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Winners and Losers: Formula versus Competitive Funding of Agricultural Research

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State Agricultural Experiment Stations (SAESs) were established with federal formula funding by the Hatch Act of 1887. In 1955, the Hatch Act was amended and a number of subsequent formula funding programs were consolidated under the USDA Cooperative States Research Service (CSRS), which today is known as the Cooperative Research, Education and Extension Service (CSREES). Currently, all of the Hatch funds and a small amount of other formula funds go to SAESs. In 1977, CSRS established its first competitive research grant program. However, this program remained quite small until 1990, when it was re-named the National Research Initiative (NRI) Competitive Grants Program with a much larger funding authorization. Currently, the SAESs account for 60% of U.S. public agricultural research, with 7% of SAESs funding obtained from Hatch funds and 2.3% from NRI Grant funds (Huffman & Evenson, 2006b, pp. 107, 117-118). Hence, the SAES system has become relatively diversified in its funding sources after starting with only Hatch funding.

The characteristics of these funding sources are quite different from a SAES perspective.

- Formula funds are allocated among the states by a legislated formula, the choices of projects and scientists to support are made locally, oversight is local, and funding is recurring.
- Grant or NRI funds are allocated to proposals submitted to programs with identified priority areas; only a small share of submitted proposals are usually funded; the process consumes many resources relative to grant funds awarded, and there is no guarantee of success or continuation of funding after the initial grant period.

The composition of these funds has changed substantially over time. From 1980 to 2003, the USDA-administered federal formula funds declined by 57% or \$124 million (2,000 dollars; Huffman & Evenson, 2006a). Over this time period, NRI appropriations increased by \$120 million, but less than 40% of NRI funds go to the SAESs. The remainder goes to non-SAES units, especially those in non-land grant universities. Hence, CSREES funding of SAESs has fallen dramatically over the past 25 years. Other changes in SAESs' funding have also occurred since 1980. They include an 88% increase in grants and contracts from non-USDA federal agencies, a 51% increase in contract, grant, and cooperative agreement funding from USDA agencies other than CSREES, and a 100% increase in Congressional earmarks or special grants for research.

Prospects are that the funding composition will continue to change. In the Fiscal 2007 Budget of the United States, President George W. Bush proposed further reductions and eventually elimination of federal formula funding for agricultural research, while replacing these funds with a new competitive grants program for State Agricultural Experiment Stations with perhaps a regional focus. The proposal seems likely to be rejected by Congress, but new proposals to redirect federal formula funds seems likely to resurface in the future. This raises questions of who wins and who loses from such a policy change.

This article examines who wins and loses from a change in the composition of federal funding. We explore the implications by examining

- Differences in who sets the research agenda,
- Implications for priorities in long- and short-term research,

- Capacity to respond to local needs,
- Cost efficiency of distributing funds,
- Distributional effects across the states and regions,
- Payoff to society, and
- Sustainability of future funding.

Who sets the research agenda?

A major issue across alternative research funding mechanisms is who sets the research agenda. With federal formula funds, the research agenda is set by the states, either by the scientists, the SAES directors, or a combination of the two. With a national competitive grant program, the research agenda is set by CSREES, which uses input from the National Agricultural Research, Extension, Education, and Economics (NAREEE) Advisory Board and other advisory groups (Board on Agriculture and Natural Resources, 2001, pp. 86-89). The current CSREES grant agenda tends to take a national perspective, but is also subject to political influence from various lobbying groups, as well as fads in research and public administration. Because crop and livestock production is sensitive to local and regional geo-climatic and economic conditions, many important agricultural research problems are local or regional and not national in nature. If formula funds are eliminated or dramatically reduced, SAES directors in small heterogeneous states might find it difficult to undertake sufficient local agricultural research to meet local needs. Research and extension faculty would spend a greater proportion of their state-funded time writing proposals for federal grants and conducting research on grants based on Federal priorities, with a smaller share of their time addressing state-level

research needs. Some experiment stations would also risk losing matching state funds, the amounts of which are tied to the amount of federal formula funds to be received. Hence, there is more at stake than just federal formula funds for agricultural research. Therefore, the influence of national, and perhaps regional, research interests would likely increase at the expense of the influence of local farmers, consumers, and agri-business firms.

How would changes affect the willingness of scientists to undertake longer-term research objectives?

