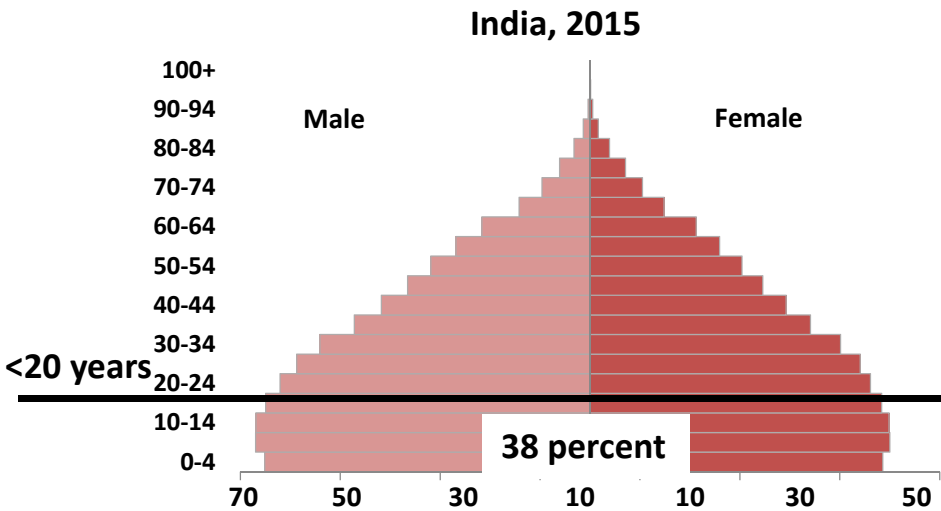
In important respects agricultural demand futures will not be like the past

Population Projections, 1950-2100



Source: UN Population Division (2015).

Age Pyramids



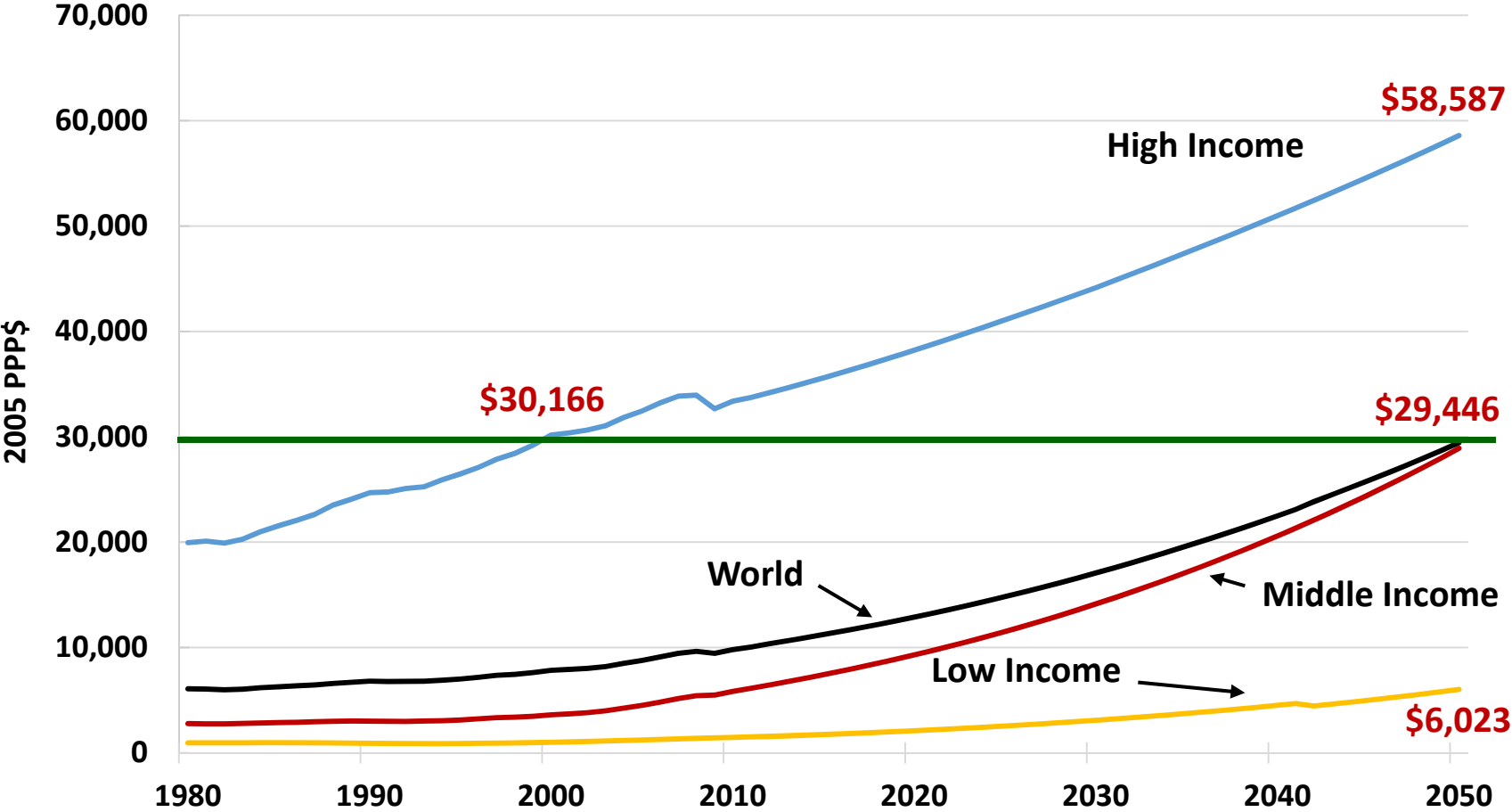
Source: UN Population Division (2015).

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.

