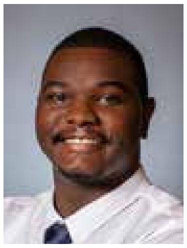
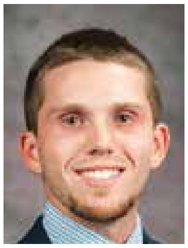
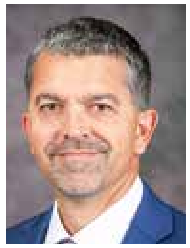
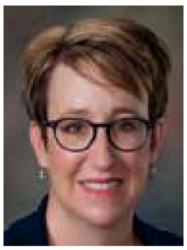
Impact of Confined Animal Feeding Operations on Agricultural Land Values

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Abstract

Previous studies have attempted to explain variations in farmland values, but few consider the effect of confined animal feeding facilities (CAFOs) on the value of agricultural land within a certain proximity. Using parcel-level transaction data and fixed-effect models with different specifications on the distance to CAFOs, this study finds a positive relationship between agricultural land prices and CAFOs located within various distances of the parcel sale. With a distance-band specification, the positive effect of CAFOs is more prominent for the 0- to 25-kilometer distance. We also find that the price rises as the nearest CAFO is located closer.

INTRODUCTION

The value of agricultural land has a significant impact on the agricultural economy. According to the USDA's Economic Research Service (ERS), farm real estate in the U.S. comprises over 80% of assets within the farm sector (USDA ERS, 2020). The National Agriculture Statistics Service has estimated that agriculture land values have increased to roughly $3,800 per acre on average in 2022 (USDA NASS, 2022). With farm real estate comprising most farm sector assets, changes in prices of agricultural land have significant impacts on the profitability of the farm sector as well as the net worth of landowners. Understanding the drivers behind agricultural land prices helps operators, landowners, lenders, and many more participants in the farm sector to make better fiscal management decisions.

Many previous studies have estimated the impacts of specific attributes of agricultural land parcels on their sales price per acre (Taylor and Brester, 2005; Gregory et al., 2020; Sampson, Perry, and Taylor, 2020; Taylor et al., 2020), and several studies have estimated the impact of confined animal feeding operations (CAFOs) on rural-residential property values (Ready and Abdalla, 2005; Herriges, Secchi, and Babcock, 2005; Kim and Goldsmith, 2008; Isakson and Ecker, 2008). With hedonic models to measure the impact of specific attributes on the value of agricultural land or on rural-residential property, these studies found that confined animal feeding operations have a negative effect on rural and residential housing values.

One reason for this is that CAFOs hold multiple animals in a small area, and the waste produced by these animals causes odor and can become a major disposal challenge unless ample cropland is available nearby (Gurian-Sherman, 2008). Increased road traffic is another reason cited for this negative effect. These issues have been relevant in recent years such as in 2018 when Smithfield Foods was ordered to pay $473.5 million in damages to rural-residential property owners surrounding three of their farms in North Carolina because of the nuisance created by their farms from odor and noise (CBS, 2018). Due to these issues, residential neighbors of CAFOs are interested in preventing loss of property value, forced changes in their lifestyle, adverse changes in their communities, and threats to their health (Thu and Durrenberger, 1998). While the effects of CAFOs on rural-residential property values has been documented, it is unknown if a relationship between farmland values and the location of CAFOs exists. Reasons that a CAFO might positively impact nearby farmland values include giving crop producers an additional outlet to sell their crops or adding value by giving them a new source of fertilizer.

In this study, we explore the relationship between CAFOs and agricultural land values in Kansas using parcel-level transaction data of 2012-2013 and two fixed-effect models with different variables accounting for distance. Additionally, this research investigates other factors that impact land values such as physical characteristics of agricultural parcels. The analysis from the first model, which is based on a distance-band specification, reveals that there is a positive relationship between agricultural land values and CAFOs that are located within 0 to 25 kilometers of the agricultural parcel. As the distance between CAFOs and an agricultural parcel increases beyond 25 kilometers, the relationship becomes less significant. The results from the second model, which uses the inverse distance to the nearest CAFO as the key explanatory variable, follow the prior model results by also identifying a negative relationship between agriculture land values and the distance to the nearest CAFO. That is, as the distance to the nearest CAFO decreases, the land value increases.

This current research is similar to previous hedonic agricultural land value models in that specific attributes of agricultural land parcels are used to explain the variance in the sales price per acre of agricultural land. There is an extensive set of previous studies that have examined the factors affecting agricultural land values. This study contributes to the literature on land values by examining the impact of CAFOs on agricultural land rather than the impact on residential housing, which has been previously explored. The findings from this study will provide insights to operators, lenders, landowners, investors, policymakers, researchers, and anyone with a stake or interest in agricultural land.

