

Animal Feeding Operations and Housing Values: Summary of Literature

The presence or proposed development of an animal feeding operation (AFO) often raises the question of its impact on nearby house values. Determining that impact requires the merging of conventional housing appraisal techniques with advanced econometric studies. This guide summarizes economic studies about the effect of AFOs on housing values.

Traditional appraisal techniques look at characteristics of the house. Each bedroom and bathroom increase the house value. Attached garages and central air conditioning also increase value. Increased age and deferred maintenance decrease the value. Comparable nearby properties are used to estimate the impact of each house characteristic.

Location is always important. Location is a proxy for the impact of non-housing characteristics on the value of the house. Amenities such as location of nearby parks or quality school systems usually increase housing values. Disamenities such as nearness to noisy highways or pollution sources usually decrease housing values. Economic studies attempt to quantify the impact of these non-housing characteristics.

The guide is organized by how different studies describe the AFOs. Proximity to urban areas, distance from AFO to house, AFO size, wind direction and animal species all might impact how an AFO affects housing values.

Market area

Economic studies suggests that the effects of AFOs on housing values will differ across regional markets and geographical areas. Three locational identifiers used in research are rural, rural-urban fringe and urban/exurban. Economic studies estimated the negative impact of hog AFOs to be greater in a rural-urban fringe of North Carolina than in several rural counties of Iowa. In Missouri this means that an AFO within a

30-minute drive of Springfield, Missouri (a rural-urban fringe) would be expected to have a different impact on nearby housing values than an AFO within 30 minutes of Milan, Missouri (rural county).

The market area also incorporates the regional density of AFOs. In a rural area with many AFOs, input suppliers and meat processing plants, these businesses create regional economic activity and may exert increased pressure on the value of houses within the county — even houses miles from the AFO. But a single AFO in a location where few other AFOs exist does not promote enough economic activity to impact housing values in locations miles from it.

Distance to AFO

Economic studies include the distance between AFO and house in three different ways. Most consider the impact of the nearest AFO on housing value. Some include the number of AFOs within specified distances of a house. Others consider the number of animals, rather than AFOs, within specified distance of houses.

Impact of nearest AFO

All economic studies indicate that distance to the nearest AFO is important in determining 1) whether or not the AFO negatively impacts a house's value and 2) how much an AFO impacts a house's value.

Economic studies find the negative impact of an AFO on rural housing values stops within three miles. Further than three miles from an AFO, there is little evidence that the AFO would negatively affect a rural residence. However, one study found houses within a town further than three miles from the AFO had diminished housing values.

The closer a house is to an AFO, the more it is expected to decrease the house value. An Iowa study on the rural-urban fringe indicated it would decrease house value an average of 17 percent within 2 miles. A Pennsylvania study in the rural-urban fringe found that AFOs decreased house values by 6 percent within 0.33 mile to an AFO but had no effect on houses further than 1 mile from the AFO.

Revised by

Ray Massey, Professor, Agricultural Business and Policy Extension

Joe Horner, State Specialist, Agricultural Business and Policy Extension

Two different North Carolina studies found AFOs to decrease housing values up to two miles away. House values within 0.75 mile of the AFO decreased about 10 percent while those closer to two miles decreased about 4 percent. An Iowa study of a rural area found AFOs within 1.5 miles decreased housing values an average of 15 percent but the findings were discounted because the researchers were less than 90% confident that their estimate was different than zero.

Impact of the number of AFOs

Several economic studies draw concentric circles with increasing radiuses around a house and count the number of AFOs within each circle. All of these studies agree with the studies mentioned in the previous section and conclude that beyond three miles an AFO does not affect rural housing values.

One study in Indiana found that each AFO within 0.5 mile lowered housing values. But between 0.5 to three miles, they found that AFOs increased housing values. A Minnesota study also found additional AFOs within three miles increased housing values. The researchers attribute these counter-intuitive results to the economic benefit associated with livestock production.

A Canadian study published in 2021 found the presence of an AFO within 1.25 miles decreased housing values about 5 to 6 percent relative to houses that are 1.25 to 3.1 miles away from the AFO.

Number of animals within a specified distance

Economic studies attempt to examine the impact of animals on housing values by looking at livestock density. If a property is situated in an area with many nearby AFOs, the impact may be different than if the subject is in a relatively animal free area.

