

PRESENTATION AT THE
SEVENTH BERKELEY BIOECONOMY CONVERGENCE
MARCH 2014:

THE POLITICAL ECONOMY OF TECHNOLOGY

HOW INSTITUTIONAL FRAMEWORKS SHAPE AGRICULTURAL
INNOVATIONS

Barbara Brandl, Pennsylvania State University

Thesis:



The sheer amount of (public) funding doesn't tell us very much. In order to understand the agricultural performance of a nation we have to look at the institutional framework (as for example the design of intellectual property rights or the antitrust law, etc).

Structure



1. Brief introduction to the varieties of capitalism approach
2. Suggestion of a typology of three regimes of knowledge provision and their impact on seed development
3. Comparison of yield development in hybrid and non hybrid crops in the U.S. and Germany
4. Conclusions

Varieties of Capitalism



- An interdisciplinary approach that provides an analytical framework in order to understand how the institutional structure of a nation affects the economic performance
- two main types of institutional structures: the liberal type (such as the U.S. or the U.K) and the coordinated type (such as Germany or France)
- Both types of institutional structure foster the emerging of different types of industries and technologies

Regimes of Knowledge Provision

	Liberal Economies		Coordinated Economies
Provision of Knowledge	Public Good <i>(e.g. US until late 1970s)</i>	Private Good <i>(e.g. US since 1980s)</i>	Club Good <i>(e.g. Germany)</i>
Exclusion mechanisms	no or very weak intellectual property protection	strong intellectual property protection	weak intellectual property protection
Intercompany relations and competition policy	competitive strict antitrust policy	competitive strict antitrust policy	collaborative collective bargaining of private companies
R&D focus	focus on 'grand mission projects'	commercially interesting knowledge products	set by a closed group of experts

Regimes of Knowledge Provision and their impact on seed development (1)

	Liberal Economies		Coordinated Economies
Regime of knowledge provision	Public good	Private good	Club good
Exclusion mechanisms	very weak intellectual property protection (variety protection act with strong farmers rights)	strong intellectual property protection (utility patents)	moderate intellectual property protection (plant variety protection with strong breeder rights)
Inter company relations	competitive, but access to public funded research	competitive	cooperative, collaborating of private companies in R&D projects

Regimes of Knowledge Provision and their impact on seed development (2)

	Liberal Economies		Coordinated Economies
R&D Focus	focus on crops which support greater political goals, such as domestic food security or the Green Revolution	focus on privately appropriable crops (hybrid or transgenic crops) blockbuster products such as maize or soybean	diversified product development
Technology focus	basic scientific research	focus on technology which allows the industrialization of breeding (e.g. transgenic methods)	focus on technology which supports the conventional breeding methods

Public and Private Spending on Agricultural R&D

in millions of 2000 international dollars

	Year	Public Spending	Private Spending	Private Share
United States	1981	\$2,568.7	\$2,495.0	49%
	2000	\$3,882.2	\$4,118.8	51%
Germany	1981	\$547.4	\$701.1	56%
	2000	\$758.2	\$877.6	54%

Source : Alston, Julian et al (2010): *Persistence Pays: US Agricultural Productivity Growth and the Benefits from Public R&D Spending*. New York: Springer.