Federal formula and state funding provide secure funding to scientists across a broad set of disciplines related to agriculture for undertaking projects that require sustained multi-year efforts before major objectives and large payoffs can be obtained. Examples of research that took decades to complete, but that generated very high payoffs, include the discovery of hybrid corn (Huffman & Evenson, 2006b, pp. 159-161) and of tillage systems that conserve soil and provide outstanding crop yields.

Uncertainty about when and if scientists will obtain competitive grant funding, coupled with typically shorter-run priorities in grant funding, reduces opportunities for long-term pursuits and shifts research efforts toward shorter-term projects with more predictable outcomes (Huffman & Just, 2000). A larger federal competitive grants program might have the advantage of leveraging state and federal formula SAES funding to focus on medium-term national needs. This focus, however, comes at the cost of reduced opportunities for long-term research. Also, for some states a significant reduction in formula funds might erode their

overall capacity to undertake agricultural research. This would mean closing campus and outlying research facilities and research farms. Under the proposed changes in science policy, SAESs would lose flexibility to pursue long-term agricultural research objectives, while agricultural research with medium-term national or possibly regional objectives would gain.

Would changes affect the capacity of states to meet local and regional needs or to respond quickly to crises?

Examples of research efforts generating high-payoffs for locally-important crops include developing

- cultivation methods and new varieties of wild rice in Minnesota,
- blueberry cultivars with improved taste and yield in Maine, Michigan, and Vermont,
- wastewater management research in Maryland and North Carolina, and
- improved procedures for combating a new wheat rust in Kansas.

These types of projects are disadvantaged when research funds are allocated by national or regional competitive grant programs, either because these programs are cumbersome and time-consuming to organize, or because they cater to national or regional, and not local, research needs. Also, once scientists have been awarded a large, multi-year competitive grant to undertake a particular line of research, their effort is "locked-in," and they are unable to redirect their efforts to important, new, and emerging local and regional issues. Hence, local research interests would lose and national research interests would gain.

What is the relative cost of distributing the two types of funding?

Compared to external competitive grants programs, formula funding has low administrative costs. Federal formula funds are distributed to the states by a fixed formula: part is allocated equally to all states, part is allocated to states according to their share of the farm and rural populations, and part is allocated for multi-state research (Huffman & Evenson, 2006b, pp. 23-25). Allocation of these funds to individual research projects and scientists is under the control of the local SAES administration and is subject to local, but minimal national political pressure. Historically, SAES Directors have built ties to local clientele groups to help prioritize state research needs and have then integrated this information with the research capacity of their local scientists to allocate the total research budget. SAES administrators have generally required a small amount of proposal writing and evaluating, preferring that their scientists dedicate their efforts to conducting research and publishing discoveries. These administrators have a variety of tools for setting incentives for scientists, including repeat contracting and annual evaluations for salary increments.

In contrast, competitive programs significantly increase the amount of scientists' time allocated to proposal writing, assisting with peer review of research proposals, and peer-panel decisions on which proposals to fund. In fact, a new layer of CSREES bureaucracy has been added to coordinate and administer the NRI and other national competitive grant programs. Costs imposed on scientists of competitive grant research are not funded by the NRI or by most other external competitive

grant programs. At the current NRI research proposal funding rates of 5-12%, large amounts of resources are being consumed per dollar of research grant funding reaching scientists from this program (Huffman & Just, 1999a). In addition, while federal formula research funds do not pay indirect costs to recipient institutions, the NRI permits indirect costs equal to 25% of project direct costs.

Additionally, the Bush Administration's grant program proposal suggests full funding of indirect costs, which would raise the current indirect cost rate on the NRI to an estimated 45-55% of direct project costs and use this higher indirect cost rate on the new grant program for the SAES.¹ Although land grant universities vary in how they use the revenue from indirect costs, it is common for central administration to take 50% or more of these funds and for the remainder to be split between the college and department of the recipient principal investigators. It is unusual for the principal investigator(s) of an externally funded project to receive part of the revenue from indirect costs. Indirect costs are primarily an accounting concept and not an economic concept, and a university's indirect cost rate for federal grants is a negotiated rate between the institution and the Office of Management and Budget (May & Sarson, 1999). Hence, the new Bush policy would significantly increase the amount of scientists' efforts allocated to proposal writing and evalu-

ating and the share of CSREES research funds allocated to university indirect costs.² Central university administrators would in general win, but the SAES system would in general be losers. If non-land grant universities were eligible for new CSREES grant funds, then scientists and administrators outside the SAES system would be gainers at the expense of the SAES system. In fact, unless the pool of competitive grant funds is increased dramatically, the actual funds reaching SAES scientists will decrease.