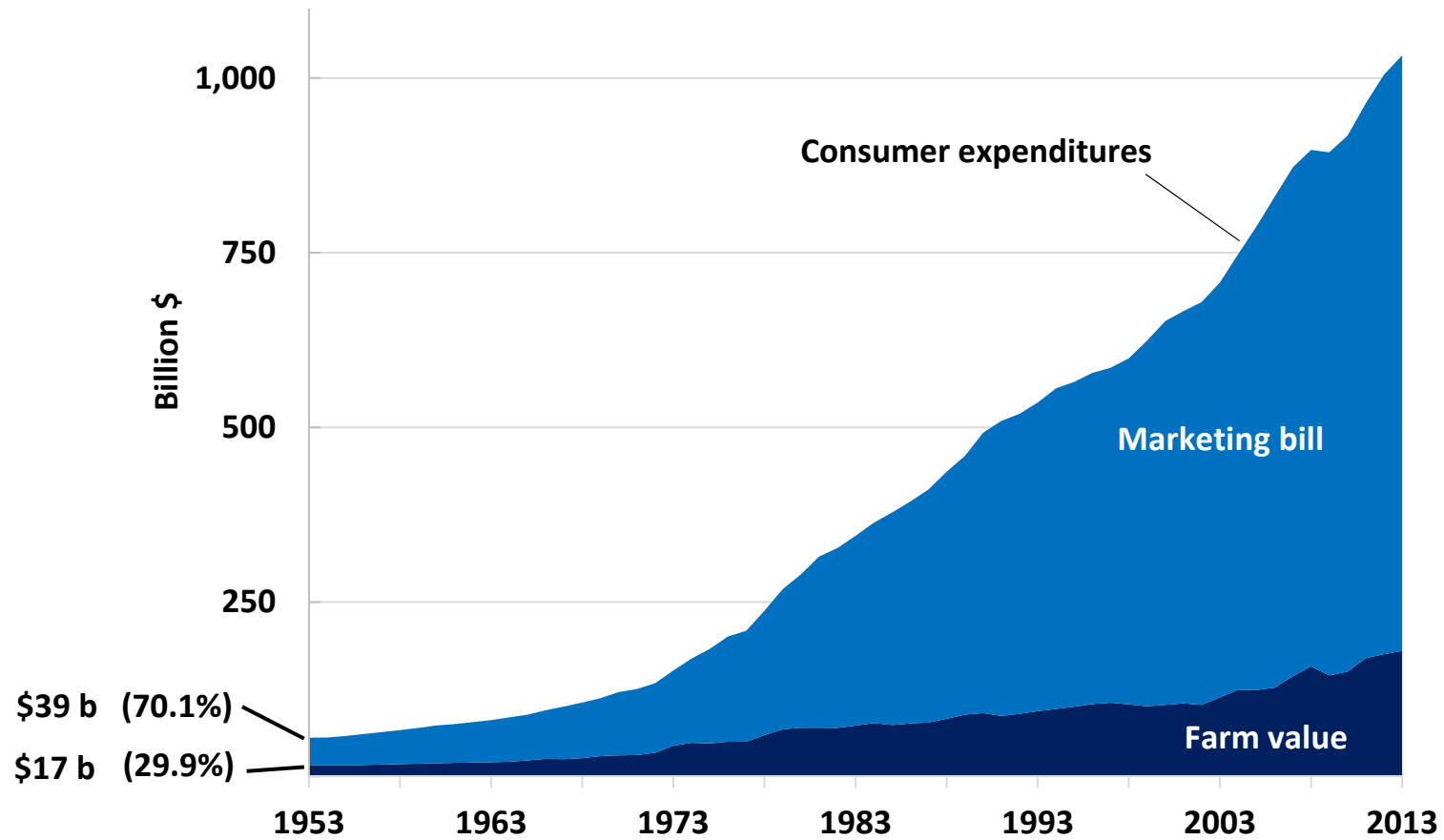
(The projected slowdown in population growth arising from a reduction in fertility is due to aging)

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



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

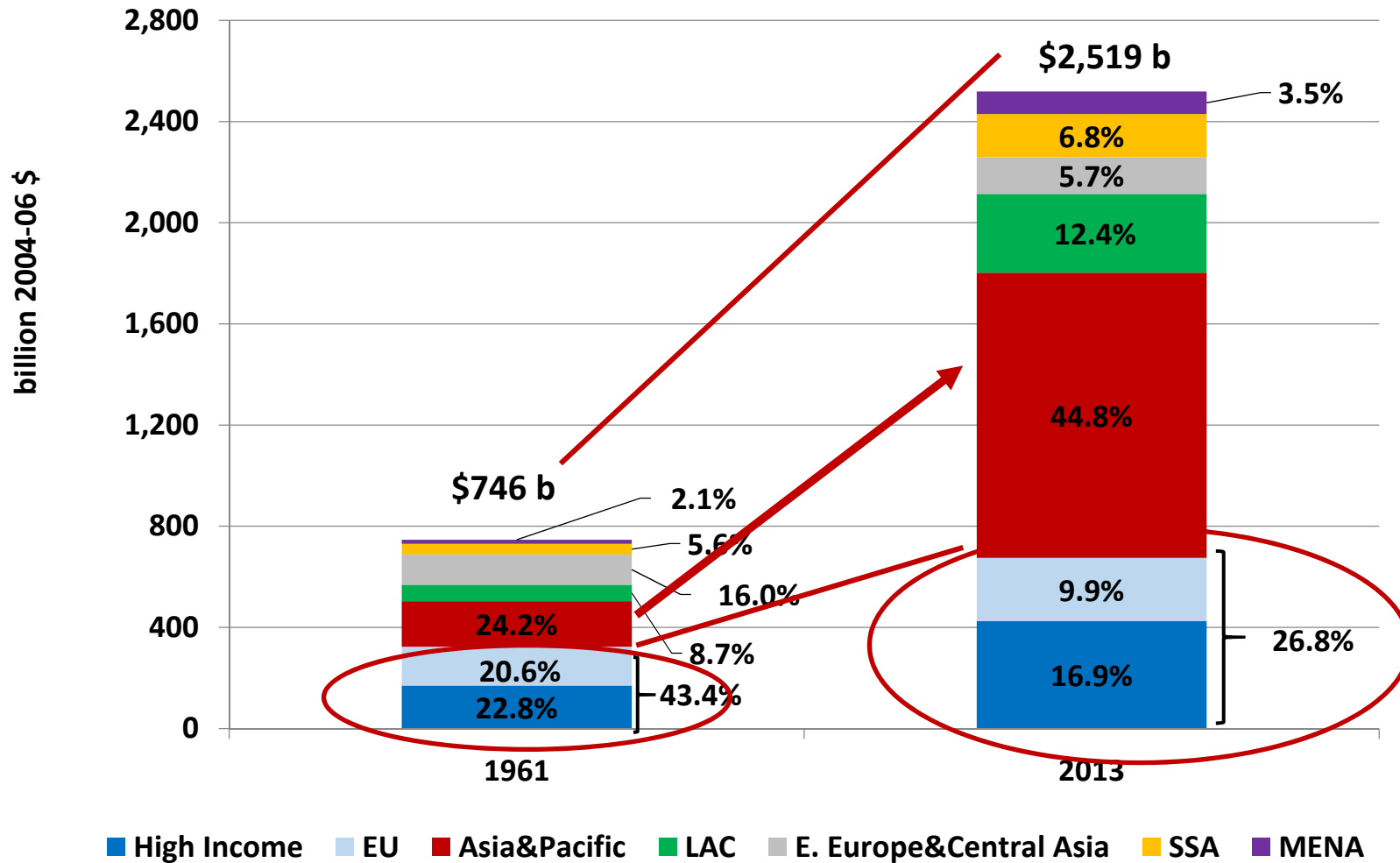
Food Costs -- Farm vs Post-Farm Shares



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

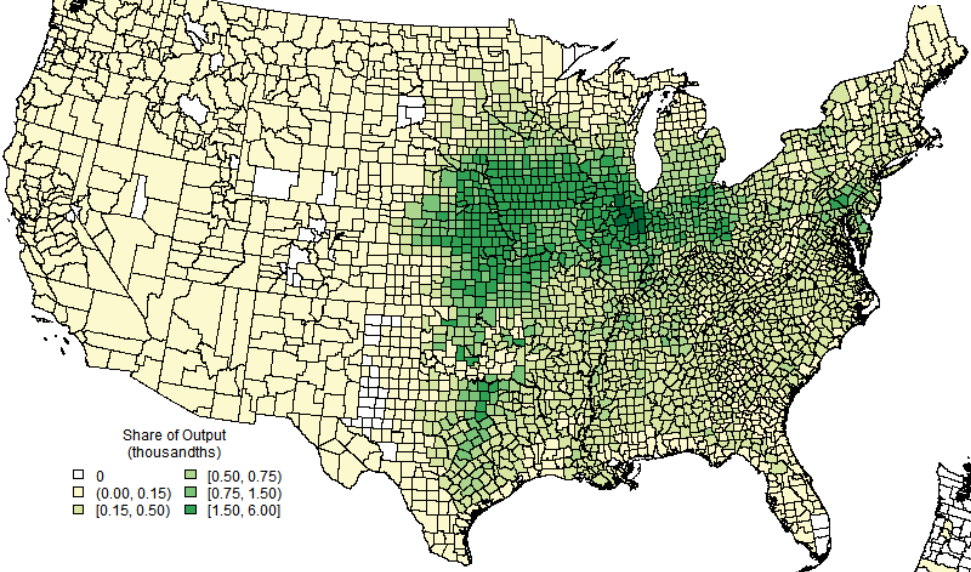
Changing Agricultural Production and Productivity Realities