PREVIOUS LITERATURE

Much of the literature surrounding the impact of animal agriculture on land values focuses on residential land, more specifically, housing. Residential properties are typically valued by amenities or desired features such as number of bedrooms, bathrooms, square footage, etc. One attribute often considered in the appraisal process is distance from specific community utilities or facilities such as schools, business districts, and larger cities. Previous research has consistently used these factors in addition to distance from the nearest CAFO facilities to evaluate the impact of animal agriculture on residential land (Massey and Horner, 2021; Lawley, 2021; Palmquist, Roka, and Vukina, 1997; Kuethe and Keeney, 2012; Milla et al., 2005). In most cases, findings have been consistent across studies regardless of geographic region. Residential properties have consistently faced a negative impact on housing values in the presence of a CAFO. An example is Herriges, Secchi, and Babcock (2005), who evaluated the effect of livestock facilities on housing prices and found that livestock facilities do have a significant negative effect on property values. However, this impact was only seen to be significant regarding the nearest facility, and there was a lack of evidence suggesting that the size of the facility amplified the negative relationship. Other studies have yielded comparable results while also looking to incorporate additional externalities that could potentially exacerbate the impact of CAFOs on residential properties. With the concerns arising about the potential odor exposure from animal facilities, research has considered wind direction as a factor that could amplify the negative relationship between CAFOs and property values (Kim and Goldsmith, 2009).

Overall, the literature suggests that residential property values in general are seen to be sensitive to the presence of facilities or enterprises that may detract from the convenience or comfort of homeowners. This can even be seen outside of the agriculture sector as other studies have concluded that the presence of wind facilities significantly reduced property values for homeowners (Heintzelman and Tuttle, 2012). However, given the fundamental difference between agricultural and residential land, factors that influence residential property in a particular way may not have the same impact on agriculture land values, providing an opportunity for further research. A recent study by Uter and Hadrich (2023) estimated the impact of swine feedlots on residential housing values in rural areas in Southern Minnesota and found that swine feedlots located between one-half to one mile away from rural homes had a positive impact on their value. This gives credit to the speculation that the properties and land in rural agricultural areas have a different relationship with CAFOs than those in urban or suburban areas.

Other economic studies have focused on analyzing the relevant factors that impact the value of farmland (e.g., Oltmans, Chicoine, and Scott, 1988; Just and Miranowski, 1993; Chavas and Thomas, 1999; Shi, Phipps, and Colyer, 1997). Due to the utility of farmland for production, studies have found that the price of crops can have an impact on price. An example is Taylor and Brester (2005), who found that land values for sugarbeet fields in Montana were positively impacted by factors such as the quality-adjusted price of sugarbeets and expected cash receipts.

Much like in the case of residential land, studies have suggested that the distance from urban or other highly populated areas has a positive impact on price due to the availability of markets to sell goods and the potential returns from future development opportunities (Taylor and Brester, 2005; Gregory et al., 2020). Other studies suggest that this effect may also be driven by increases in population and per capita income causing a shift in homeowners' preference toward living away from city centers (Guiling, Brorsen, and Doye, 2009). Farmland with high levels of productivity often tends to be highly valued as well, which is reflected in the literature as both soil quality and irrigation are seen to have a positive effect on cropland values (Gregory et al., 2020). As residential land and farmland are utilized in distinctly different ways, certain factors that affect residential land negatively have been shown to have either little or, in some cases, a completely different impact on farmland values.

While research surrounding the presence of wind power facilities around residential land showed a distinctly negative effect, similar relationships have been shown to be different with respect to farmland. For example, studies show that wind farms have the potential to alter local temperatures and thus impact crop yields in the surrounding area (Li et al., 2018; Kaffine, 2019). In addition, wind energy production is speculated to serve as a complementary sector to agriculture production since many are located on agriculture land. Sampson et al. (2020) examined this relationship when evaluating the on-/near-farm effects of wind turbines on agricultural land values in Kansas. The results from this study suggested that, though positive, the relationship between on-/off-farm wind turbines and land values was not statistically significant. Thus, the researchers could not conclude that wind turbines placed on or near an agriculture parcel would definitively increase the price of the land.

