Volume Title: Economics of Research and Innovation in Agriculture

Volume Authors/Editors: Petra Moser, editor

Volume Publisher: University of Chicago Press

Volume ISBNs: 978-0-226-77905-8 (cloth), 978-0-226-77919-5 (electronic)

Volume URL: https://www.nber.org/books-and-chapters/economics-research-and-innovation-agriculture

Conference Date: May 17, 2019

Publication Date: September 2021

Chapter Title: Comment on "Local Effects of Land Grant Colleges on Agricultural Innovation and Output"

Chapter Author(s): Bhaven N. Sampat

Chapter URL: https://www.nber.org/books-and-chapters/economics-research-and-innovation-agriculture/comment-local-effects-land-grant-colleges-agricultural-innovation-and-output-sampat

Chapter pages in book: p. 175 – 178

Wagoner, J. J. 1970. *Arizona Territory, 1863–1912: A Political History*. Tucson: University of Arizona Press.
Willis, J. F. 2009. *Southern Arkansas University: The Mulerider School's Centennial History, 1909–2009*. Bloomington, IN: Xlibris.
Wright, B. D. 2012. "Grand Missions of Agricultural Innovation." *Research Policy* 41 (10): 1716–28.

Comment

Bhaven N. Sampat

4.C1 Background

This chapter examines the effects of land grant universities on local innovation and agricultural output. It is a useful contribution not only to the literature on agricultural innovation but also to the broader literature on returns from publicly funded research.

In previous work, I have been among those who have pointed to the land grant college system as an exemplar of university applied research and dissemination working well. In particular, I have held up the land grant system as a good model of technology and knowledge transfer and as perhaps better at securing social returns from publicly funded research than the current system focused on patenting, licensing, and technology transfer (Mowery et al. 2004).

Reading this chapter led me to rethink this.

4.C2 Summary

As the chapter indicates, a big problem in the economics literature examining the effects of universities on local outcomes is that universities are not randomly located.

Through meticulous (and what seems like very labor intensive but also fun!) historical research, Andrews finds the cases where the location of the land grant university within a state was chosen through an "as good as random" process and focuses empirical analyses on these 29 universities. A big contribution of this chapter is laying out the site choice decision, which points to the importance of politics, personalities, and happenstance

Bhaven N. Sampat is an associate professor in the Department of Health Policy and Management at Columbia University and a research associate of the National Bureau of Economic Research.

For acknowledgments, sources of research support, and disclosure of the author's material financial relationships, if any, please see https://www.nber.org/books-and-chapters/economics-research-and-innovation-agriculture/comment-local-effects-land-grant-colleges-agricultural-innovation-and-output-sampat.

in these decisions. This alone will be useful for future empirical research on the economics of agricultural research.

Next, Andrews tests whether the establishment of a land grant college had effects on local innovation and agricultural output. The identification approach involves comparing outcomes for the land grant counties versus the "good as random" runner-ups.

The chapter finds that measures of agricultural innovation (patents and new crop varieties) increase in these counties. These effects are large and statistically significant. However, when the chapter looks next at measures of agricultural performance (agricultural yields, the value of agricultural output, the value of crop output, the value of livestock produced), there do not appear to be strong local effects.

This leaves us with a puzzle. Why, if innovation increases locally, including agricultural innovation, do we fail to see local productivity effects? As the chapter points out, one potential explanation is that the innovation was not very useful to local farmers. Another is that it was useful, but it diffused broadly throughout the state, including to the runner-up county. These different explanations would obviously lead us to very different assessments of the land grant universities from a national perspective or that of state taxpayers.

Unfortunately, it is not possible to test directly which of the competing explanations is more plausible given the data that are available. As a second best, Andrews does provide some evidence from a catalog of wheat varieties, showing that land grant universities came up with about 30 percent of new wheat varieties, but these accounted for only 10 percent of national acreage. That is, yes, there was wheat innovation, but it did not broadly diffuse. One thing that we do not learn from this exercise is whether these innovations were useful locally (in the land grant counties themselves), but that too likely reflects data constraints.

4.C3 Suggestions

The next steps in this line of research would seem to be to better distinguish between the competing explanations. I have a few other observations and suggestions as well.

