2014

Does Environmental Regulation Hinder Hog Production Expansion? The Answer is More Complicated than the Question

Azzeddine Azzam
University of Nebraska-Lincoln, Aazzam1@unl.edu

Karina Schoengold
University of Nebraska-Lincoln, kschoengold2@unl.edu

Gibson Nene
University of Minnesota-Duluth, gnene@d.umn.edu

Cornhusker Economics

University of Nebraska–Lincoln Extension

September 9, 2014

Institute of Agriculture & Natural Resources
Department of Agricultural Economics
http://agecon.unl.edu/cornhuskereconomics
Follow us on Twitter and Facebook @UNLAgEcon

Does Environmental Regulation Hinder Hog Production Expansion? The Answer is More Complicated than the Question

Market Report	Year Ago	4 Wks Ago	9/5/14
Livestock and Products, Weekly Average			
Nebraska Slaughter Steers, 35-65% Choice, Live Weight.	123.34	159.61	162.95
Nebraska Feeder Steers, Med. & Large Frame, 550-600 lb.	185.51	287.50	267.78
Nebraska Feeder Steers, Med. & Large Frame 750-800 lb.	164.44	235.73	238.17
Choice Boxed Beef, 600-750 lb. Carcass.	195.94	262.26	247.62
Western Corn Belt Base Hog Price Carcass, Negotiated.	89.76	113.55	96.70
Pork Carcass Cutout, 185 lb. Carcass 51-52% Lean.	94.69	124.29	101.43
Slaughter Lambs, Ch. & Pr., Heavy, Wooled, South Dakota, Direct.	108.00	154.38	161.25
National Carcass Lamb Cutout FOB.	282.56	359.97	366.37
Crops, Daily Spot Prices			
Wheat, No. 1, H.W. Imperial, bu.	6.64	5.51	5.43
Corn, No. 2, Yellow Nebraska City, bu.	5.53	3.40	3.39
Soybeans, No. 1, Yellow Nebraska City, bu.	14.78	11.83	12.52
Grain Sorghum, No.2, Yellow Dorchester, cwt.	8.36	5.93	5.75
Oats, No. 2, Heavy Minneapolis, Mn, bu.	3.44	4.02	3.88
Feed			
Alfalfa, Large Square Bales, Good to Premium, RFV 160-185 Northeast Nebraska, ton.	242.50	190.00	203.00
Alfalfa, Large Rounds, Good Platte Valley, ton.	110.00	100.00	90.00
Grass Hay, Large Rounds, Good Nebraska, ton.	117.50	100.00	87.50
Dried Distillers Grains, 10% Moisture Nebraska Average.	214.00	105.00	105.00
Wet Distillers Grains, 65-70% Moisture Nebraska Average.	80.00	37.75	36.00

* No Market

Federal regulation governing management and disposal of the millions of tons of hog manure produced every year is derived from the Clean Water Act (CWA). Enacted in 1972, the CWA amended the 1948 Federal Water Pollution Control Act to shift regulatory oversight from states to the federal government by requiring the former to adopt a federally-mandated National Pollutant Discharge Elimination System permit. Administered by the Environmental Protection Agency (EPA), the program empowers the agency to issue permits to facilities applying for permission to discharge and to do so within the agency's Effluent Limitations Guidelines and Standards. Discharge permits may also be issued by states authorized to implement the CWA. However, the EPA retains the authority to enforce any violation of state-issued permits. The EPA also has the power to overrule state decisions on water pollution.

While the EPA rules must be adopted nationwide, many states have adopted more stringent regulation than the federal standards. For example, the states of North Carolina, Minnesota, Nebraska, and Kansas have adopted zoning requirements. Another regulation that varies by state is the required setback between a facility and the nearest residence. The federal government requires a setback of 1000 feet but the states of Iowa, North Carolina, Missouri, Illinois, Kansas, and Oklahoma have adopted more stringent setback requirements of 1875 feet, 2500 feet, 3000 feet, 4000 feet, 1 mile, and 3 miles, respectively. In addition to variation in stringency in regulation across states, environmental regulation facing the hog industry is size-based

with farms of 2500 animals or more facing more stringent environmental regulation and, hence, higher costs of compliance.

In a peer-reviewed study to be published in the the *Canadian Journal of Agricultural Economics*[1] (CJAE), we set out to address the question of whether or not an increase in environmental regulation stringency (hereafter, environmental stringency) hinders hog production expansion. The question is of particular interest to Nebraska because growth in the hog industry has lagged behind other states and environmental regulation is believed to be a factor that may be contributing to the lagging growth. Indeed, the Livestock Friendly designation implemented in the state is testimony to that belief.

Intuitively, one is tempted to answer yes to the question because, after all, all business regulation of any kind is thought to be bad for the bottom line. There may be a grain of truth in that but since environmental stringency in the hog industry is size-based, the answer is *it depends*. This is because there are three possible responses to new regulation. First, regulation may drive existing regulated hog farms out of business or lead them to downsize below 2500 head so they face less stringent regulation. Second, it may prevent potential entrants from getting into the hog business or, or if they do, may choose to start operations with 2500 head or less, and finally, it could lead existing regulated and unregulated hog farms to expand either up to 2500 head or above 2500 head depending on the additional benefit of expansion relative to the cost of expansion, including production costs as well as the cost of environmental compliance. How it all shakes out in the long run is not clear a priori, and it could turn out that environmental stringency may not hinder hog production expansion after all and one has to look for other explanations.