Other potential complementary sectors have also had their relationship to agriculture land values explored. Ethanol production, for example, has been speculated to increase corn prices and thus increase the value of neighboring farmland. Gardner and Sampson (2022) estimated that irrigated parcels within 50 km of an ethanol plant experience a price premium of about 8.8% on average, while non-irrigated acres saw a price premium of 6.3% relative to parcels that were more distant. With respect to CAFOs and their relationship or potential impact on land values, there have been no formally published studies in this area. However, results from Huang et al. (2003) suggest that the impact of swine production on farmland values in Illinois was positive, with changes in swine inventory and the scale of swine operations leading to changes in farmland prices from -\$10.56 to \$62.96 per acre and overall increasing the value of farmland. This may suggest that similar to speculations about wind energy or ethanol production, animal production and crop production serve as complementary sectors, and this relationship could potentially be observed in the prices of assets such as land.

When exploring empirical techniques for examining land values in the literature, several studies implement some variation of a hedonic modeling approach. The most frequently cited and seminal work on hedonic modeling is the study by Rosen (1974), who suggested that differences in prices are the equalizing factor between two goods with different observed characteristics. To gain insight into the effects of differing product characteristics on prices, Rosen developed the hedonic model that follows the general form where $p(z)$ is the price of the good as function of a vector of its characteristics, z, and each z_i is a different characteristic of that good. The partial derivative with respect to each characteristic, z_i, provides the marginal value for each characteristic of the good. Several studies have implemented Rosen's framework to understand key factors that influence both rural and residential land values. It allows for a clear understanding of the key attributes and environmental factors that impact prices of the land in question.

While no functional form is specified with the hedonic model, researchers commonly opt for a semi-log specification when exploring price effects on agricultural land (Sampson, Perry, and Taylor, 2020; Gardner and Sampson, 2022). Land productivity, soil quality, and environmental factors have set a precedent for having a distinctly significant impact on price (Taylor and Brester, 2005; Gregory et al., 2020). One of the of the most crucial specification considerations to address when implementing a hedonic framework is distance. This is a particular concern when trying to account for the distance from multiple locations of interest at once. A common way to incorporate distance into a hedonic framework has been through the use of distance bands (Herriges, Secchi, and Babcock, 2005; Kim and Goldsmith, 2009; Uter and Hadrich, 2023). These distance bands allow for the consideration of multiple neighboring points of interest within specified spatial rings by counting their frequency within a given range. Sampson, Perry, and Taylor (2020) noted that the way in which a neighbor is defined and the distance ranges used for the spatial bands can impact the number of observations exploitable in the treatment groups. Thus, the use of consistent spatial bands that are reasonable given the study area is a crucial point of empirical specification. Another method for considering distance is the natural log of the inverse distance from the nearest point of interest. The rationale behind this method of calculating distance is that it can potentially capture negative environmental or positive agglomeration effects (e.g., Heintzelman and Tuttle, 2012; Sampson, Perry, and Taylor, 2020).

Studies that utilized both distance variables typically saw the same sign on either coefficient. However, the magnitude and level of significance have been shown to vary slightly between approaches. Management of omitted variable bias, time-invariant heterogeneity effects, and spatial autocorrelation in land values have been noted as consistent points of concern when researching land values. These issues arise as a result land prices being affected by trends through time or by environmental factors relative to space not captured in the model. Spatial lag, spatial error, and spatial temporal models as well as fixed effects approaches are all common methods of addressing these concerns (e.g., Kim and Goldsmith, 2009; Heintzelman and Tuttle, 2012; Huang et al., 2003; Gregory et al., 2020; Sampson, Perry, and Taylor, 2020; Gardner and Sampson, 2022). This study does implement the use of fixed effects to address some of the challenges presented.

DATA AND VARIABLES

The primary source of data for this study is the Kansas Department of Revenue, Property Valuation Division (PVD) database for agricultural land sales. Data for characteristics of the parcel such as the date of sale, composition of the parcel, size of the parcel (*Size*), price per acre of the sale, and measures of productivity (*CropIndex*) were all taken from the PVD's agricultural land sales dataset. Variables calculated by using PVD data are the natural log of the real price per acre (*lnppa*), percentage of acres that are irrigated *(%Irr*), pasture (*%Past*), homestead acres (*%Home*), and total parcel acres squared ($Size^2$). Price data are adjusted for inflation to 2017 dollars using the Consumer Price Index (CPI) (BLS, 2019).

