Economic Returns to U.S. and Global Agricultural Research

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Economic contribution of research

- Nation's investment in R&D is key instrument of economic growth
  - U.S. public ag R&D accounts for about half of all agricultural growth since 1950 (Shane et al., 1998)
- Economic payoff to innovator is frequently much lower than benefit society as a whole
  - Social return at least twice the private return (Mansfield, 1977)

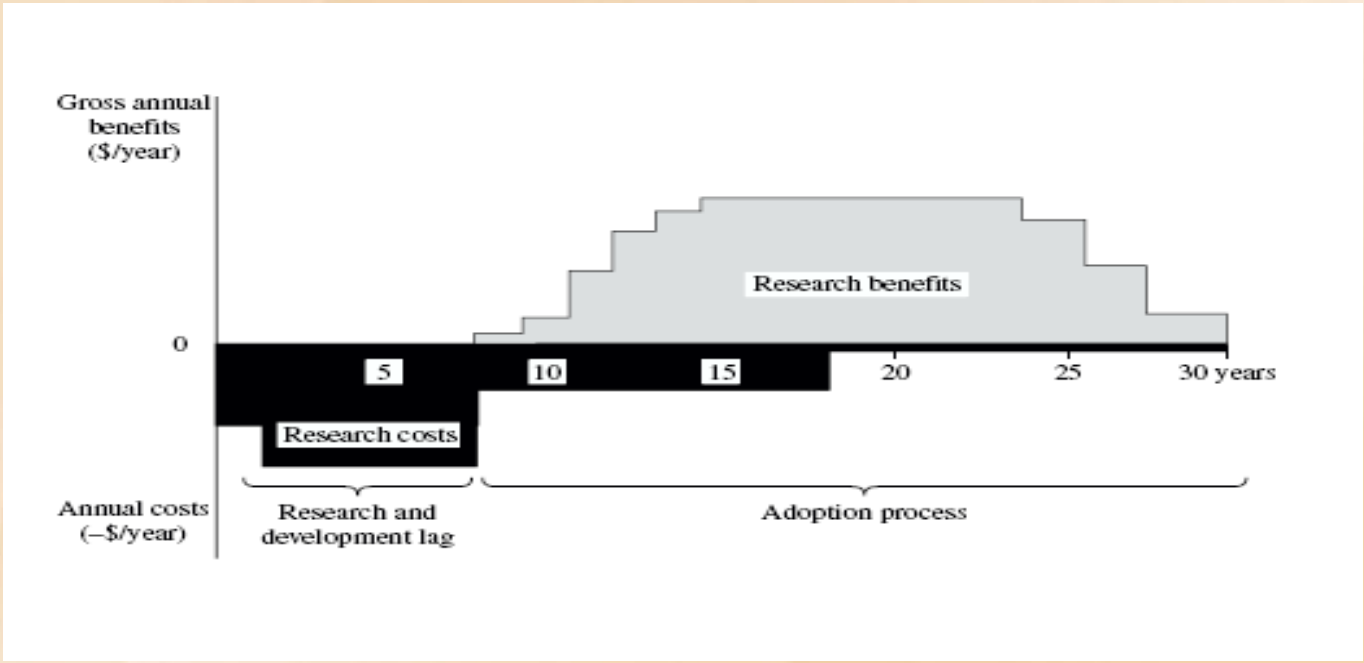
Economic returns to research

Has attracted attention of economists since 1950s

- Agricultural sector most heavily studied
  - Returns to research on hybrid corn (Griliches, 1958)
  - Government plays large role in supporting research
  - Relatively good data on R&D spending & productivity change
- Now also have studies on returns to industrial research, basic academic research, health research, etc.

How economists measure returns to research

- Benefit-cost analysis



- Project evaluation method
  - Trace R&D cost and adoption benefits of a specific innovation
- Statistical method
  - Correlate past investments in research with rate of productivity growth

What the “rate of return” means

- Social returns = economic benefit to society
  - higher profits for farms
  - lower costs for consumers
- Internal rate of return (IRR)
  - Discount rate that equates present value of research costs and social benefits from adoption of research outcomes
  - 40% rate of return: $100 invested today generates an annual stream of benefits of $40 into the future

Issues in measuring rate of return to research

- Attribution issues
  - Contribution of private sector and agricultural extension
  - “Spillovers” from research done in other regions
- Lag time
  - When research is done and when its economic effects are felt
- Efficiency losses of tax revenue
  - $1 in government expenditure costs economy more than $1
- Studies have generally not considered some of the consequences of new technology
  - Environmental and health effects
  - Dislocation and adjustment costs

The agricultural research enterprise

United States, 2007

- $5.1 billion in public research
  - Funders: Federal (58%), States (27%), Other (15%)
  - Performers: USDA (25%), State Ag. Exp. Stations (75%)
- $3-4 billion in private research on farm technologies
  - Machinery, chemical, pharmaceutical, biotechnology, food

Worldwide, 2000

- $23 billion in public research
- $10-13 billion in private food & agricultural research

Sources: United States (ERS), Worldwide (Pardey et al., 2006)