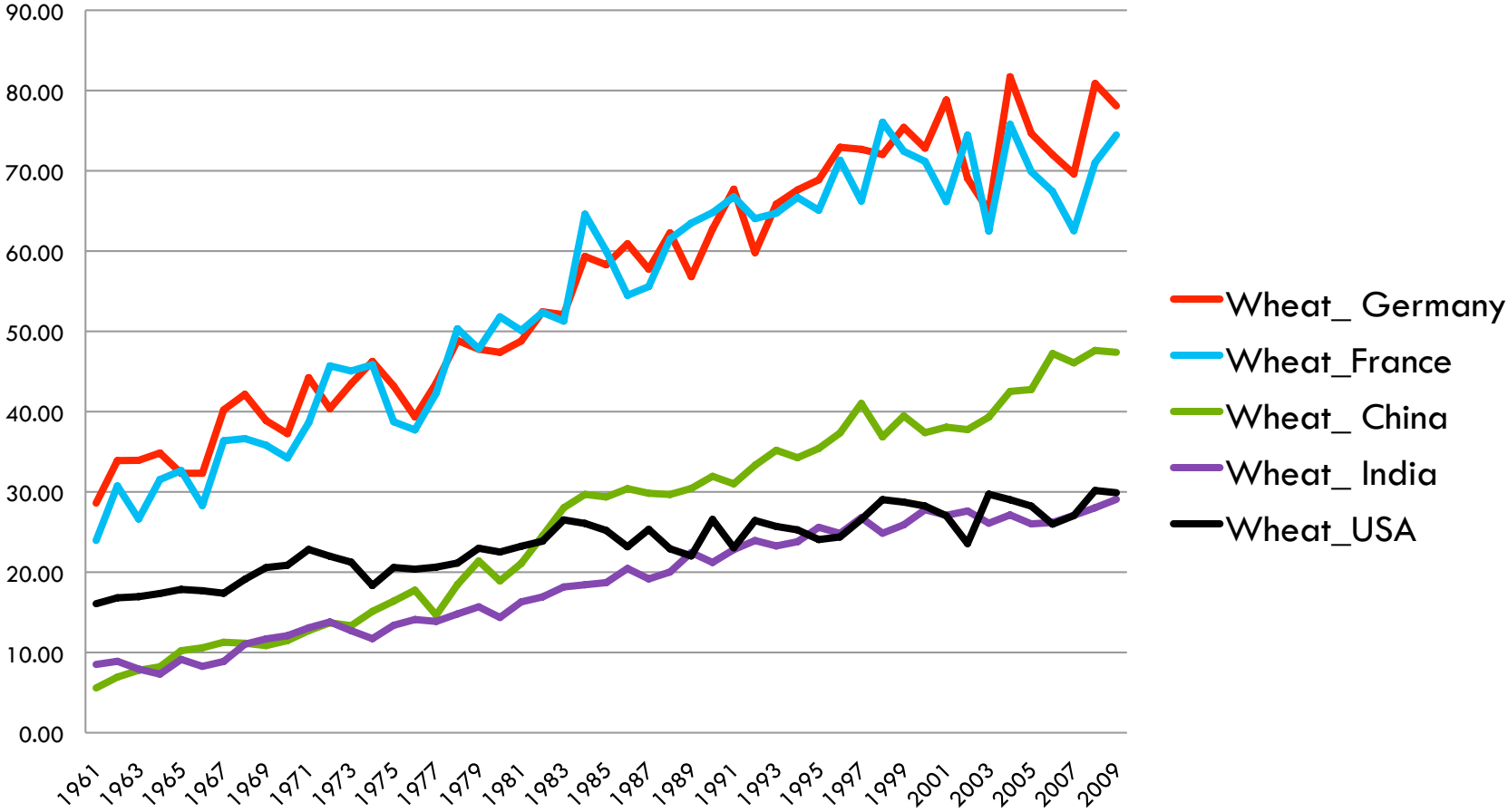
Indicators



- **yield increase over time** as an indicator for the innovation activity in the respective crop
- subdivision of crops according to the degree of commercial interest of private companies
- **highly commercially interesting crops:**
 - > private appropriation is possible such as hybrid or transgenic seed (e.g. corn, soy, rapeseed)
- **less commercially interesting crops:**
 - > private appropriation is difficult or not possible (open pollinated grains such as wheat)