A list of CAFOs, including their physical addresses, was provided for the years 2012 and 2013 by the Kansas Department of Agriculture (KDA). These facilities included beef cattle, dairies, swine, and sheep. The physical address was geocoded to produce a longitude and latitude for each facility, and then the distance from each parcel sold to each CAFO was measured using the law of cosines method to get an "as the crow flies" measure of distance. Monthly data for the S&P 500 (*S&P*) were collected from Yahoo! Finance (Yahoo!, 2019). Data for the monthly 30-year fixed-rate mortgage rates were collected from the St. Louis Federal Reserve (Fed, 2019). Table 1 provides the definitions of the variables, and Table 2 presents the overall summary statistics for the variables used in this study.

Distance Variables

We first measured the distance between a parcel to the CAFOs in kilometers, considering two different specifications. First, we followed the distance band approach used by other studies in the literature (Herriges, Secchi, and Babcock, 2005; Kim and Goldsmith, 2009; Sampson, Perry, and Taylor, 2020, Uter and Hadrich, 2023). We counted the number of CAFOs within each "band," where bands were defined by the intervals 0-25, 25-50, 50-75, and 75-100 kilometers. A positive relationship was anticipated between the number of livestock facilities within 25 km of the parcel sale and the price per acre of that sale because of the option for selling grain and purchasing fertilizer created by having CAFOs near the parcel. The same relationships were also expected for the other distance bands, but the magnitude and significance of the coefficients were expected to decline the greater the distance from the parcel of land.

An alternative approach to measuring distance is to follow the method presented by Heintzelman and Tuttle (2012) and Sampson, Perry, and Taylor (2020). That method uses the natural log of the inverse distance to the nearest CAFO of the parcel sold as the key regressor. Similar to the distance-band specification previously discussed, the inverse distance to the nearest CAFO is calculated at the time of the parcel sale. The inverse distance will increase for each parcel sold in the presence of a new CAFO. As the distance between the parcel sold and the CAFO gets shorter, the inverse distance will appear larger. Taking the natural log of the inverse distance allows for the interpretation of the coefficient as an elasticity. In line with the hypothesis for the band method of distance calculation, this variable is expected to have a positive relationship with the price per acre of each agricultural land parcel sold. This is because, as the true distance between the parcels and CAFOs decreases, the inverse distance would increase, thus, a positive relationship between the price and the inverse distance would indicate a negative relationship between the true distance and price resulting in a higher price premium for parcels located closer a CAFO location.

MODEL SPECIFICATION

This study used a hedonic framework put forth by Rosen (1974). In the current study, the price per acre of a parcel of agricultural land was estimated as a function of the type of land in the parcel, parcel size, land productivity, location, timing of the parcel sale, and general economy.

The model for this analysis can be seen outlined in Equation 1:

$$lnPPA_{irmt} = \alpha + \beta X_{irmt} + \gamma_{irmt}\, CD + \mu_r + u_m + v_t + \varepsilon_{irmt} \quad (1)$$

Here, $lnPPA_{irmt}$ is the real log price per acre for parcel in region , month , and year . Additionally, X_{irmt} is the vector of covariates, and $\gamma_{irmt}\, CD$ used to denote the distance variable in the model estimating the impact of CAFO distance on the price. We also included regional, monthly, and year-fixed effects, nothing that Pendell and Featherstone (2005) showed the seasonal effects on the price per acre of agricultural land using Kansas farmland data from the period of 1980 to 2003. Figure 1 is a histogram showing the distribution of the price per acre for 2012-2013 for all seasons of the year. As discussed above, we considered two specifications for the distance variables. The first uses the numbers of CAFOs within a “band” and can be represented as $Band^k_{irmt}$, which is the number of CAFOs in k_{th} band located near the land parcel in one of the four distance bands explained in the previous section. The second specification uses the log of inverse distance to the nearest CAFO, replacing the band variables given as $(\frac{1}{Distance_{irmt}})$. Figure 2 provides a visual aid for each distance variable used in the analysis. A key difference to note between the two variables is that the “band” method allows us to capture the marginal impact on the price of an additional CAFO present within a given radius, while the inverse distance method allows us to capture the immediate price effect of the closest CAFO to the parcel location. Figure 3 provides a map of the 514 CAFO locations and species types in Kansas in 2013.

Parcel Characteristics and Economic Control Variables

Size is one of the main characteristics used to determine the price of a land parcel. Here, the variables total acres in the parcel (*Size*) and total acres in the parcel squared (*Size*^{2}) were used to account for this effect. A negative relationship was expected between the per-acre sales price and total acres as larger parcels tend to have a lower sales price per acre compared to smaller parcels. Larger parcels require more financial resources, which limits the number of potential buyers (Xu, Mittelhammer, and Barkley, 1993). Conversely, a positive relationship was expected between the sales price and the squared size term since the negative effect of parcel size on the price is expected to lessen as parcel size increases.