An Indiana study found that increasing the number of animals within three miles decreased housing values, depending on distance to the animals. Conversely, an Ohio study found that increasing animal density increased housing value. The researchers emphasized that animal density and proximity of the nearest AFO competed. Animal density increased housing value; animal proximity decreased housing value. The interaction could cause a new hog farm to either increase or decrease nearby housing values.

Researchers estimated the impact of a new 2,400-head hog barn in Johnson County, North Carolina (population density of 260 people/square mile). An AFO within 0.5 mile of a house where no current hogs are raised decreased housing values by 8.4 percent. If many other hog farms already existed in the area, the 2,400-head barn within 0.5 mile lowered house prices by 0.3 percent.

AFO size

Economic studies report ambiguous results on the impact of AFO size on house value.

An Iowa study found that for houses within three miles of an AFO, a 50 percent increase in the size of the closest AFO was responsible for a 3.3 percent loss in housing value. An Indiana study also found that larger AFOs had a larger negative impact on housing values than smaller AFOs.

Another study conducted in Iowa and one in North Carolina found that increased AFO size had a positive effect on housing values. The presence of an AFO reduced housing values but the larger ones (4,333 pig capacity barn) reduced housing values less than the smaller ones (1,667 pig capacity barn). The reduced impact of a very large hog farm was unexpected. The researchers concluded that larger farms may more efficiently manage their environmental impact on the neighborhood.

Several of these studies included manure management practices such as application equipment or having a nutrient management plan. They found no significant impact on housing value of the specific practices studied.

Wind direction

The most common reason given for AFOs decreasing housing values is odor. Odor is not evenly dispersed around an AFO but rather dependent on prevailing wind directions and topography. Houses downwind from an AFO are expected to experience a larger loss than those upwind. Several studies that looked at the impact of wind direction found no difference.

Two Iowa studies found an interesting difference. In the fourth-most densely populated county in Iowa, the prevailing wind direction was found to be the largest determinant of the impact of AFOs on housing values within three miles of the AFO. Research in a more rural counties in Iowa found wind direction reduced housing values only within 1.5 miles of a hog AFO. The impact of wind direction on housing value was much smaller in the rural Iowa counties than in the densely populated county in Iowa.

Animal species

AFOs can raise pigs, beef or dairy cattle, poultry or other livestock. Most economic studies of AFOs on housing values target pigs as the animals most likely to impact housing values, which may be explained by several reasons. Modern pig farms tend to be large and regulated by environmental agencies. Pig expansion has occurred in areas where it did not exist several decades ago. Pigs are raised in confined buildings rather than

outdoors, which results in a concentration of animals and manure. It may also be that many people consider pigs to have the most offensive odor.

Several economic studies differentiate between animal species in an AFO. An Indiana study of rural and suburban areas found that dairy cattle AFOs reduced housing values within 3 miles while pig AFOs reduced housing values within 1 mile. Beef cattle AFOs increased housing values within 3 miles. A Colorado study also found that beef cattle AFOs increased housing values while hog AFOs decreased housing values.

The economic study of an exurb area of Pennsylvania found beef, pig and poultry AFOs reduced house prices but poultry AFOs reduced them more than beef AFOs. A Minnesota study that found AFOs increased housing value also found that hog AFOs added more to house values than poultry AFOs.

Relative house value

Economic studies report ambiguous results when trying to estimate the impact of AFOs on houses of different values. The Minnesota study that found AFOs increased housing values concluded that increased housing values occurred on older, lower priced houses.

In three Indiana counties ranging from rural to rural-urban fringe, the researchers concluded “a home would need to sell at a price above the median home to realize a significant penalty for being near” an AFO.

Anticipation and post-establishment impacts

Economic studies often find correlation between housing values and the presence of amenities and disamenities. While an economic study may find that the presence of individual features is correlated with price, it is not always clear if these features cause price changes or reflect pre-existing conditions. For example, a business may build where real estate prices are low in order to inexpensively gain access to real estate. The presence of the business does not lower nearby real estate prices but takes advantage of them. That would be a correlation but not causation. If the business builds and subsequently real estate prices change, the presence of the business contributed to the price change. That would be a causal relationship.

Most economic studies admit they are unable to distinguish between causation and correlation. However, a Canadian study looked at the impact of AFO establishment timing on houses in an effort to discover if reduced housing values are caused by AFOs or if AFOs just locate next to a property that is diminishing in value.