Which states would be likely to gain or lose?

Competitive grant funding tends to favor institutions that have a large research infrastructure supporting research proposal writing and administration. In 1990, all but 11 SAES units received more than 90% of their CSRS-administered funds from federal formula funds and just 10% from competitive grants. Experiment Stations with larger shares from competitive grants included Massachusetts, New York, Florida, Michigan, Wisconsin, Arizona, California, and Oregon. In 2004 these same states, plus Maryland, Rhode Island, Kansas, Iowa, Illinois, Indiana, and Texas, were the leaders. The states that remain heavily dependent on formula funds are the ones likely to be the most disadvantaged by a shift toward increased funding through competitive grant programs. They are New Hampshire, New Jersey, W. Virginia, Georgia, Louisiana, Minne-

1. *Indirect cost revenue goes to pay for university administration, research facilities (infrastructure), and utilities to laboratories, which are not easily attributable to individual projects, and hence not permitted under project direct costs.*

2. *It is a data-intensive and time-consuming process for universities to document and defend their request for an indirect cost rate to the Office of Management and Budget (May & Sarson, 1999).*

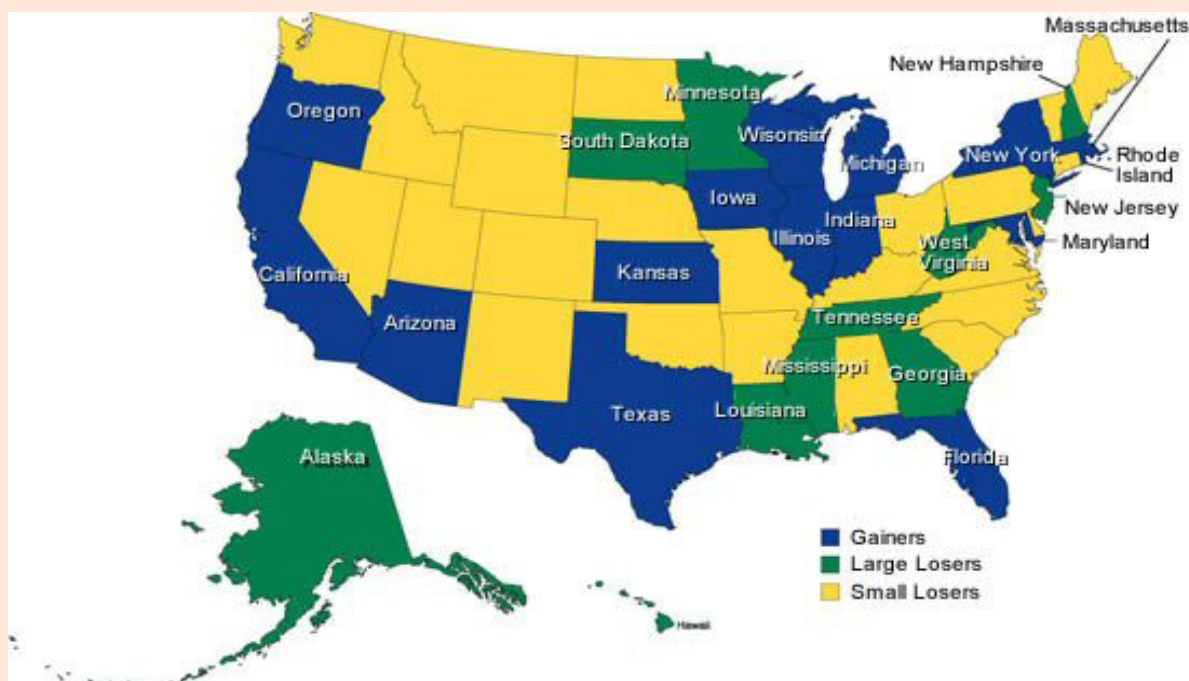


Figure 1. States likely to gain or lose from a CSREES increase of competitive grant funding and decrease in formula funding.

sota, Mississippi, Tennessee, South Dakota, Alaska, and Hawaii. The other 24 states would be small losers. See figure 1. In general, states where the SAES is part of a mid- to large-size land grant university outside of the South-Southeast would be winners and others would be losers, including states with a small agricultural sector. If the new grant program were regional in nature, this would provide a more equitable distribution of the research funds across regions, but it would sacrifice much of the potential gains from high scholarship.