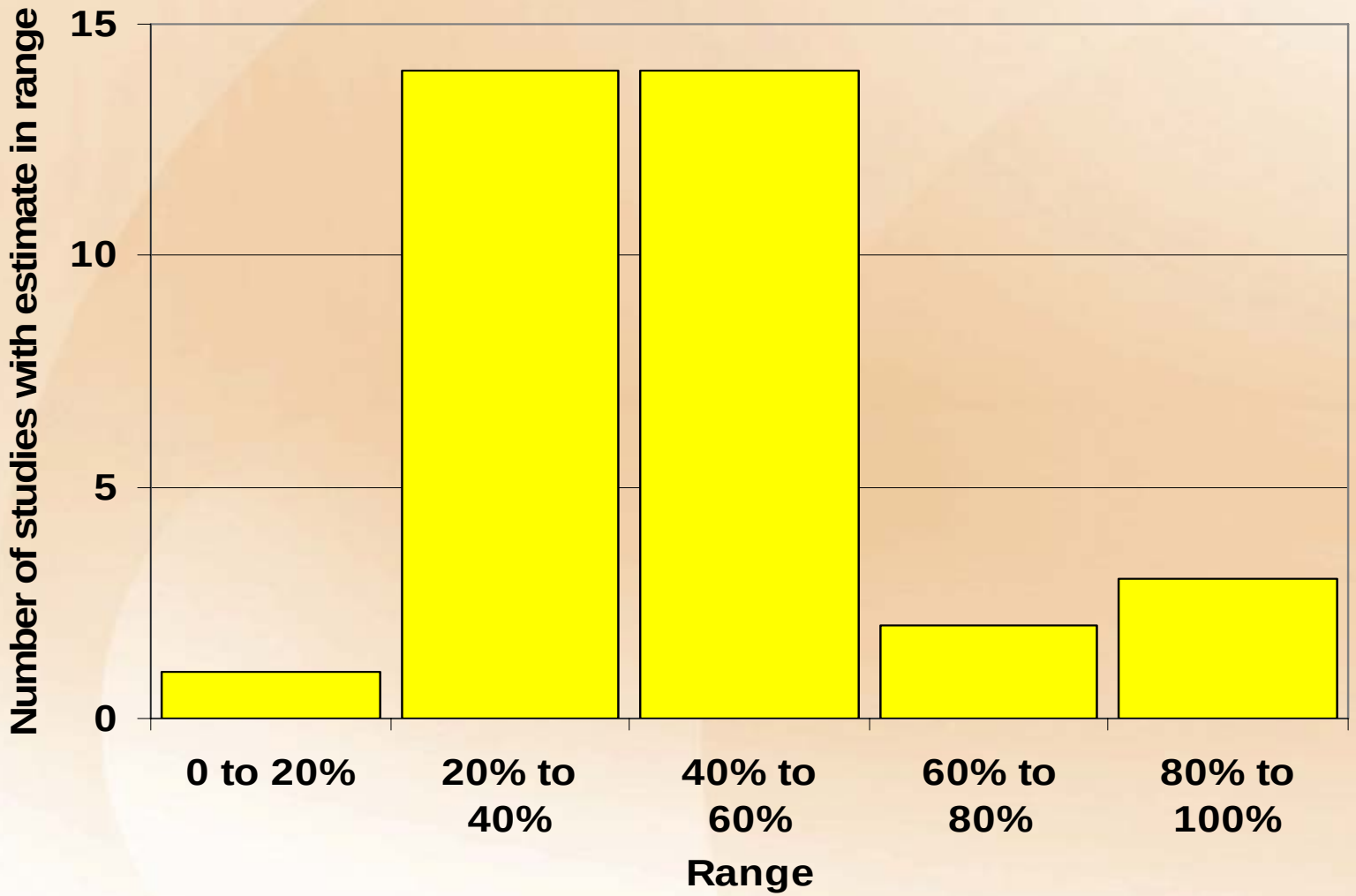
What the studies say

Economic returns to the U.S. agricultural research system

Sector	Number of estimates	Mean estimate	Median estimate
Public ag research	35	53%	45%
Private ag-related research	4	45%	45%

Source: ERS, based on Huffman and Evenson, 2006.

Distribution of estimates of rate of return to U.S. public ag research



Economic returns to global agricultural research (public sector)

Location of research performer	Number of estimates	Median estimate (% return)
Industrialized countries	990	46
North America	740	47
Europe	85	62
Developing countries	683	43
Asia-Pacific	222	50
Latin America	262	43
Africa	188	34
Multinational	136	37

Source: Alston et al., 2000.

Implications from studies

- High rate of return implies underinvestment in research
- Research returns high for most states and commodities
- Research “spillovers” are significant
- Research benefits widely distributed in economy
  - Most benefits eventually transferred from farm sector to the food industry and consumers in form of lower prices
- Agriculture makes oversized contribution to productivity growth in U.S. economy
  - 1.8% of GDP but 12.1% of total factor productivity growth in U.S economy during 1970-2004 (Jorgenson, 2006)
- Getting a high payoff from research depends on other institutions working properly (markets, industry, extension)