The extremely rigorous study reports that AFOs within 1.25 miles of a house reduced value by 5 to 8 percent in a heavily populated area of Canada. Looking at 20 years of sales data and hog barn construction information, the researcher found that house prices fell up to three years prior to hog barn establishment, or during the period that the barn was obtaining permits. After the barn was built, housing prices sold at a larger discount than before the AFO was built. The results indicate that AFOs caused nearby house values to decrease.

Cautions on economic studies

Economic literature on the impact of housing values is frequently misunderstood and misquoted. Kilpatrick has published a flawed literature summary in *The Appraisal Journal*. A list of some of those errors were published in a subsequent edition of that journal.

Abeles-Allison and Connor also published work that focused on the impact of 8 hog operations that had received multiple odor complaints. Hog operations that did not receive odor complaints were not included in the study. This selection bias in data used has caused many economists to discount this work.

Because Missouri is a non-disclosure state, access to sale prices for houses is very limited. This is one reason that no successful economic studies on the impacts of AFOs on housing values have been completed in Missouri. Two non-peer reviewed reports in Missouri attempted to estimate the impact of AFOs on land (not housing) values.

One study concentrated on the impact of a very large confinement hog operation on property values in north central Missouri. Their report states “the results reported here should be considered as preliminary” until sufficient price data was obtained. Sufficient data was never obtained and the report never submitted for publication.

The other Missouri study looked at the impact of AFOs on rural land values in Pettis County, Missouri. The results were not statistically significant. The publication was never published in a peer-reviewed journal. However, the results have frequently been erroneously quoted. Tom Johnson, one of the authors and concerned about the misuse of his work, corrected the misinterpretation in writing.

Summary

Table 1 provides summaries of the studies referenced in this guide. Studies mentioned in the Cautions on Economic Studies section are not summarized. The purpose of the table is to provide guidance should the reader want to pursue a particular idea. Like economists, economic papers present “on the one hand” and “on the

Table 1. Summary of economic studies on animal feeding operations and housing values.

Ref. No.	Housing market		Furthest distance		Impact on house values of:						
	State	Market area	Studied (miles)	Impacted by AFOs (miles)	Nearest AFO	Number of AFOs	Animal density	Larger AFOs	Downwind from AFO	Animal species	House characteristics
2	OH	Rural	1	1	Decrease value	Not considered	Considered in AFO size	Less effect than smaller AFO	Not considered	Not considered	Not considered
4	IA	Rural	10	1.5	Decrease value if downwind	Not significant	Not considered	Less effect than smaller AFO	Decreases value	Hogs	Not considered
5	IN	Rural, rural-urban fringe	10	3	Decrease value if in town within 0.5 mile; increase value if past 0.5 mile	Increase value past 0.5 miles	Increase or decrease depending on species, distance to AFO and town or rural houses	Not considered	Decrease value	Cattle, poultry and hogs have different impacts	Impacts town and rural houses differently
6	IA	Rural-urban fringe	5	5	Not significant by itself	Not significant by itself	No effect from 0 to 3 miles; decrease value 3 to 5 miles from AFO	Not considered	Decrease value within 3 miles of AFO	Hogs	Not considered
8	NC	Mostly rural	3	1.75	Decreases value	Not considered	Decrease value	Less effect than smaller AFO	Insignificant	Hogs	Not considered
10	IN	Rural-urban fringe	Unclear	Unclear	None to negative, depend on house value	Not considered	Not considered	Only large AFOs studied	Not considered	Not considered	Only higher priced houses decrease in value
11	Canada	Rural, rural-urban fringe	6	1.25	Decrease value	Not significant	Not considered		Not considered	Hogs	Not considered
13	NC	Mostly rural	Unclear	Unclear	Decrease value	Not considered	Decrease value		Not considered		Not considered
14	NC	Rural-urban fringe	2	2	Decrease value	Not considered	Decrease value	Impact captured in animal density	Not considered	Hogs	Not considered
15	CO	Mostly rural	3	3	Decrease value	Increase or decrease depending on species and house value	Not considered	Increase or decrease depending on species and house value	Not considered	Increase or decrease depending on species and house value	Increase or decrease depending on species and house value
16	PA	Rural-urban fringe	2	1	Decrease value	Decrease value	Not considered	Greater decrease than smaller AFO	Insignificant	Poultry and hogs decrease value more than cattle	Not considered
18	MN	Rural	3	3	Increases value	Increases value	Not considered	Greater increase than smaller AFO	Unclear	Not considered	Only lower priced houses increase in value

other hand” conclusions. For this reason, the table does not attempt to specify the magnitude of the AFO impact on housing values. Readers will find that size, distance, species and housing values all join together to create an impact this is not the sum of individual impacts. “Not significant” in the table means that the statistical measures of the study could not say with confidence that an impact exists for that category. “Not considered” means that the study did not attempt to quantify the impact for that category.