Various physical attributes play a role in estimating the value of farmland (Swanepoel, Hadrich, and Goemans, 2015). Variables accounting for the effect of different types of land on the parcel included the percentage of total dedicated to irrigation (*%Irr*), dryland (*%Dry*), pasture (*%Past*), and to the homestead or residential portion (*%Home*). The type of land in the parcel was found by measuring the ratio of acres of a particular type and dryland acres. A positive relationship was expected between the price and percentage of irrigated and homestead acres as both are often valued more than dryland acres. Furthermore, a negative relationship was expected between price and percentage of pasture acres as it is typically less valuable than dryland acres. The variable to account for the impact of productivity on sales price was the crop index (*CropIndex*), which came from the United States Department of Agriculture Natural Resources and Conservation Service National Commodity Crop Productivity Index (NCCPI). This index measures the productivity of agricultural land for growing dryland crops. Each parcel had a score ranging from 0 to 100 measuring the least and most productive soil, respectively. A positive relationship was expected between the index score and price as it was expected that more productive soil would be more valued by potential buyers looking to farm the land.

The economic environment can also potentially impact the value of land at the time of a sale, for example, factors such as interest rates, inflation rates, and cash rents are known to have an impact on land value (Schurle et al., 2012) To address this, specific economic variables were selected as controls in this study, with the average S&P 500 value (S&P) for the month of the parcel sale used to control for alternative investments to purchasing land. It was anticipated that a positive relationship would exist between the S&P 500 and the price per acre of agricultural parcel sales. Additionally, the average 30-year fixed-rate mortgage rate for the month of the parcel sale (*Mort*) was included to account for the impact of financing options on farmland values. A negative relationship was expected between the price per acre and the 30-year fixed-rate mortgage rate as an increase in the mortgage rate would increase financing expenses. Table 1 provides a summary of the variables included in this analysis while Table 2 provides summary statistics for each variable.

RESULTS

Distance Variable Results

Table 3 displays the results from the regression models in this study. In Model 1, a positive relationship was found between the number of CAFOs within 0 to 25 kilometers of the parcel sale ($Band_{0\text{-}25}$) and the sales price per acre. The model estimated the marginal effect of one additional CAFO being located within this distance band on a parcel for sale would increase the sales price per acre by 1.5%. Positive relationships were also found between the number of CAFOs between 25 and 50 kilometers ($Band_{25\text{-}50}$), between 50 and 75 kilometers ($Band_{50\text{-}75}$), and between 75 and 100 kilometers ($Band_{75\text{-}100}$) of the parcel for sale and sales price per acre, but none of these variables were statistically significant, thus it can be surmised that CAFOs within 25 kilometers of a parcel would have the greatest influence on sale price. In Model 2, the natural log of the inverse distance to the nearest CAFO was shown to have a significant positive relationship with the price per acre of agricultural land parcels with a coefficient of 0.05. This suggests that a 1% change in the inverse distance from parcels to CAFOs yields a 5% premium. Thus, when examining similar pieces of land, the parcel that is 1% closer to a CAFO location would have a 5% higher value on average. Essentially, parcels that have a larger inverse distance (i.e., a smaller distance between the parcel and CAFO) would experience a greater price per acre on average.

Parcel Characteristics and Fixed Effect Results

The results for the remaining variables will be presented for Model 1 as there was no notable deviation in the results for most of the variables in either model. A positive relationship was found for the percent of total parcel acres that were irrigated and price per acre when compared to the percent of the total parcel acres that were dryland acres. The coefficient estimated for *%Irr* showed that a 1% increase in the percentage of total acres that were irrigated led to a 0.5% increase in the sales price per acre of an agricultural parcel relative to dryland acres. Similarly, the estimated coefficient for *%Home* showed that a 1% increase in the acres designated for the home resulted in a 3.6% increase in the sales price per acre. The *%Past* was the only land type variable to have a negative impact on the price. The results showed that a 1% increase in the percent of total parcel acres that were pasture led to a 0.5% decrease in the price per acre of a parcel sale when compared to dryland acres.

The sales price per acre and total acres in the parcel (*Size*) and total acres in the parcel squared ($Size^2$) had a negative and positive relationship, respectively. The magnitude of the coefficient (-0.003) for total acres in the parcel was small. The estimated coefficient for the squared term of total price per acre was positive but close to zero (0.00002). With the coefficient of the squared term being near zero, the coefficient for the size of the parcel was interpreted to imply that a one-acre increase in the size of the parcel would result in a 0.3% decrease in sales price per acre. These findings are consistent with previous studies. The coefficient for the crop index (*Crop Index*) was positive as expected with a one-unit increase in the crop index score for a parcel leading to an increase in the sales price per acre by 0.008%.

