

2004 SAES – ARD Workshop  
Oklahoma City  
Sept. 28, 2004

**Implications and Use of the Counterfactual  
Study:  
Results and Conclusions**

By

**Wallace E. Huffman**  
C.F. Curtiss Distinguished Professor of Agriculture and  
Professor of Economics  
Iowa State University

## **I. Introduction**

**Preliminary report was given in Baltimore (2002) using data for 1970-95**

**Today:**

**Document recent changes in the SAES funding situation**

**Give new guidance from public finance**

**Review updated results and conclusions**

- Demand for experiment station resources**
- Impacts of public agr research stocks and composition of resources on state TFP growth**

## II. Recent Changes in the SAES Funding Situation

### A. Expenditure Record—Table 1. Obligations (CRIS)

Categories	Change (2000 dol.)	Change (2000 dol.)
	<u>1980 – 2000</u>	<u>2000 – 2003</u>
Total budget	+\$336.1 mil	+\$61.7 mil
CSREES	- 28.9 mil	+ 50.0 mil
Hatch, Regional and non-grant	- 98.0 mil	- 1.3 mil
Competitive Grants	+ 44.7 mil	+44.5 mil
Special Grants	+ 24.4 mil	+14.8 mil
Other Federal Grants and Contracts	+ 338.8 mil	+119.0 mil
Private Contracts	+ 166.8 mil	+ 4.1 mil
	Change (2000 dol.)	
	<u>1990 – 2000</u>	
State Gov. Approp.	- \$ 79.0 mil	-\$115.6 mil

**Table 2. Distribution of Major Sources of Revenues of U.S. State Agricultural Experiment Stations, 1980-2003.**

Sources	Distribution (%)			
	1980	1990	2000	2003
Regular federal appropriations	17.0	14.0	13.1	15.3
Hatch, regional research, and other non-grant funds	[15.8]	[10.3]	[9.0]	[8.7]
CSRS/CSREES special grants	[1.2]	[2.5]	[2.1]	[2.7]
Competitive grants, including NRI	--	[1.2]	[2.0]	[3.9]
Other federal government research funds	11.4	12.1	16.2	20.9
Contracts, grants, and cooperative agreements with USDA agencies	[3.0]	[3.1]	[3.4]	[4.2]
Contracts, grants and cooperative agreements with non-USDA federal agencies	[8.4]	[9.0]	[12.8]	[16.7]
State government appropriations	55.5	55.0	50.1	43.7
Industry, commodity groups, foundations	9.2	13.2	15.3	15.1
Other funds (product sales)	6.9	5.7	5.3	5.0
Grand total	100.0	100.0	100.0	100.0

Source: U.S. Dept. Agr. 1982, 1991, 2001, 2004.

### III. CSREES Appropriations

#### A. Competing Institutions

SAES

1890 Institutions

Forestry Schools

Veterinary Colleges

Others

#### B. Appropriation Record

Change (2000 dol.)

2000 - 2003

Formula programs

**-\$23.1 mil** (+\$2.9 mil)

Competitive Grants

+ 39.2 mil (+46.7 mil)

Special Grants

+ 28.8 mil (+52.9 mil)

Source: CSREES, "Research and Education Activities: Appropriation History"

**C. SAES gets all of the Hatch Act federal formula funds but not all of the other CSREES appropriated funds**

## **IV. Guidance from Public Finance**

**A. Agr research in public sector produces discoveries, which are a type of public good—"ideas" are not used up by the R&D process**

**B. Principle of Fiscal Equivalence: A theory of matching the jurisdictional authority with the geographic range of benefits**

- If nutrition research benefits all citizens, than federal government should channel resources to this research**
- If a pest affects crops in the Midwest, than an organization of the Midwestern states should channel resources to this research**
- If soils of a particular state affect crops uniquely, then this state's government should channels resources to research**

**Therefore:**

- A system of possibly overlapping jurisdictions for agr research provision would be more efficient that the current federal/state system**

## C. Model of State Demand for Agr Research, an Impure Public Good

### 1. Conceptual Framework

Each input of research resources produces a different mix of public and private goods at state level

Plus in-kind transfers from other states of the public good and from local private agr research of the private good

State autocrat maximizes utility from the public and private goods produced from research subject to budget constraint

Complete demand system for four research types:

- (1) federal grant and contract funds,
- (2) federal formula funds,
- (3) state funds, and
- (4) private contract and grant funds

with spillin public agr research from other states and local private agr research

## 2. Empirical results: share equations fitted to panel of 48 states, 1970-1999

- An increase in real SAES budget increases the share for federal and private grants and contracts, unchanged share for state resources, and decline in share for federal formula resources
- If land grant university increases its NRC ranking of graduate faculty in basic sciences OR SAES capacity for basic biological science research, this increases the demand for federal grants and contracts
- Demand for state resources is increased by a higher Gourman ranking of graduate faculty in agricultural sciences
- Spillins of interstate public agr research and of local private agr research substitute for federal formula resources
- When a state has a larger share of its population on farms, it increases the demand for state resources and federal formula research resources—implying they serve farmers' interests well
- Implied Income elasticity of demand for agr research resources: federal grants and contracts and private contracts and grants ( $\sim 1.5$ ), state funds ( $\sim 1.0$ ), and federal formula funds ( $\sim 0.5$ )