Changing Location of World Agriculture, 1961 vs 2013

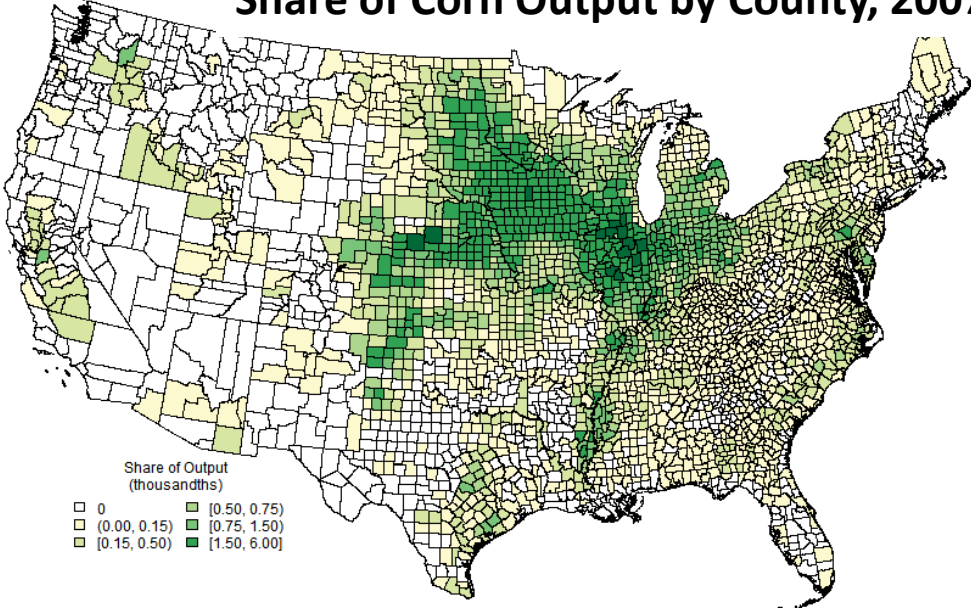


Corn Movement in the U.S., 1899-2007

Share of Corn Output by County, 1899



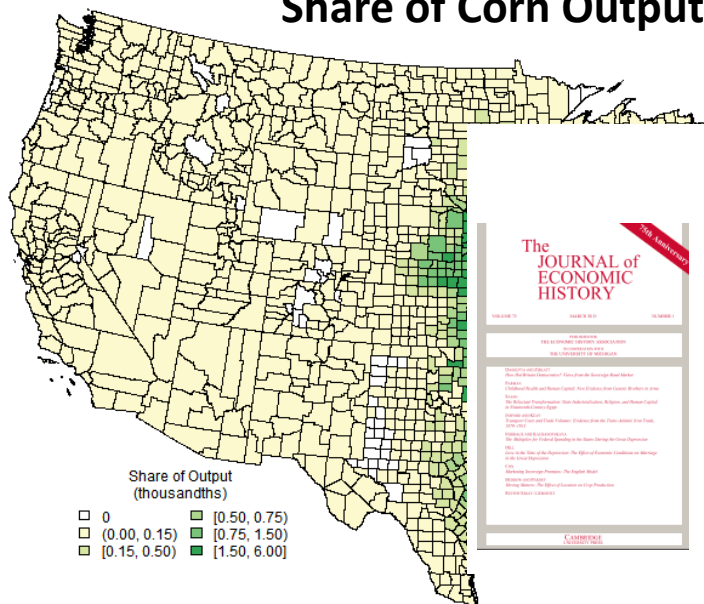
Share of Corn Output by County, 2007



Source: Beddow and Pardey (2015)