Wheat Yields 1961 – 2012

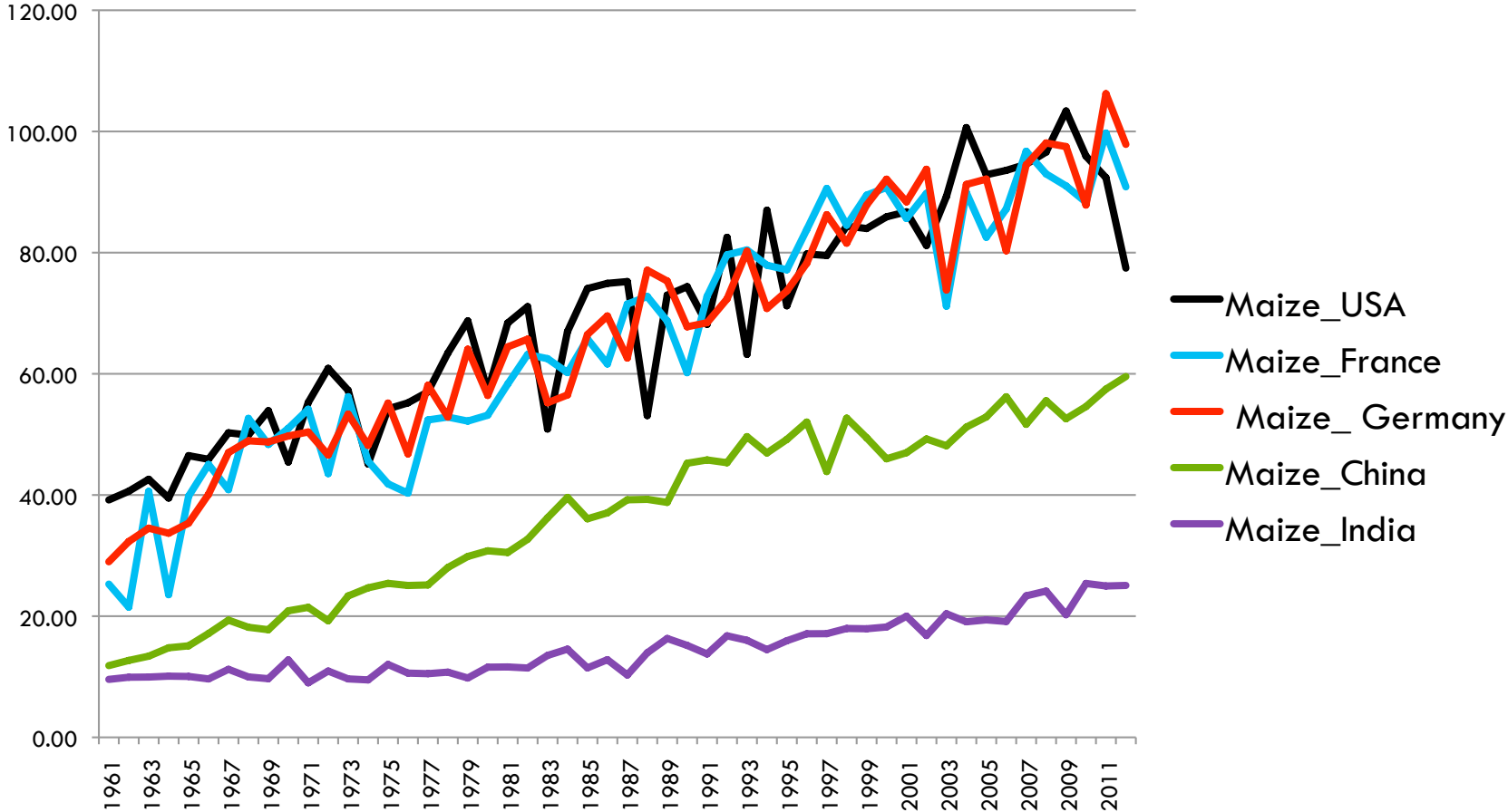
in 1,000 Hectogram per Hectare



Source: FAOSTAT, own calculations

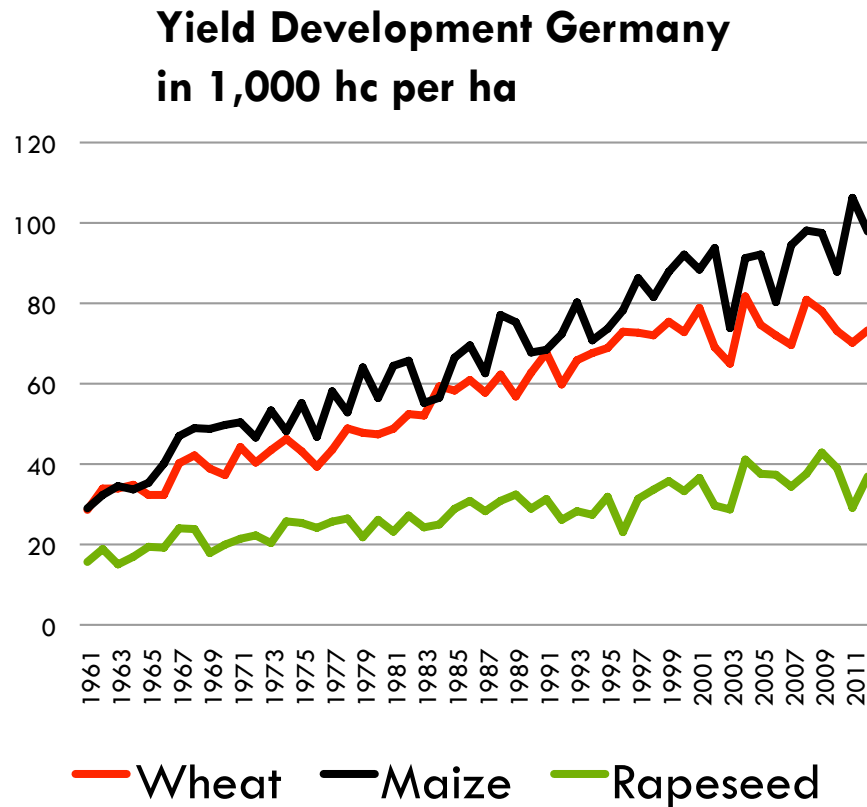
Maize Yields 1961 – 2012

in 1,000 Hectogram per Hectare



Source: FAOSTAT, own calculations

Change in Yield Development Germany

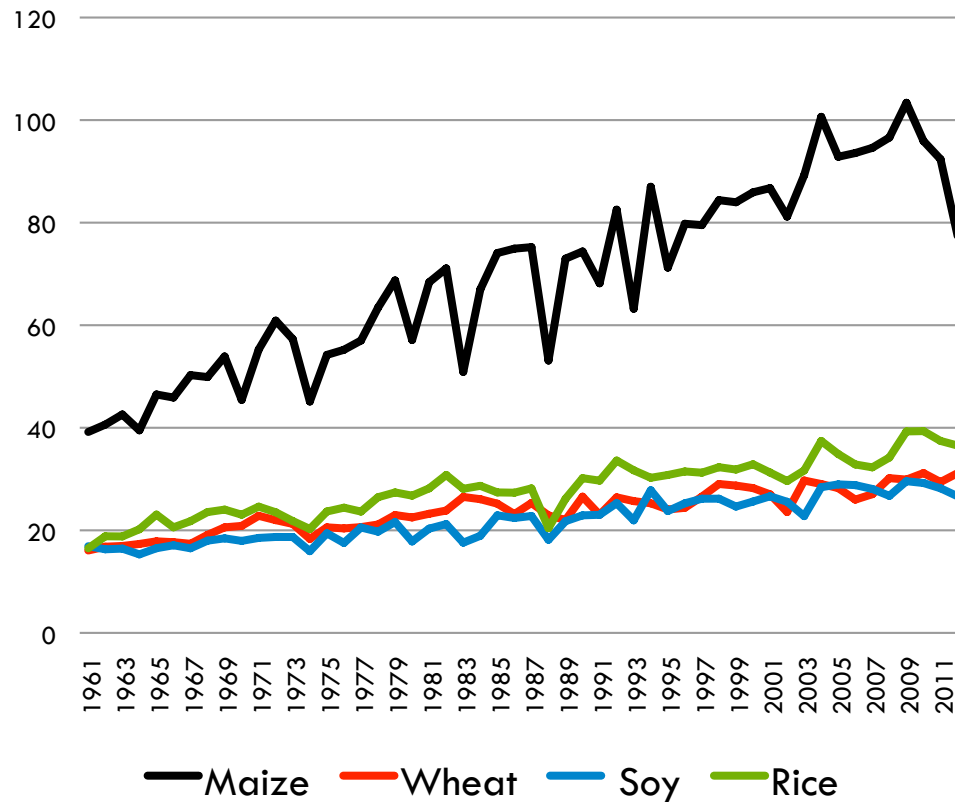


Source: FAOSTAT, own calculations

	average yield increase 1961 - 2012	average yield increase 1961 - 1981	average yield increase 1982 - 2012	change since 1982
Maize Germany	1.29 hc	1.49 hc	1.29 hc	-13.42%
Wheat Germany	0.98 hc	0.87 hc	0.72 hc	-17.24%
Rapeseed Germany	0.40 hc	0.44 hc	0.39 hc	-11.36%

Change in Yield Development United States

**Yield Development U.S.
in 1,000 hc per ha**



	average yield increase 1961 - 2012	average yield increase 1961 - 1981	average yield increase 1982 - 2012	change since 1982
maize USA	1.16 hc	1.23 hc	1.26 hc	+ 2.44%
wheat USA	0.25 hc	0.31 hc	0.20 hc	-35.48%
soybean USA	0.27 hc	0.20 hc	0.30 hc	+50.00%
Rice USA	0.75 hc	0.45 hc	0.87 hc	+93,33%