CONCLUSION

This is the first known published study to examine if there is a relationship, and to what extent, between the location of confined animal feeding operations (CAFOs) and agricultural land values. Because agricultural land comprises such a large majority of the assets in the farm sector, understanding the factors driving the differences in land prices between parcels is pivotal. This study employs a hedonic framework to explain the variability in the sales price per acre of agricultural parcel sales in Kansas for the years 2012 and 2013. Positive and significant relationships were found between sales price per acre of agricultural parcels and the percent of the total parcel acres that were irrigated, percent of the total parcel acres that were pasture, total acres in the parcel, and crop index score (a measure of land quality). When examining distance, it was revealed that both the number of CAFOs within the closest set radius and the distance to the nearest CAFO in proximity to the parcel have a significant positive relationship with the price per acre. The results of this study suggest that CAFOs do have an impact on the value of agricultural land via a price premium. This premium is something that landowners should be aware of when appraising the value of their assets in addition to other characteristics.

Future research can expand on this study to continue to evaluate the impact that CAFOs have on the price of agriculture land prices over a greater time period. The data used in this study included the years 2012 and 2013. By expanding the number of years included in this study we could evaluate how temporal impacts and possibly account for structural changes within the farm and livestock sector over time. Evaluating how these price impacts could complement or conflict with the price impacts from CAFOs could lead to a deeper understanding of the complementary or conflicting factors that influence the price of agricultural land parcels in Kansas. Future research could also further contribute by accounting for various types of CAFOs (i.e., swine, cattle, sheep, poultry) and exploring implications related to differences in CAFO size.

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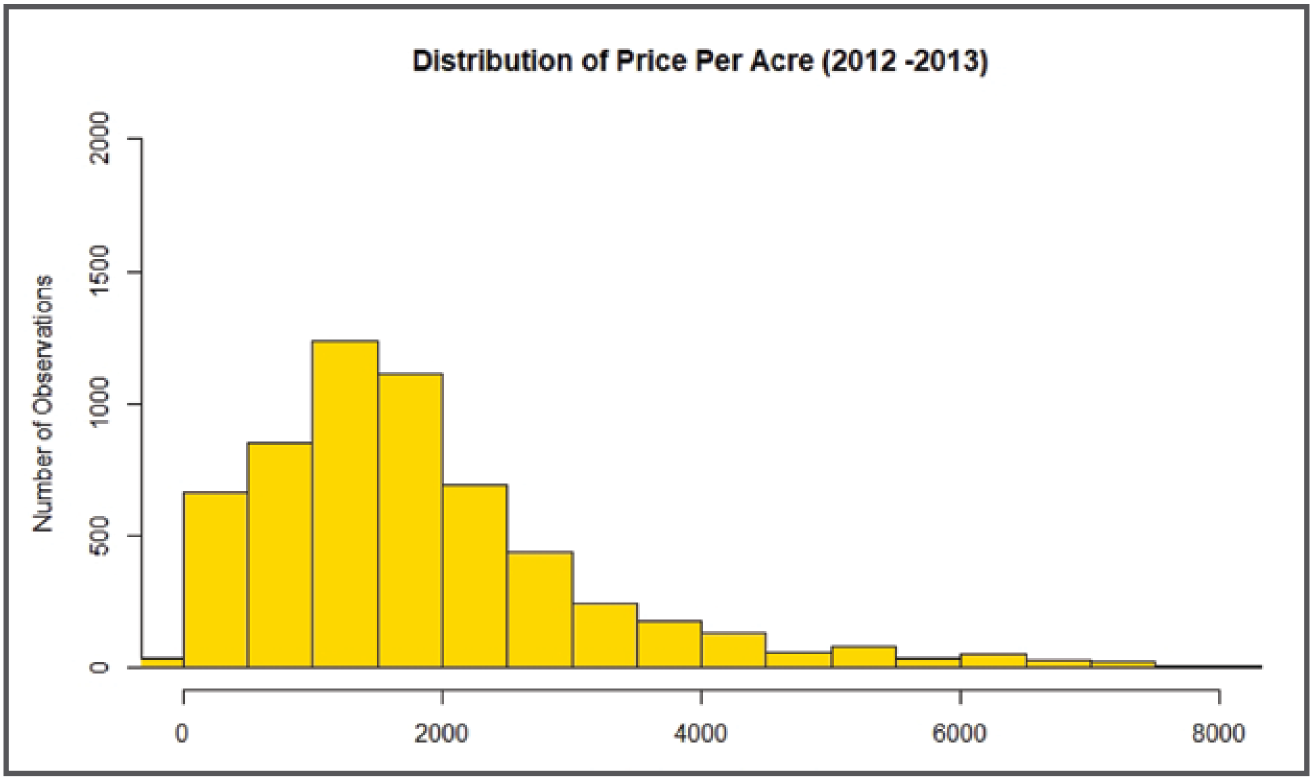