First, the finding that only about 10 percent of wheat acreage in home states was from land grants contrasts with previous, more positive assessments of the Morrill Act (Wright 2012), which suggest that three-fourths of wheat acreage by 1920 used wheat varieties that were unavailable when the act passed.

But it also seems possible that the land grant research had an indirect effect on productivity—producing new research techniques and science rather than new varieties themselves. I read the literature on the economic impact of universities as suggesting that actual products from academic research

are less important than research techniques and tools (Cohen, Nelson, and Walsh 2002). Indeed, Griliches's famous article on hybrid corn emphasizes that "hybrid corn was the invention of a method of inventing" (Griliches 1957, 502). My own research in a very different context, drug development over the 1988–2005 period, suggests that public sector labs account directly for about 10 percent of drugs but may enable two-thirds of marketed drugs (Sampat and Lichtenberg 2011). Cockburn and Henderson (2000) find similar orders of magnitude for drugs. All this would seem to suggest that for land grants, tracking disembodied knowledge flows and indirect effects of the universities may be useful going forward. Similarly, it may be interesting to track where graduates went to assess the role of knowledge "wrapped up in people," to paraphrase Robert Oppenheimer (Zolas et al. 2015).

Another explanation for the puzzle that I flagged above—that land grants helped with local innovation but not output—is that the universities were not sufficiently focused on local demand. There is a gap between the innovation that universities do and what the funders want. This echoes broader critiques of public research in science and technology policy, where concern by policy makers that research is not effectively targeted to demand, or not effectively diffused, has ebbed and flowed over the post–World War II era (Brooks 1996; Geiger 2008). I am not exactly sure how to test this without data on research investments and agricultural needs, but it would seem to me that if this were the case for the land grants (or similarly, if diffusion and "translation" of the research findings were not effective), one would see some qualitative evidence in state-level debates about funding. If the land grant innovation is not that useful after all, where are the disgruntled state taxpayers? This seems trackable through testimony, media articles, or the historical literature. The idea that land grant research was not actually that relevant (or that good) would challenge the prevailing understanding on the political economy of land grants, suggesting they were a model of use-oriented research and active dissemination that worked—and worked because they were responsive to local taxpayers. This is precisely why it is important to do.

Though there is a lot more to be done, this chapter, and the author's companion work, represent an excellent start on what will be a very important line of research that will contribute not only to assessment of the land grants and the Morrill Act but also to our understanding of the economics of innovation and diffusion and potentially the political economy of innovation policy. I appreciate the opportunity to comment on it in its germinal stages.

References

Brooks, H. 1996. "The Evolution of US Science Policy." In *Technology, R&D, and the Economy*, edited by Bruce L. R. Smith, Claude E. Barfield, and Paul Dufour, 15–48. Washington, DC: Brookings Institution.

Cockburn, I. M., and R. M. Henderson. 2000. "Publicly Funded Science and the Productivity of the Pharmaceutical Industry." *Innovation Policy and the Economy* 1:1–34.

Cohen, W. M., R. R. Nelson, and J. P. Walsh. 2002. "Links and Impacts: The Influence of Public Research on Industrial R&D." *Management Science* 48 (1): 1–23.

Geiger, R. L. 2008. *Research and Relevant Knowledge: American Research Universities since World War II*. Piscataway, NJ: Transaction.

Griliches, Z. 1957. "Hybrid Corn: An Exploration in the Economics of Technological Change." *Econometrica* 25 (4): 501–22.

Mowery, D. C., R. R. Nelson, B. N. Sampat, and A. A. Ziedonis. 2004. *Ivory Tower and Industrial Innovation: University-Industry Technology Transfer before and after the Bayh-Dole Act*. Palo Alto, CA: Stanford University Press.

Sampat, B. N., and F. R. Lichtenberg. 2011. "What Are the Respective Roles of the Public and Private Sectors in Pharmaceutical Innovation?" *Health Affairs* 30 (2): 332–39.

Wright, B. D. 2012. "Grand Missions of Agricultural Innovation." *Research Policy* 41 (10): 1716–28.

Zolas, N., N. Goldschlag, R. Jarmin, P. Stephan, J. Owen-Smith, R. F. Rosen, B. M. Allen, B. A. Weinberg, and J. I. Lane. 2015. "Wrapping It Up in a Person: Examining Employment and Earnings Outcomes for Ph.D. Recipients." *Science* 350 (6266): 1367–71.