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

Share of Corn Output by County, 1899



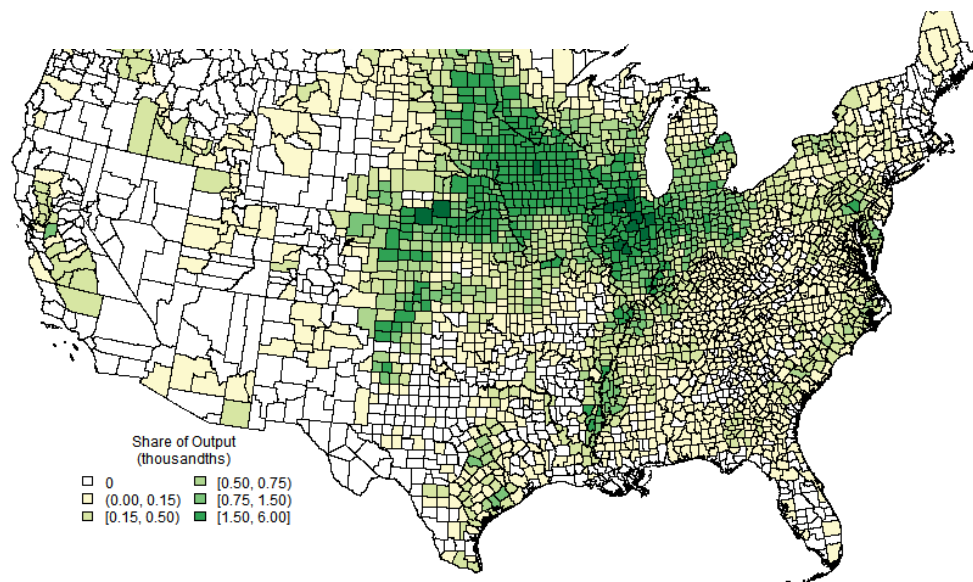
Moving Matters

279 kilometers north

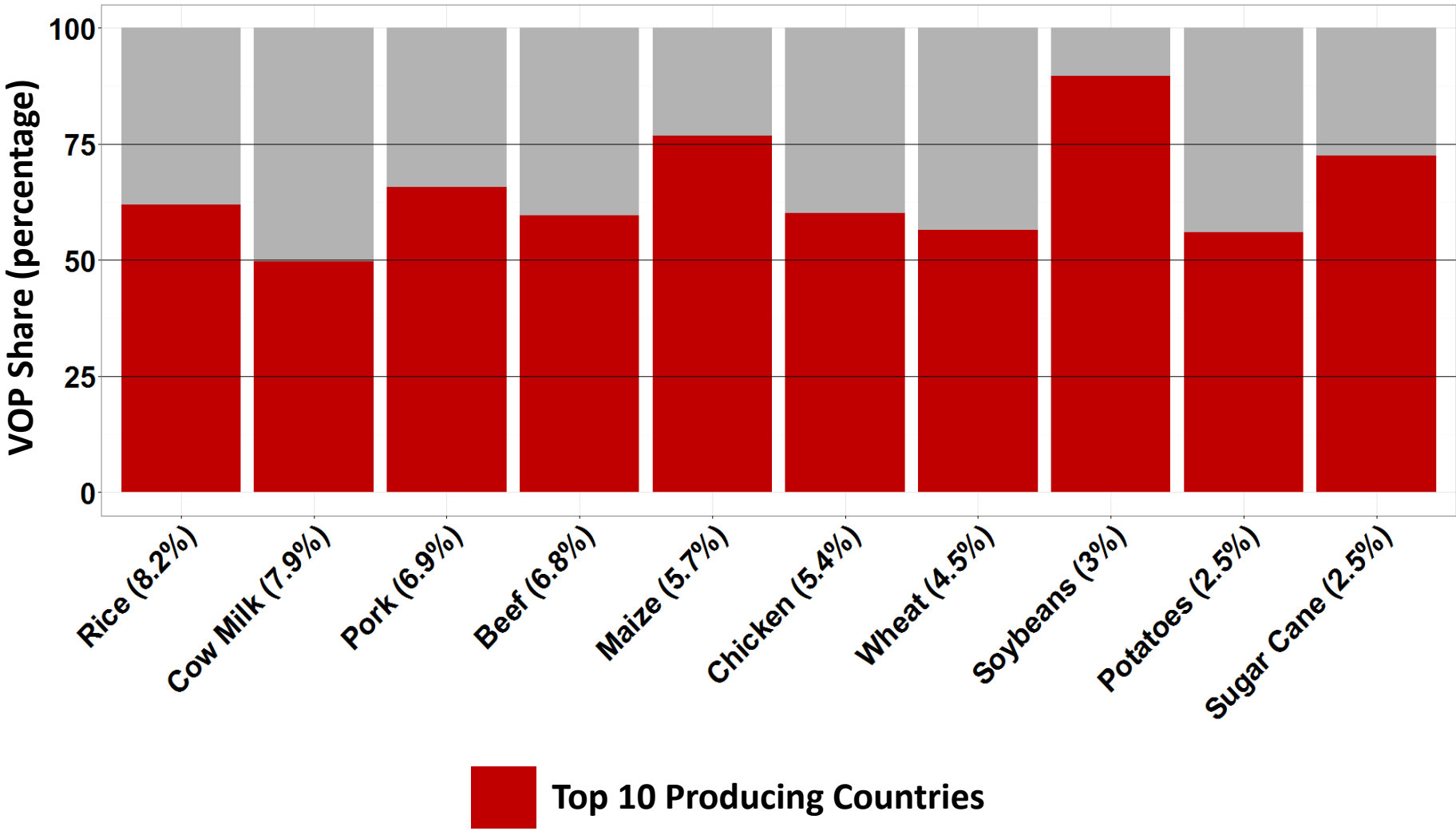
342 kilometers west

16 to 21 percent of corn output growth

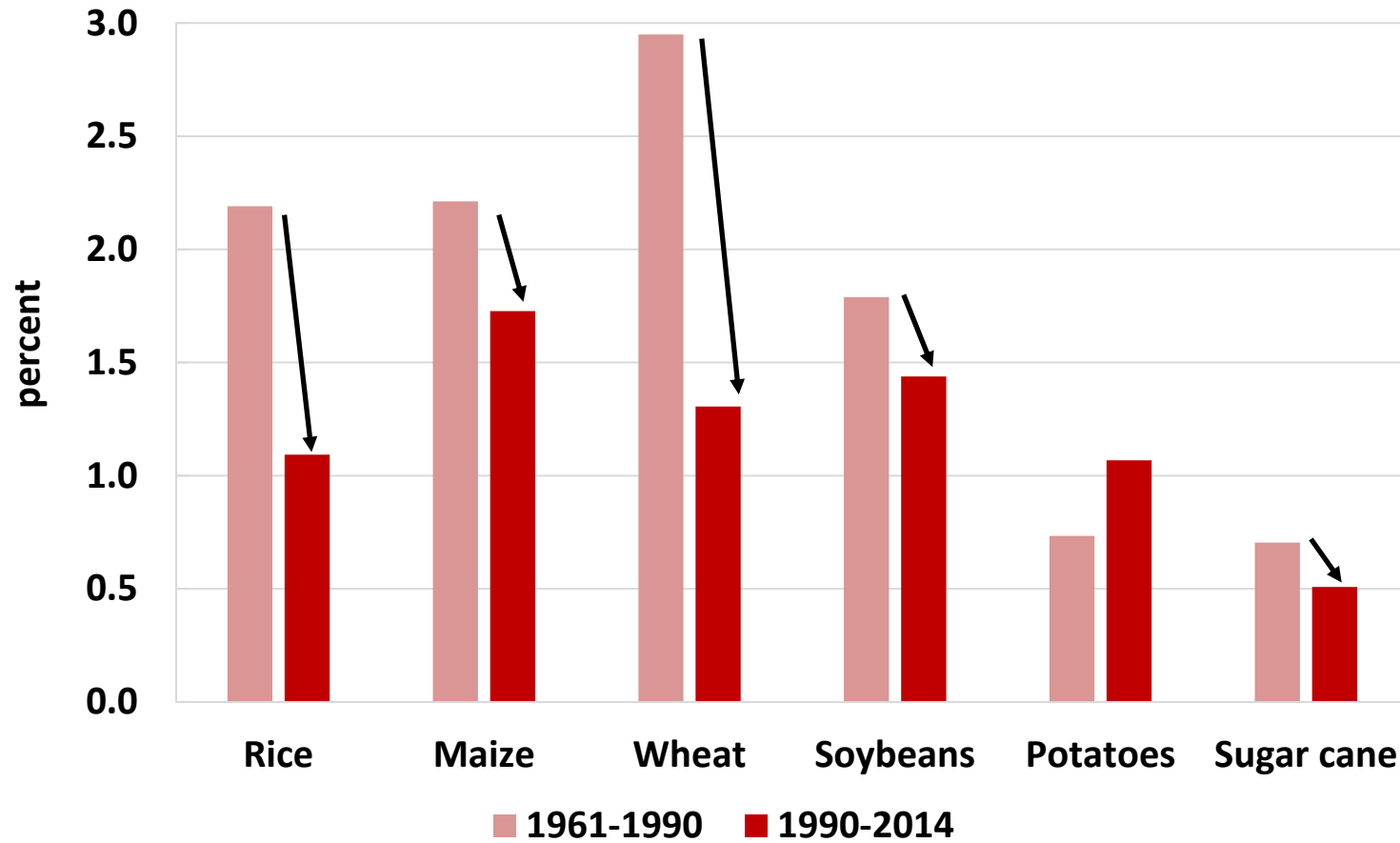