Finding out how it all shakes out requires not only an enormous amount of data that traces the business history of every existing and bygone hog operation, but also a method for a) separating the effect of environmental stringency on the hog supply response of unregulated small hog farms (SHF) from the supply response of large hog farms (LHF); b) determining the effect of environmental stringency on entry and exit of LHFs, c) isolating the effect of environmental stringency from other factors that effect hog production expansion, like hog and corn prices, contracts, and technical change; and d) separating between the short-run, a time frame during which the number of hog operations is fixed, and the long run, a time frame during which the number of hog operations varies because of entry and exit due to environmental stringency.

Since detailed historical data on identifiable hog operations are not available, we developed a method that allowed us to tease out the various effects of environmental stringency from aggregate state-level data on inventory and number of SHFs and LHFs between 1994 and 2006 for the top ten hog producing states (Iowa, North Carolina, Minnesota, Illinois, Nebraska, Indiana, Missouri, Oklahoma, Ohio, and Kansas). Readers interested in the technical detail of the method are referred to the CJAE article. What we do here is summarize what we learned in the process of developing the method and report our conclusions.

The most important thing we learned is that economic logic suggests that the change in a state's hog inventory due to a change in environmental stringency in the long-run is made up of three additive changes: the first is the change in the numbers of LHFs through entry and exit. The second is the change in the size of LHFs. The third is the indirect hog inventory supply response of unregulated hog farms (SHFs). The response of the latter is "indirect" because the response of regulated hog farms to environmental stringency affects the overall market price of hogs. Whether hog production expands, contracts, or stays the same depends on the direction and magnitude of the three additive changes in the long-run. Why the long-run? It allows enough time for operations to enter or exist in response to changes in the short-run economic profits (as opposed to accounting profits) until they are driven to zero.

To complicate the issue, the direction and magnitude of the three changes depends on the costs of the abatement technology used by regulated LHFs. For example, requiring an LHF to build a larger lagoon to store manure or to get a siting permit will increase the average total cost (fixed plus variable) per head but has little effect on marginal (additional) cost of producing one more head of inventory, leading LHFs to expand in the

[1] Azzam, A., K. Schoengold, and G. Nene. "Hog Industry Structure and the Stringency of Environmental Regulation."

long-run. On the other hand, a requirement to reduce the application rate for manure spreading will have a large effect on the marginal cost of production because land and transportation costs for manure spreading are higher with increased distance. Thus, with no abatement technology, a regulation about manure spreading rates will likely lead LHFs to contract in the long-run.

Our econometric results for the entire US show that environmental stringency leads to an increase in the average inventory levels for both SHFs and LHFs. This result is consistent with regulation that affects the total cost more than the marginal cost (e.g., setbacks or lagoon requirements). On average, an increase in the environmental stringency index increases the size of an average SHF and LHF by 1.5 and 2.8 percent, respectively. However, we also find evidence that environmental stringency has led to a decrease in the number of LHFs. The same increase in the stringency index reduces the number of LHFs in a state by 7.5 percent.

What does this mean for the effect of environmental regulation on hog production expansion in the top-ten hog producing states? Between 1995 and 2005, the average index of environmental stringency increased by 5.5 points, the observed hog inventory for SHFs declined by 60.8%, the observed hog inventory for LHFs increased by 94.7%, and the observed hog inventory for all farms increased by 9.4%.[2]

Without environmental regulation, the inventory for SHFs would have declined by 69.1% instead of 60.8%, the hog inventory of LHFs would have increased by 120.6% instead of 94.7%, and the hog inventory of all farms combined would have increased by 16.5% instead of 9.4%. So, while increased stringency of environmental regulation during the sample period led to an overall contraction of hog inventory by 7.1%, it led to a contraction of the hog inventory of large farms by 25.9%, and an expansion of the hog inventory of small farms by 8.2%. In other words, while the stringency of environmental regulation has hindered expansion of hog production, largely because of its negative effect on large hog farms, it facilitated expansion on small hog farms.

For regulators who are concerned about both environmental quality and the protection of small family farms, environmental regulation seems to decelerate the effect of technological change on shifting more and more hog production to larger hog farms. Moreover, if one looks at environmental regulation as a policy to induce hog producers to internalize the negative externalities associated with hog production, then the contraction in hog production could also be indicative of a policy that balances negative environmental impacts with the benefits of hog production.

Dr. Azzeddine Azzam
Professor
Departmental of Agricultural Economics
103E Filley Hall
University of Nebraska-Lincoln
aazzam1@unl.edu
Phone: 402-472-5326

Dr. Karina Schoengold
Assistant Professor
Daugherty Water for Food Institute Fellow
Ag Economics & School of Natural Resources
307A Filley Hall
University of Nebraska-Lincoln
kschoengold2@unl.edu
Phone: 402-472-2304

Dr. Gibson Nene
Assistant Professor
Department of Economics
University of Minnesota-Duluth
gnene@d.umn.edu
Phone: 218-726-7864

[2]All statistics refer to changes in the top-ten hog production states