Would society gain or lose?

Under the Hatch Act, federal formula funds are allocated for research across problems in agriculture, marketing, forestry, home economics, and rural and community development, which are researched from the perspective of several disciplines.

Washington administrators sometimes suggest that this is too broad—topics or disciplines—or not adequately targeted on important national issues, reducing its overall impact. In addition, a claim is sometimes made that this research is not subject to rigorous research methods, and that projects are reviewed infrequently. But scientists working on these projects must publish in scholarly outlets in order to prosper professionally. Thus, the expectations set by their colleagues and university administrators are a critical factor affecting scientists' efforts in research and other activities. As evidence that public agricultural research is productive, Huffman and Evenson (2006a) found that the social rate of return to public agricultural research remains high—about a 50% real rate of return. However, they also found that shifting federal formula to competitive grant programs would lower

its impact and rate of return. In a related study, Huffman and Evenson (2006b, pp. 276-278) found that from this type of fund reallocation only California, Oregon, and Wisconsin would likely benefit from increased research productivity, while the other 45 contiguous states would likely see a decline in productivity. Hence, a case can be made for increasing federal formula funding.

The production process for scientific discoveries contains uncertainty. Scientific efforts result in a continuum of output from no discovery to a revolutionary discovery. Furthermore, unanticipated discoveries sometimes occur. Hence, the social payoff or value of any research project is initially unknown. The uncertainty to stakeholders in scientific discovery can be reduced by research administrators choosing to undertake a portfolio of diverse projects with diverse incentives for

discovery (Huffman & Just, 2000). This implies that more than expected returns are at issue. With a variety of research funding mechanisms, such as federal formula and competitive funding, it is possible for some scientists to be working with strong incentives for discovery and others with weaker incentives. Simultaneously, some can work on long-term goals and yet others on short-term or intermediate goals. Hence, a case can be made for larger competitive grant funding for selective national or perhaps regional priorities. Moreover, a diversified portfolio of projects and funding mechanisms decreases society's discovery risk.³

How would changes affect the sustainability of research funding?

If fewer dollars were allocated across the land grant system for formula funding, for example by eliminating formula funds to small SAESs, those dollars could be used to increase the research funds available for competitive grant programs. In this scenario, the country might not "need" more than 20 Colleges of Agriculture and SAESs, and perhaps could get by with even fewer. However, dramatically reducing the number of states receiving federal agricultural research funds would greatly change the political economy of federal agricultural research funding. One prospect is that, over time, the currently strong Congressional support for formula funds would wither under a competitive grant program, and total CSREES appropriations for competitively funded agricultural research would decline. State matching funds

would also decline. Another possibility is that the excluded land grant universities would pursue Congressionally earmarked research funds or "special grants" on a grander scale (National Research Council, 2003, pp. 71-72; Huffman & Evenson, 2006b, pp. 116-117; Law & Tonon, 2006). Hence, a few states would win in the short run, but all might lose in the long run. There are also strong implications for complementary university instruction and public outreach (extension) programs of altering the nature of the complementary research support from formula funds.

Conclusions

Some will win and some will lose with changes in the size and relative amount of CSREES-administered formula and competitive grant funding for agricultural research. We conclude that a further reduction or elimination of federal formula funding of agricultural research will significantly impact

- Future research priorities and the research agenda,
- The composition of short- versus long-term research,
- The mix of national versus local needs research,
- The transactions costs of undertaking research,
- The distribution of research funds across the states,
- The distribution of research benefits across states,
- The rate of return that society earns from its research investments,
- The discovery risk faced by society, and
- The sustainability of future research funding.

Although recent research has shown that the social rate of return to public agricultural research would decline as

the competitive grant share rises, we believe that the very considerable risks associated with future discoveries in agricultural research will be best diversified by maintaining a portfolio of CSREES administered formula and competitive grants funding in the future. Moreover, a case can be made for continuing and possibly increasing federal formula funding because of their high payoff and at the same time expanding competitive grant funding to address selective high priority national or perhaps regional needs.

For More Information

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3. *The analogy to wealth management based on a criteria containing expected return and risk trade-offs is intended.*

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