ut by County, 2007



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

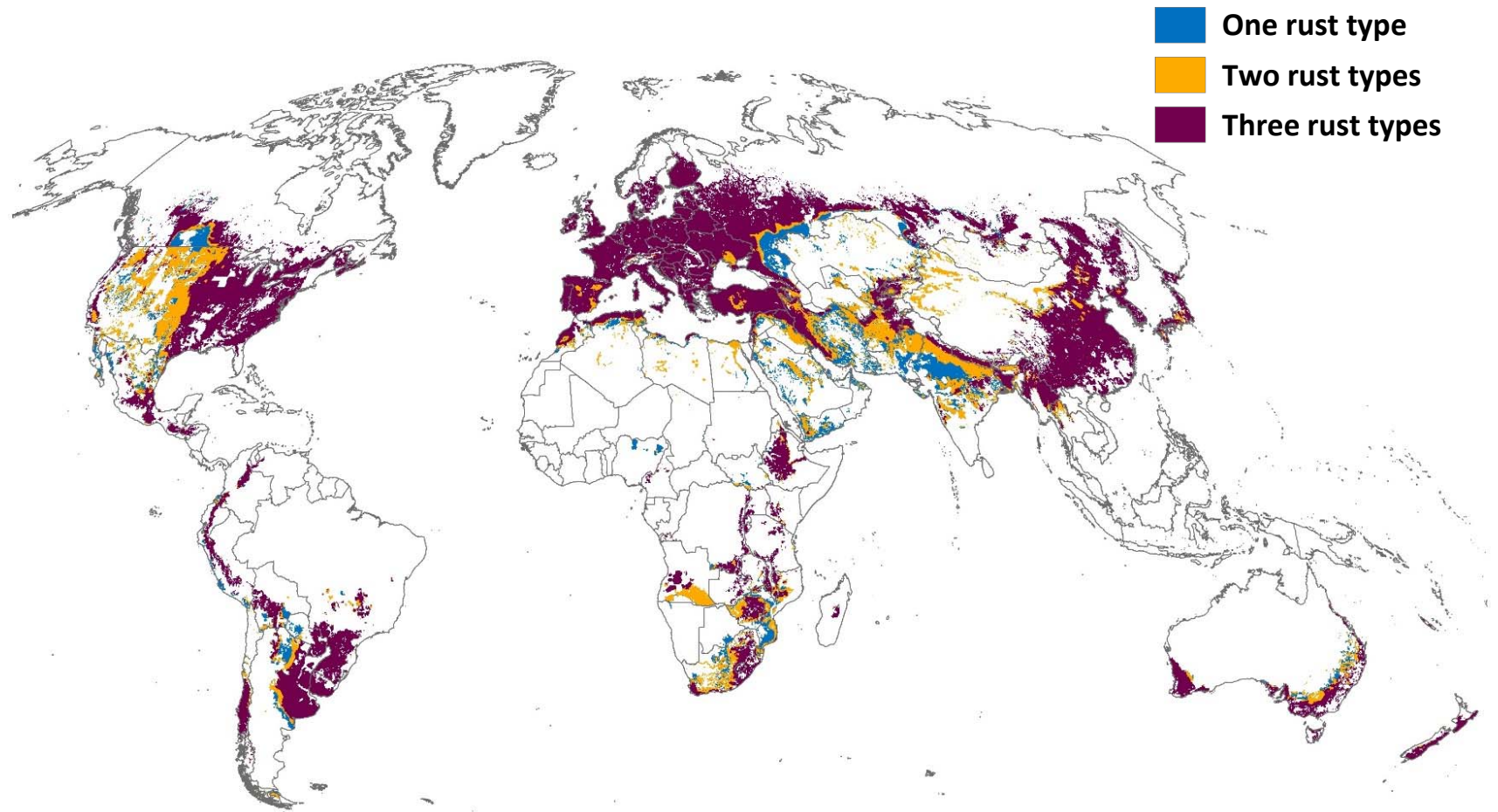


Stripe Rust



Leaf Rust

Three Rusts—Seasonally Vulnerable



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

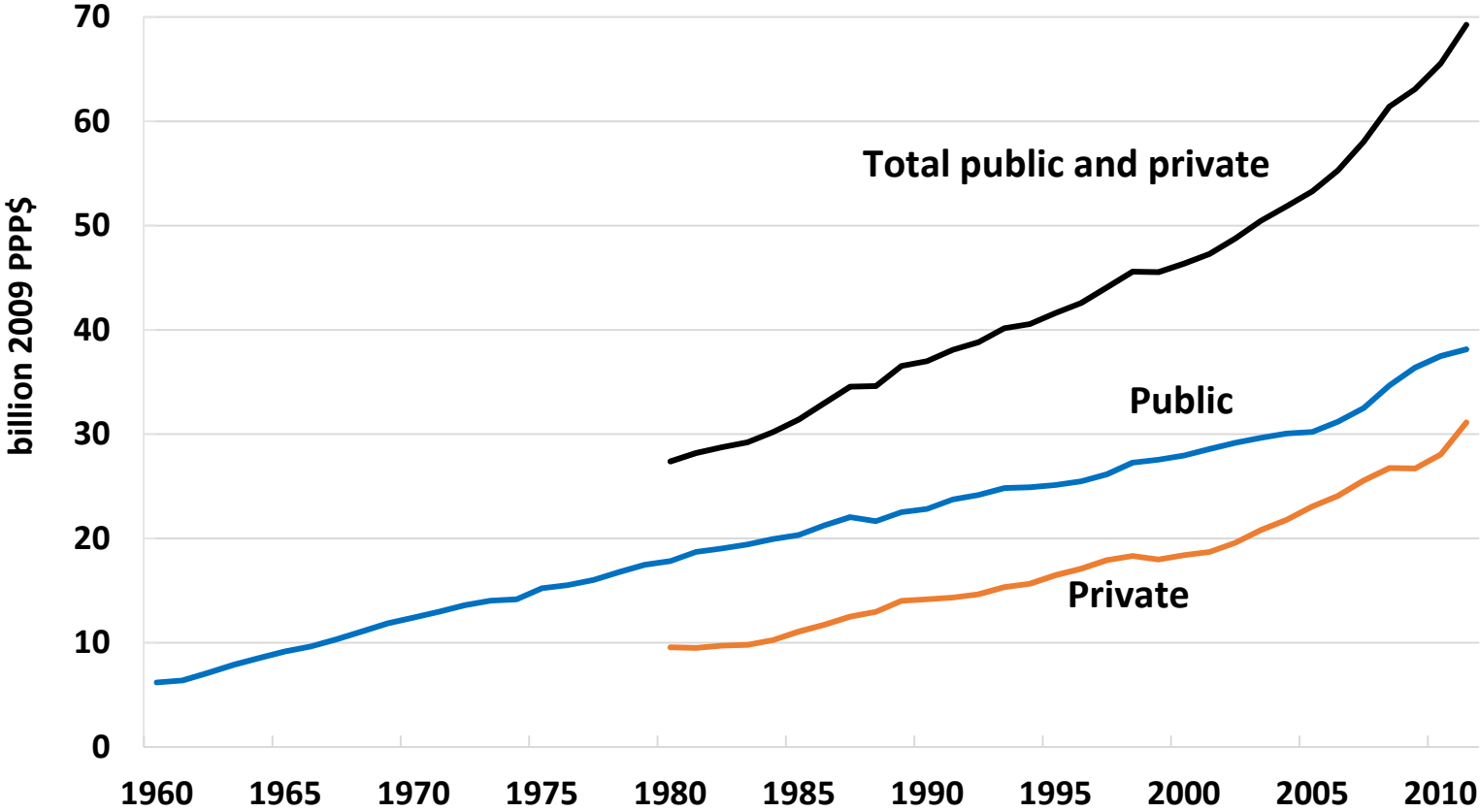