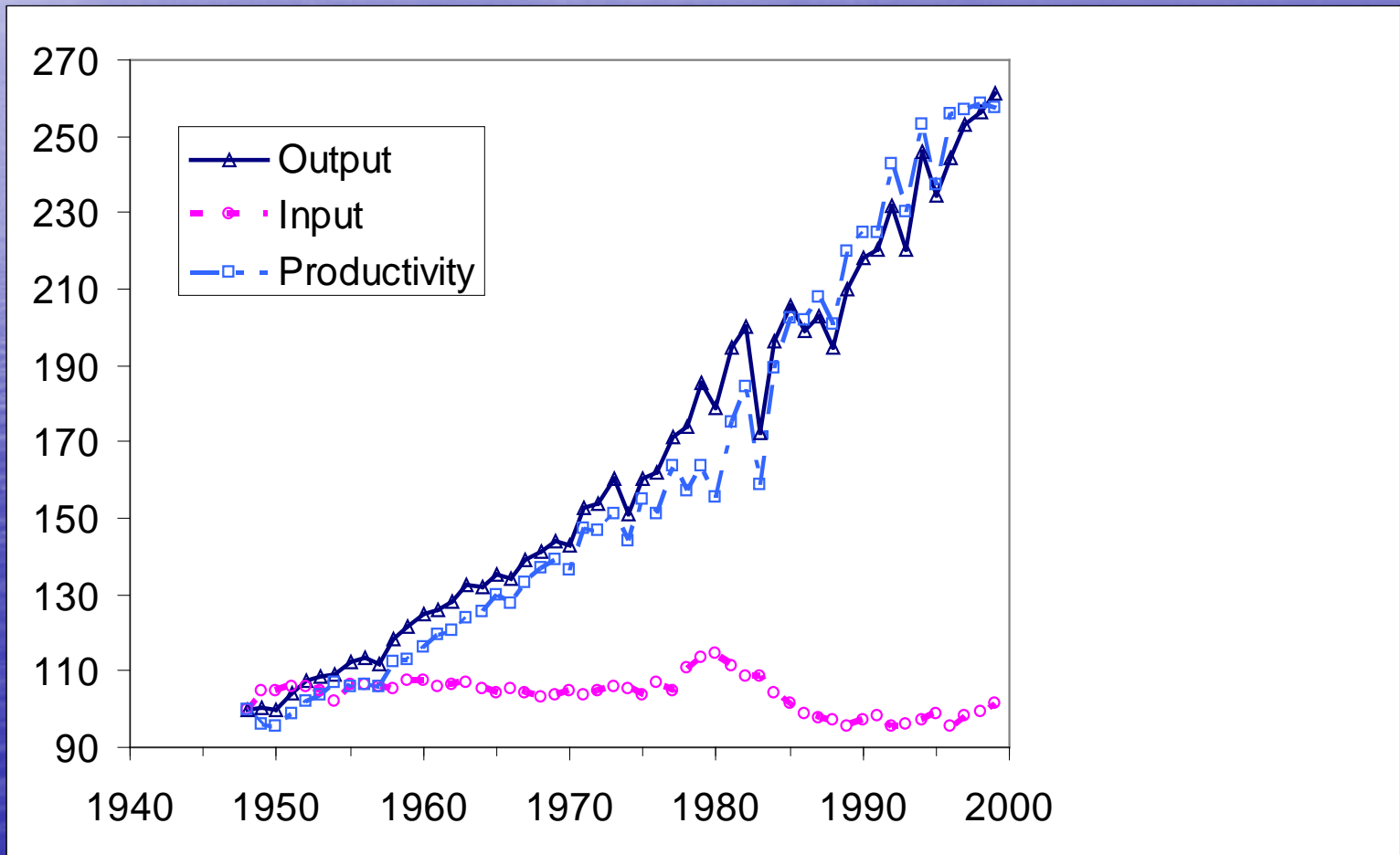


## V. Impacts of Public Agricultural Research on State Agr TFP Growth

### A. The Record of U.S. Agr Technical Change and TFP Growth has been Exceptional

#### 1. Dramatic long term change in farm level technology

#### 2. Figure 1. U.S. Farm Sector TFP, 1950-99



## **B. Statistical Decomposition Analysis of TFP at State Level**

### **Variables:**

**Dependent variable: In TFP**

**Regressors include:**

**Stock of local public agr research**

**Stock of spillin public agr research**

**Stock of local private agr research**

**Stock of agricultural extension**

**Composition of SAES funding**

**—share of SAES funds from federal grants and of programmatic funds (federal formula and state funds) interacted with stock of local public agr research**

**Model fitted to panel of 48 states, 1970 - 1999**

## Results:

- Stock of public agr research—within state and spillin--have significant positive impact on TFP