Figure 1. Histogram of sales price per acre of agricultural parcels 2012–2013

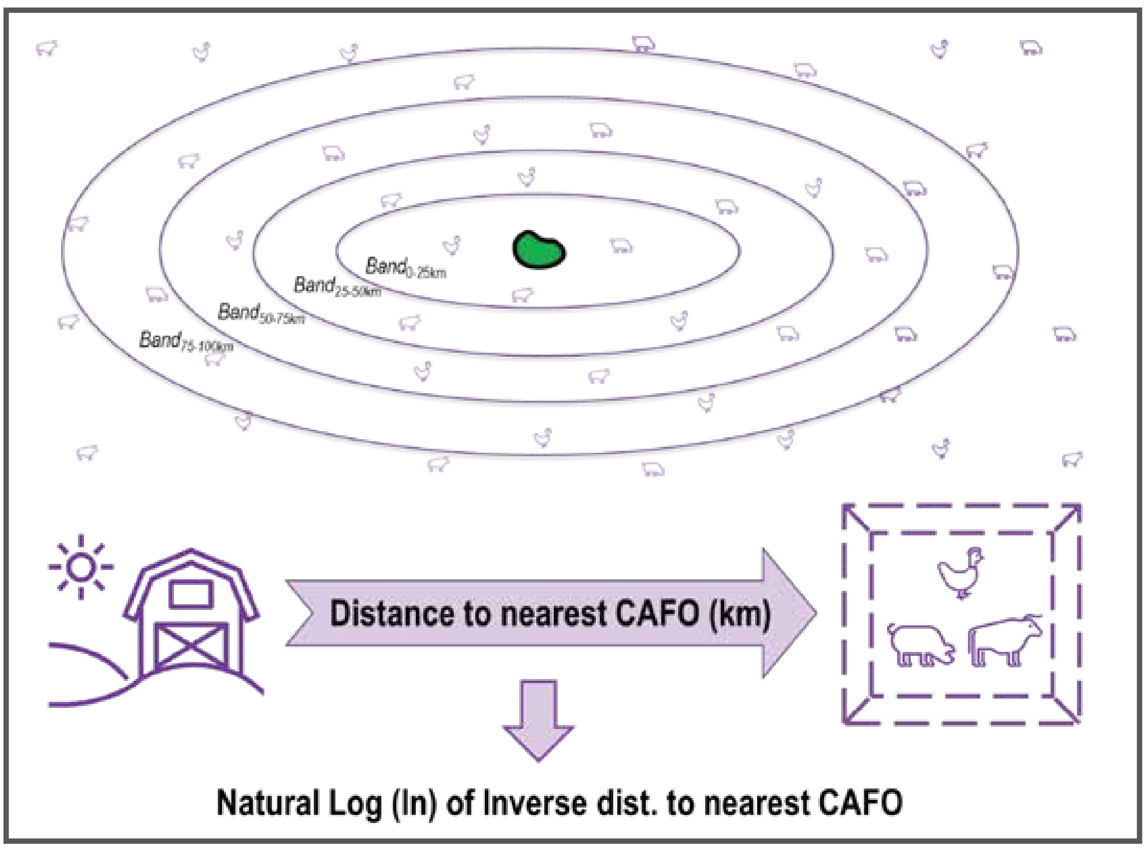

Figure 2. Visualization of distance variables

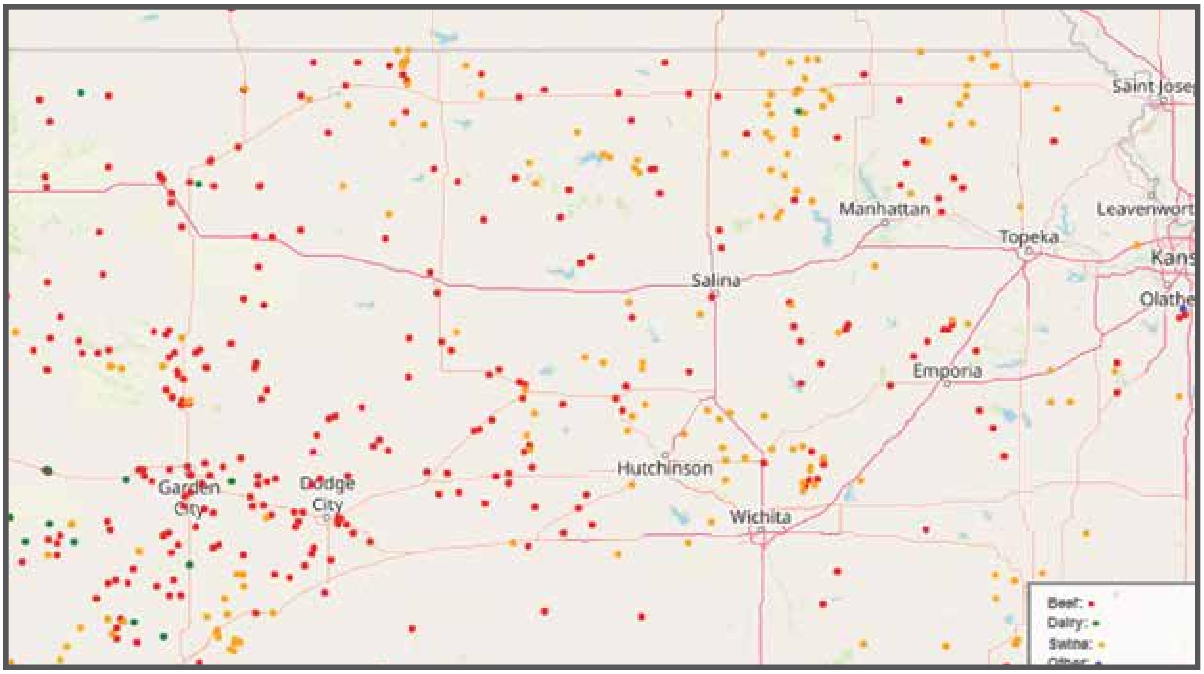

Figure 3. Map CAFO locations and types in Kansas (2013)

Table 1. Variables and Descriptions Used in the Regression Analysis	
Variable	**Description**
Dependent	
lnppa ($/acre)	natural log of price per acre
Independent	
%Irr	percentage of the total parcel acres that are irrigated
%Past	percentage of the total parcel acres that are pasture
%Home	percentage of the total parcel acres that are homestead acres
%Crop	percentage of the total parcel acres that are cropland
Size	total acres in the parcel
Size2	total acres in the parcel squared
Crop Index	NRCS National Commodity Crop Productivity Index (NCCPI)
Band0-25	total number of CAFOs within 0 - 25 km of the parcel sale
Band25-50	total number of CAFOs between 25 km and 50 km of the parcel sale
Band50-75	total number of CAFOs between 50 km and 75 km of the parcel sale
Band75-100	total number of CAFOs between 75 km and 100 km of the parcel sale