Vulnerability to Wheat Rusts Worldwide

	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

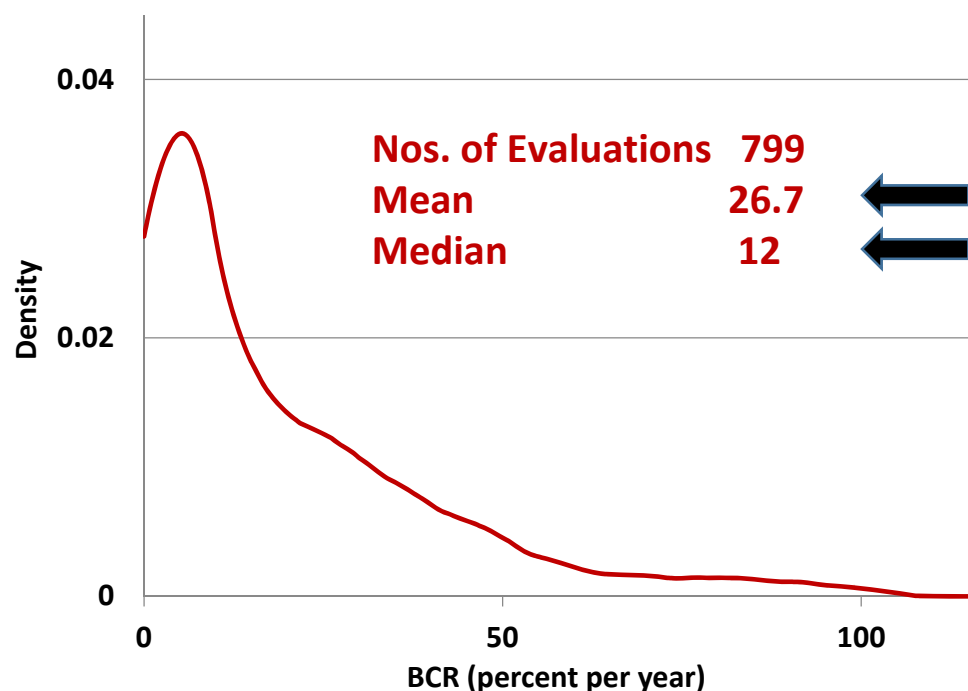
The Global Food and Agricultural R&D Landscape

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



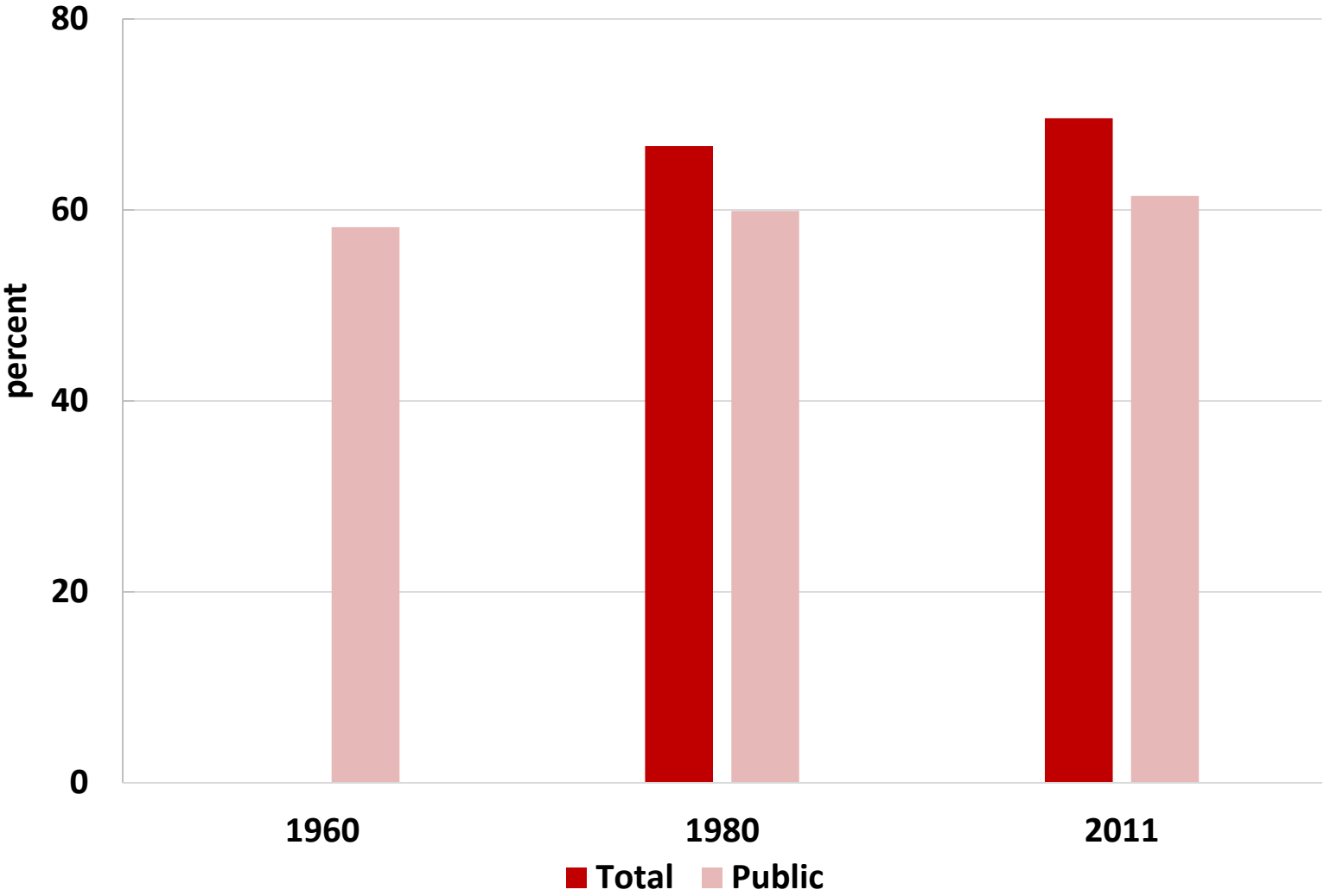
Have the returns to R&D declined over time?

