



EDICIÓN 30



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Un congreso a suelo abierto



Measuring Success and Technology Adoption

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Outline of Presentation

- **Competitive Advantage**
 - Resource Based Theory of the Firm
 - Importance of New Technologies
- **Technology Adoption and Productivity**
 - U.S. Production Agriculture
 - U.S. Corn Production
- **Precision Agriculture**
 - Automaton and Robotics
 - Potential Payoffs



Competitive Advantage

Competitive Advantage

▪ **What is our firm's long-run business strategy?**

- A business can outperform rivals only if it can establish a difference that it can preserve.
- Firms must deliver greater value to customers or create comparable value at a lower cost, or both.
 - Delivering greater value allows the firm to charge higher average per unit prices (value added strategy).
 - Greater efficiency results in lower average per unit costs (low per-unit cost strategy).

Competitive Advantage

		Relative Price Per-Unit		
		Lower	Average	Higher
Relative Cost Per-Unit	Lower	1 Indeterminate Position	2 Competitive Advantage	3 Competitive Advantage
	Average	4 Competitive Disadvantage	5 Parity Position	6 Competitive Advantage
	Higher	7 Competitive Disadvantage	8 Competitive Disadvantage	9 Indeterminate Position

Resource Based Framework

- The **resource based theory of firm** focuses on the resources that contribute to a firm's **competitive advantage**.
- This framework involves asking four questions related to:
 - Value
 - Rareness
 - Imitation
 - Organization

Resource Based Framework

- **The Question of Value**
 - Does the firm's resources and capabilities enable the firm to respond to environmental threats and opportunities?
- **The Question of Rareness**
 - How many competing firms already possess particular valuable resources and capabilities?

Resource Based Framework

- **The Question of Imitation**
 - Do firms without a resource or capability face a cost disadvantage in obtaining it compared to firms that already possess it?
- **The Question of Organization**
 - Is the firm organized to exploit the full competitive potential of its resource and capabilities?

Resource Based Framework

- Identifying and utilizing unique resources that are difficult for other firms to obtain is a key component in sustaining a firm's competitive advantage.
- Firms without any unique resources will find it increasingly difficult to compete.

Resource Based Framework

Valuable?	Rare?	Costly to Imitate?	Exploited by Organization?	Competitive Implications	Economic Performance
No	No	No	No	Disadvantage	Below Normal
Yes	No	No	No	Parity	Normal
Yes	Yes	No	No	Temporary Advantage	Above Normal
Yes	Yes	Yes	Yes	Sustained Advantage	Above Normal
Adapted using information in Chapter 3 of Barney and Clark (2007), Resource-Based Theory.					



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Identification of Unique Resources

- **Identify at least one unique resource for your business.**
 - The Question of Value
 - The Question of Rareness
 - The Question of Imitation
 - The Question of Organization
- **This is your homework!**

Importance of New Technologies for Crop Farming

- Adoption of technology has been important to production agriculture for decades.
- For example, through the adoption of technology and improved managerial practices, aggregate U.S. farm output in the U.S. tripled from 1948 to 2019 with almost no corresponding increase in aggregate input (USDA-ERS, 2022).
- Let's take time to ponder the last statement!

Importance of New Technologies for Crop Farming

- **The adoption of technology in production agriculture is expected to accelerate in the next decade.**
- **Changes to crop agriculture:**
 - **Increased use of monitoring and control systems, communication technologies, and data analytics**
 - **Micro-management of production activities**
 - **Traceability of output attributes**



Technology Adoption and Productivity

Measuring Productivity

- **Definition:**
 - **Ratio of total output to total inputs**
- **Rate of Growth:**
 - **Rate of growth of outputs minus rate of growth of inputs**
- **Components:**
 - **Efficiency Change**
 - **Scale Change**
 - **Technical Change**

Input Categories: Production Agriculture

- **Labor**
 - Hired
 - Family
- **Capital**
 - Equipment
 - Buildings
 - Land
 - Inventories

Input Categories: Production Agriculture (continued)

- **Intermediate Goods**

- **Feed and Seed**
- **Energy**
- **Fertilizer and Lime**
- **Pesticides**
- **Purchased Services**