Source: FAOSTAT, own calculations

Summary



- the agricultural performance of a nation is highly influenced by the institutional framework of an economy
- not only is the amount of public funding is important but also an institutional structure which fosters public interests
- political measurements in the agricultural sector have to be adapted to respective type of economy (liberal vs. coordinated)



I'm looking forward to the discussion!

Public and Private Spending on Agricultural R&D

in millions of 2000 international dollars

	Year	Public Spending	Private Spending	Private Share
Canada	1981	\$520.7	\$109.2	17%
	2000	\$474.3	\$244.5	34%
France	1981	\$478.5	\$377.7	44%
	2000	\$341.9	\$1,009.2	75%
Brazil	1981	\$628.0	NA	NA
	2000	\$928.8	\$36.8	4%
China	1981	\$586.9	NA	NA
	2000	\$1,762.8	\$73.5	4%
India	1981	\$332.4	NA	NA
	2000	\$1,159.5	\$128.8	10%

Source : Alston, Julian et al (2010): *Persistence Pays: US Agricultural Productivity Growth and the Benefits from Public R&D Spending*. New York: Springer.

Coordinated Economies



Countries such as Germany, France or Sweden

- finance system based on banks and concentrated ownership
-> allows long-term financing of companies
- intercompany system that enable technology and standard setting collaboration between companies
- education and training system focused on (company) specific human capital
- cooperative industrial relations – wage bargaining across companies (strong role of industry unions)
- comparative advantage in high-tech and service industries (incremental innovation)

Liberal Market Economies

Countries such as the United States, Canada or the United Kingdom

- finance system based on the stock market
 - > short-term horizons but allows high risk taking
- intercompany system that impose strong competition requirements therefore limited possibilities for collaboration between companies
- education and training system emphasis general human capital
- deregulated labor markets discourage employees representation
- comparative advantage in high-tech and service industries (radical innovation)