- 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

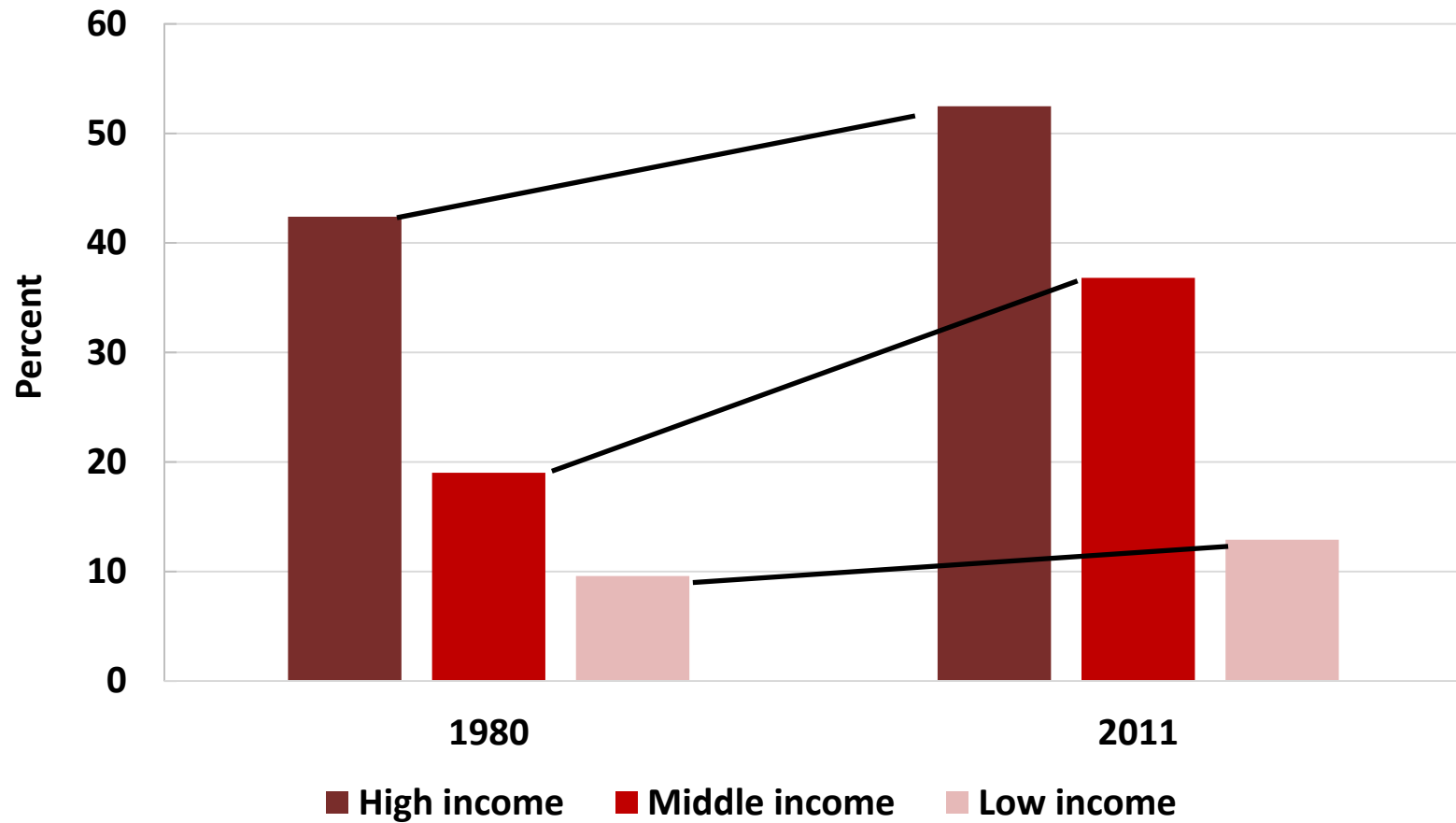
Spatial Concentration -- Top 10 Country Share



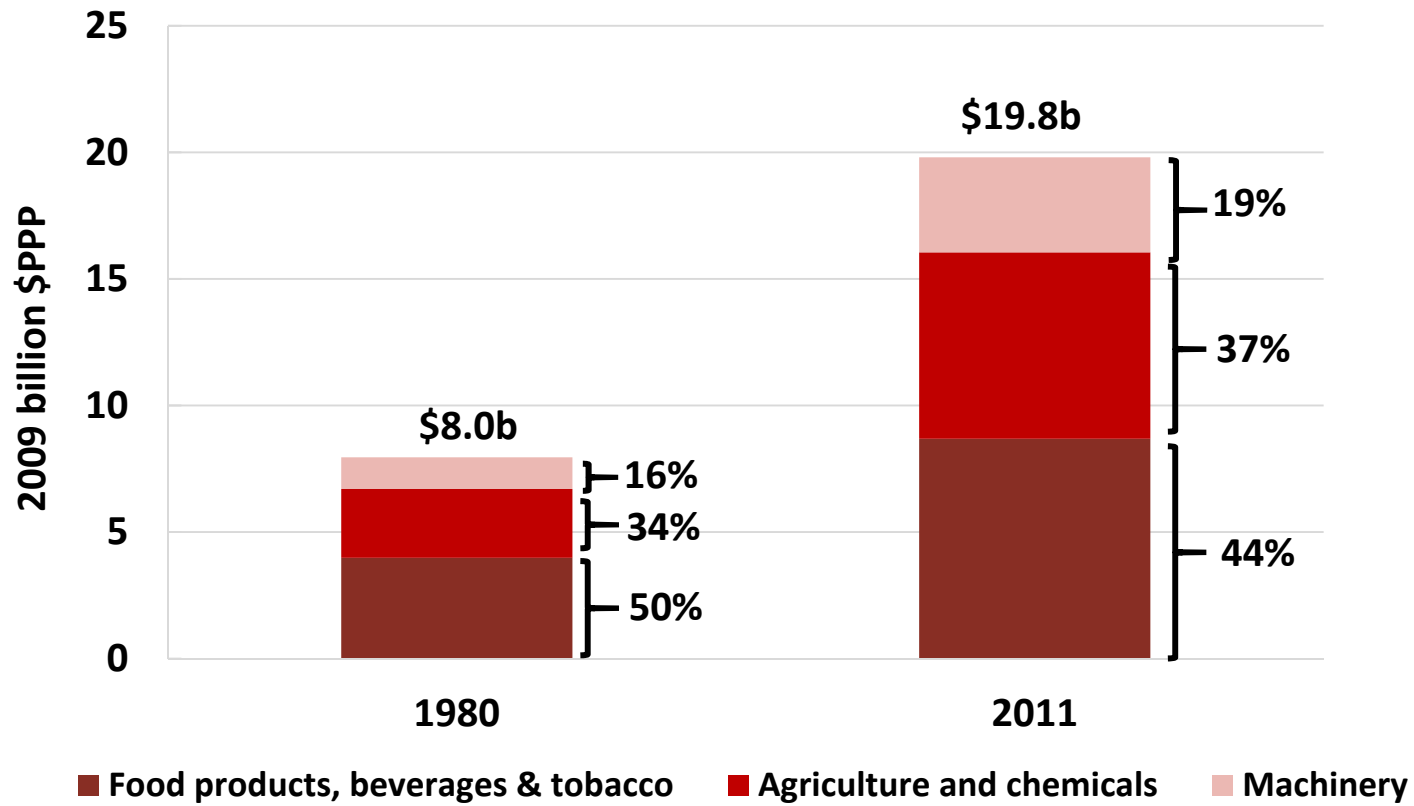
Behind the Aggregate R&D Numbers

- 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%)