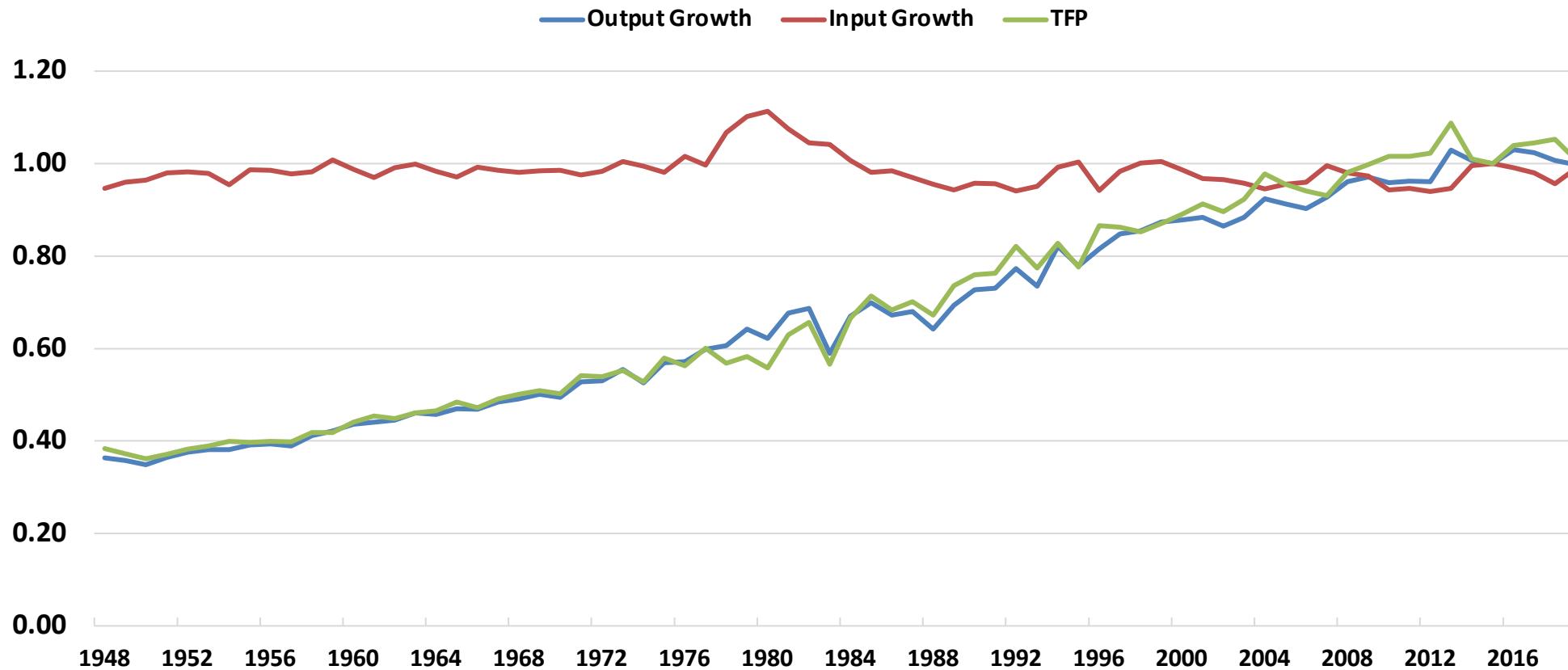
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U.S. Productivity, Production Agriculture