The impact of AFOs on housing values remains an elusive question. The presence of an AFO is likely to have a negative impact on nearby housing values. This impact likely does not exceed past three miles and probably would not exceed 1.5 miles. The closer the house is to the AFO, the more housing value may be diminished.

Aside from the importance of distance to an AFO, all other factors may either increase or decrease housing values. The impact is likely to be different depending on the area of the state where the AFO is located. If near a city, the impact is likely to be larger than in rural areas. If near many other AFOs, the housing value impact is likely to be very limited. It may actually increase the value of all houses in the area but decrease (relative to all houses) those very close.

It is uncertain whether size of AFO and animal species raised will impact the degree to which AFOs affect housing values.

References

1. Abeles-Allison, M. and L. J. Connor. 1997. “An analysis of local benefits and costs of Michigan hog operations experiencing environmental conflicts.” *Ag. Econ. Report 536*. Michigan State University.
2. Bayoh, I., E. Irwin and B. Roe. 2004. “The value of clean dairy air: Accounting for endogeneity and spatially correlated errors in a hedonic analyses of the impact of animal operations on local property values.” Presentation paper. Denver: AAEA Annual Meeting.
3. Hamed, M., T. G. Johnson and K. K. Miller. 1999. “The impacts of animal feeding operations on rural land value.” Report R-99-02. Community Policy Analysis Center, University of Missouri.
4. Herriges, J. A., S. Secchi, and B. A. Babcock. November 2005. “Living with hogs in Iowa: The impact of livestock facilities on rural residential property values.” *Land Economics* 81 (4): 530–545.
5. Indiana Business Research Center. 2008. “The effects of regulated livestock operations on property values in selected Indiana counties.” Indiana University.
6. Isakson, H. and M. Ecker. July 2008. “Analysis of the impact of swine CAFOs on the value of nearby houses.” *Agricultural Economics* 39: 365–372.
7. Johnson, T. 2008. Personal Communication. October 10, 2008.
8. Kim, J. I. and P. Goldsmith. 2009. “A spatial hedonic approach to assess the impact of swine production on residential property values.” *Environmental and Resource Economics* 42 (4): 509–534.
9. Kirpatrick, J. 2015. *Animal Operations and Residential Property Values*. *The Appraisal Journal*. Winter 2015: 41-50.
10. Kuethe, T. and R. Keeney. 2012. *Environmental Externalities and Residential Property Values: Externalized Costs along the House Price Distribution*. *Land Economics*. 88(2):241-250.
11. Lawley, C. 2021. *Hog Barns and Neighboring House Prices: Anticipation and Post-Establishment Impacts*. *Amer. J. Ag. Econ.* 00(00):1-23.
12. Massey, R. 2019. Letter to the Editor re “Animal Operations and Property Values.” *The Appraisal Journal*. Fall 2019: 278-281.
13. Milla, K., M. H. Thomas and W. Ansine. 2005. “Evaluating the effects of proximity to hog farms on residential property values: A GIS-based hedonic price model approach.” *URISA Journal* 17 (1): 27–32.
14. Palmquist, R. B., F. M. Roka and T. Vukina. February 1997. “Hog operations, environmental effects, and residential property values.” *Land Economics* 73 (1): 114–124.
15. Park, D. H., A.F. Seidl and S. P. Davies. September 2004. “The effect of livestock industry location on rural residential property values.” Report EDR 04-12. Dept. Ag. and Res. Econ., Colorado State University.
16. Ready, R. C. and C. W. Abdalla. May 2005. “The amenity and disamenity impacts of agriculture: Estimates from a hedonic pricing model.” *Amer. J. Ag. Econ.* 87 (2): 314–326.
17. Seipel, M., H. Mubarak, J. Rikoon and A. Kleiner. 1998. *The Impact of Large-Scale Hog Confinement Facility Sitings on Rural Property Values*. Proc. of Anim. Prod. Syst. and the Envir.
18. Taff, S. J., D. G. Tiffany and S. Weisberg. 1996. “Measured effects of feedlots on residential property values in Minnesota: A report to the legislature.” Staff paper P96-12. Dept. of App. Econ., University of Minnesota.