Private Share of Total Agriculture & Food R&D



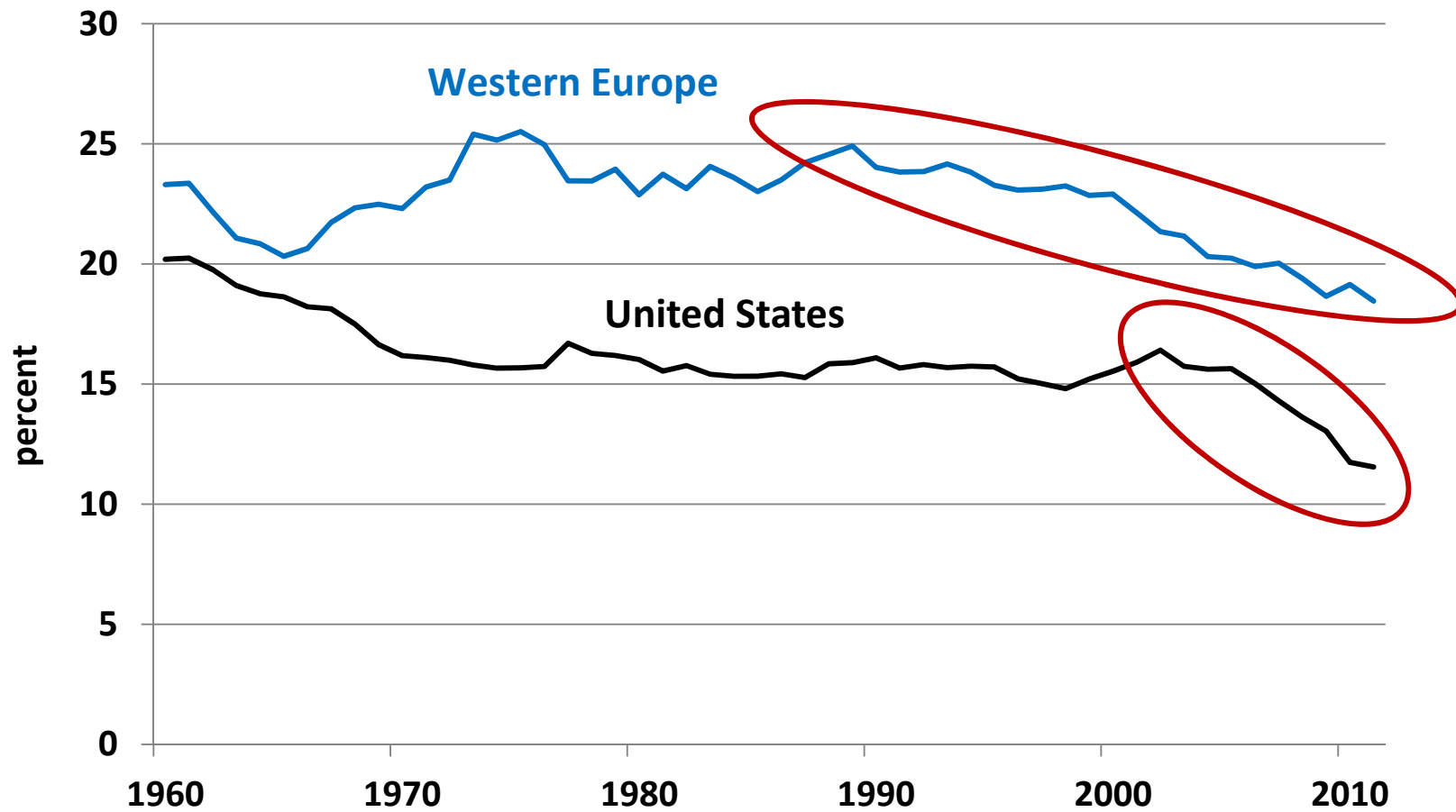
Private Food and Agricultural R&D in Rich Countries



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



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!

The screenshot shows the InStepp website homepage. The header features the InStepp logo and navigation links for publications, datasets, and presentations. Below the header, there are tabs for Agriculture, Health, Intellectual Property, R&D and Innovation, and About Us. The main content area is divided into two columns. The left column has a large image of a plant stem and a section titled 'Agriculture'. The right column is titled 'About InStepp' and describes the organization's mission. Below this, there is a 'Recent Additions' section with three entries: 'Investments in and the Economic Returns to Food and Agricultural R&D Worldwide', 'Rethinking Yield Gaps', and 'Insect Resistance Management: Adoption and Compliance'. At the bottom right, there is a 'InStepp Partners' section for the Department of Plant Pathology at the University of Minnesota.

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publications datasets presentations

Agriculture Health Intellectual Property R&D and Innovation About Us

Agriculture

About InStepp
International Science & Technology Practice & Policy (InStepp) brings together a community of scholars at the University of Minnesota and elsewhere to engage in economic research on science and technology practice and policy, emphasizing the international implications.

Recent Additions

- "Investments in and the Economic Returns to Food and Agricultural R&D Worldwide"
- "Rethinking Yield Gaps"
- "Insect Resistance Management: Adoption and Compliance"
- "Influences of Agricultural Technology on the Size and Importance of Food Price Variability"

InStepp Partners

DEPARTMENT OF PLANT PATHOLOGY
Department of Plant Pathology, University of Minnesota
Saint Paul, Minnesota
United States



www.instepp.umn.edu

The screenshot shows the HarvestChoice website homepage. The header includes the HarvestChoice logo and navigation links for Data, Publications, Maps, and Tools. A large banner image shows baskets of fresh produce with the text 'Mapping the Growing Seasons in sub-Saharan Africa'. Below the banner, there is a 'HIGHLIGHTS' section with three featured articles: 'Agricultural Innovation: The United States in a Changing Global Reality', 'Atlas of African Agriculture Research and Development: Preview', and 'What Can be Done to Reinvigorate U.S. Agricultural Research?'. On the right side, there is a 'HarvestChoice BLOG' section with a list of recent posts from October 2013 to July 2015. At the bottom right, there is a 'FEATURES' section with a small image of food.

HarvestChoice
BETTER CHOICES, BETTER LIVES

ABOUT BLOG

TOPICS REGIONS COMMODITIES

Data Publications Maps Tools

Mapping the Growing Seasons in sub-Saharan Africa

HIGHLIGHTS

- Agricultural Innovation: The United States in a Changing Global Reality**
This report looks at the processes of agricultural innovation and the role of R&D in increasing agricultural productivity.
- Atlas of African Agriculture Research and Development: Preview**
The Atlas of African Agriculture Research and Development is part of a wide-ranging e-Atlas Initiative that will showcase, through print and online resources, a variety of spatial data, tools, and services.
- What Can be Done to Reinvigorate U.S. Agricultural Research?**
We describe the evolving patterns of support for public agricultural and food R&D, the shifting emphasis of spending within the broad portfolio, and some potential policy approaches to revitalize U.S. agricultural research.

HarvestChoice BLOG
What we think.

- Oct 7, 2013**
New Dawn, New Day: A New Alliance for Africa
- Sep 27, 2013**
A Time to Sow: How HarvestChoice is Mapping the Life Cycle of Crops
- Aug 15, 2013**
Global Production System Characterization: SPAM and Beyond
- Jul 23, 2013**
Labor Constraints in sub-Saharan African Farm Households

VIEW ALL >

FEATURES



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