Output Growth, Input Growth, and Total Factor Productivity, U.S. Farms

Source: USDA-ERS, 2022

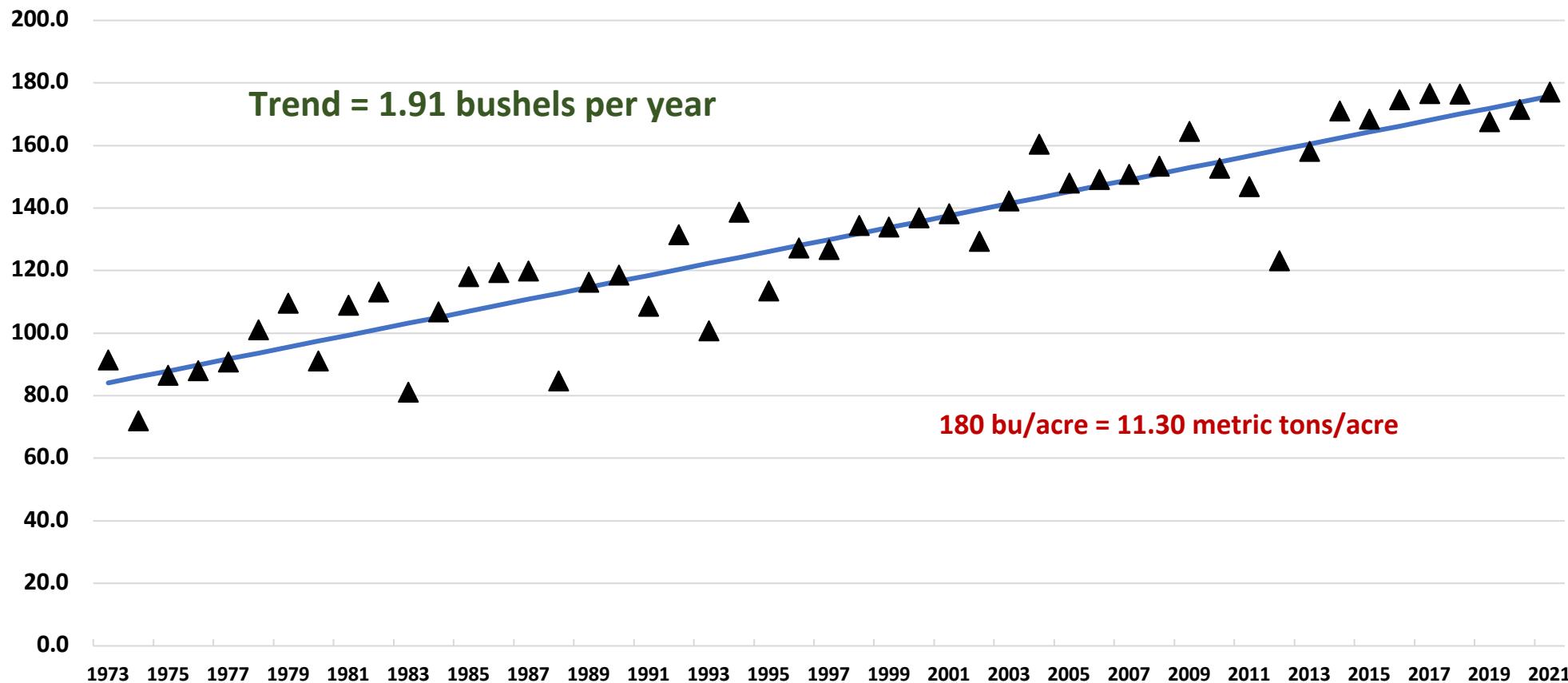


Annual Rates of Growth

- **Output = 1.42%**
- **Inputs = 0.06%**
 - **Labor = -0.42%**
 - **Capital = -0.06%**
 - **Intermediate Goods = 0.54%**
- **Total Factor Productivity = 1.36%**

U.S. Corn Production

U.S. Corn Yields, 1973 to 2021



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Precision Agriculture

■ Trends in Automation and Robotics

- Physical Robots
 - Perform industrial tasks that were previously more labor intensive
- Robotic Process Automation
 - Use software to automate tasks that were previously performed by humans
- Cognitive Automation
 - Use software to automate tasks or improve task precision (e.g., machine learning, visual processing of data, and the use of data sets to improve decision making)

Automation and Robotics in Production Agriculture

- **Automation will not necessarily eliminate entire occupations. However, automation is likely to affect portions of almost all jobs.**
- **Three groups of occupational activities:**
 - **Highly susceptible to automation**
 - Includes predictable physical work
 - Examples: welding on an assembly line, food preparation, and packaging
 - **Less susceptible to automation**
 - Includes stakeholder interactions and unpredictable physical work
 - Examples: construction, forestry, and raising animals
 - **Least susceptible to automation**
 - Examples: personnel management and decision making, planning, and creative tasks

- The most difficult activities to automate are those that involve managing and supervising people, and the activities that apply expertise to decision-making, planning, and creative work.
- Computers do a good job performing well-defined tasks.
- However, it is difficult to codify and improve machine learning techniques to mimic human skills and capabilities.
- In particular, tacit knowing or the fact that humans know more than they can describe is problematic to automation.

Automation and Robotics in Production Agriculture

- **Examples in production agriculture:**
 - Autonomous grain carts
 - Drones
 - Hands Free Hectare; Harper Adams University
 - 3-D Printing
 - Robotic Milkers

Potential Payoffs of Precision Agriculture

▪ Payoffs for Producers

- Cost reduction and improvements in efficiency
- Value enhanced differentiated products
- Improve span of control (i.e., farm over a larger geographical area)
- Reduced downtime and better capacity utilization
- Risk reduction
- Landlord, supplier, and buyer relationships
- Enhanced property value

Potential Payoffs of Precision Agriculture (continued)

- **Payoffs for the Agribusiness Value Chain**
 - Food safety
 - Sustainability
 - Traceability

Potential Payoffs of Precision Agriculture (continued)

- **Payoffs for the Environment**

- **Reduced fertilizer and chemical leaching and runoff**
- **Conserving irrigation water**
- **Comprehensive nutrient plan**



Concluding Comments

Concluding Comments

- **Competitive Advantage**
 - What are your unique resources?
- **Technology Adoption and Productivity**
 - Productivity has historically created large increases in output and improved resource use, and is critical for feeding a growing population with a growing per capita income.
- **Precision Agriculture**
 - The adoption of precision agriculture, which includes artificial intelligence, automation, and robotics, will have payoffs for agricultural producers, the agribusiness value chain, and the environment.