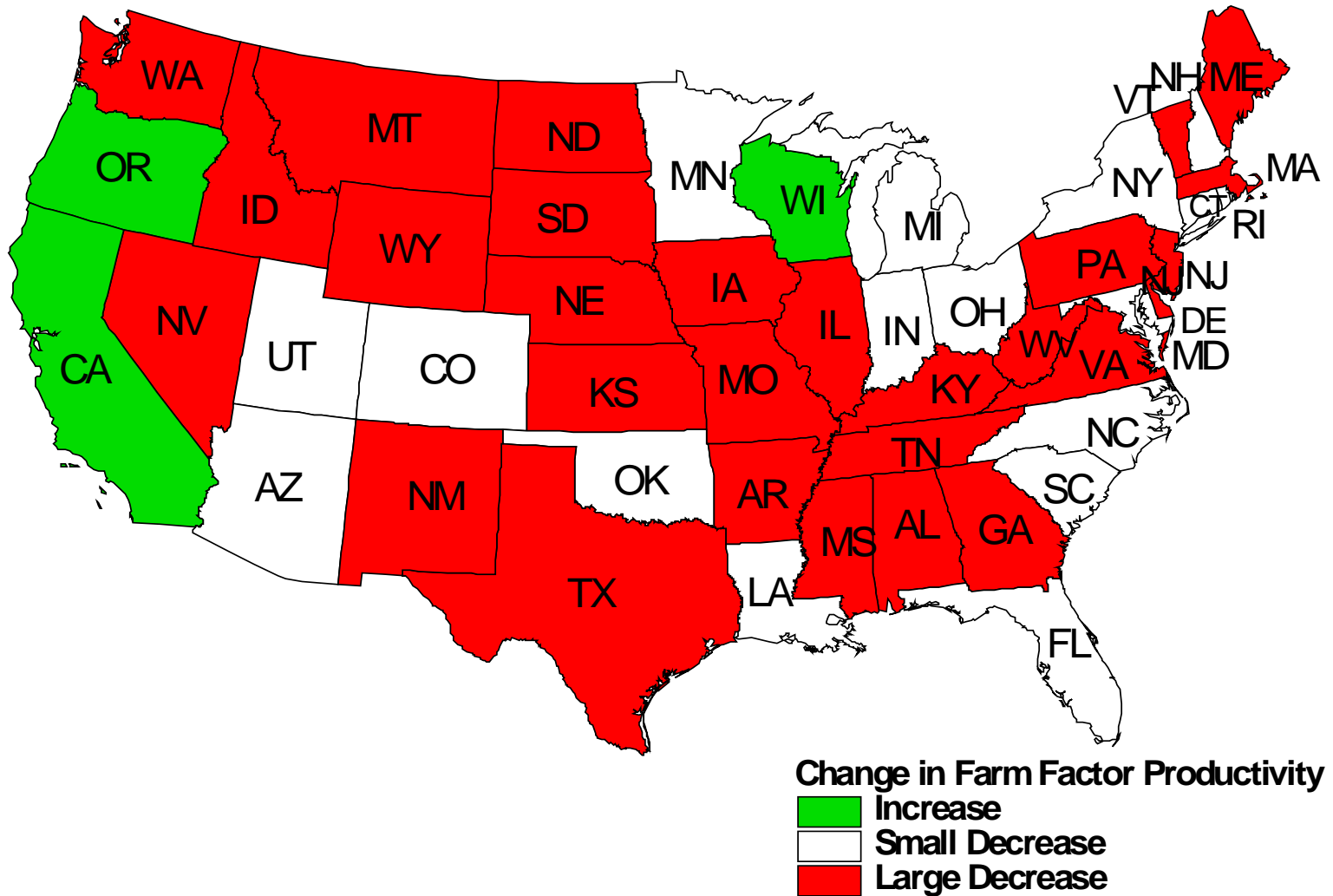
**At sample mean of data, the implied internal rate of return on public fund investment in agr research is about 50 % (inflation adjusted)**

- Composition of SAES research resources significantly affects impact of public agr research stock on TFP

**Marginal transfer of federal formula funds to federal competitive grant funds would lower state agricultural TFP**

**Simulated likely long-run outcome of a non-marginal 10 percentage point reallocation of federal formula to SAES competitive grant funding on the percentage change in state agr TFP**

Figure 2. Simulated Impact of Science Policy Change on Percentage Change in Farm Total Factor Productivity



## VI. Conclusions

- The funding environment for the state agricultural experiment station system has changed recently
  - More funds have become available through CSREES**  
with Hatch Act funds, the SAES system obtains (or bears) **all of any change**  
with an increases in competitive grant funds (e.g., NRI), the SAES system obtains **a fraction significantly less than one**
  - Fewer funds are now available from state governments**
- Federal formula and state agr research funds are demanded by farmers
- Federal formula and state government funding of public agr research have relatively large impacts on agr TFP at the margin
  - About a 50 % real rate of return on investment
  - A long-run reallocation of formula to competitive grant funds would reduce TFP growth in almost all states and by more than 4 percent in 60 % of the states
- Strong arguments can be made for traditional federal sources of SAES funding**
- The principle of fiscal equivalence can be used to rationalize federal support for public agricultural research and as a tool to create new jurisdictional authorities for channeling resources to agr research