ln(1/Distance)	The natural log of the inverse of the distance from the site of the parcel to the nearest CAFO in the area
S&P	S&P 500 index
Mort	30-year fixed-rate mortgage rate

Table 2. Summary Statistics of Variables in the Analysis				
Variable	**Mean**	**Std. Dev.**	**Min**	**Max**
lnppa ($/acre)	7.25	1.05	0	12.30
Distance to nearest CAFO (km)	14.29	9.83	0.221	62.64
$Band_{0-25}$	20.96	15.41	2	119
$Band_{25-50}$	20.30	15.17	1	129
$Band_{50-75}$	25.24	16.13	1	118
$Band_{75-100}$	449.74	41.40	168	510
Size	138.58	119.64	0.1	1634.7
Size2	33,500.75	78,730.92	0	2672244
%Irr	2.53	13.60	0	100
%Past	20.21	36.10	0	100
%Home	0.07	1.35	0	54.92
% Crop	50.36	41.69	0	100
Crop Index	42.85	12.28	0	89.48
Mort	3.80	0.345	3.35	4.49
S&P 500	1,519.95	160.36	1,310.33	1,848.36

Number of Observations 5,957

Table 3. Regression Results [1]

Variable	Coefficients					
	Model 1			Model 2		
$Band_{0-25}$	0.015	***	(0.005)	-		
$Band_{25-50}$	0.004		(0.005)	-		
$Band_{50-75}$	0.003		(0.005)	-		
$Band_{75-100}$	0.008		(0.005)	-		
ln (1/Distance)	-		-	0.05	***	(0.017)
Size	-0.003	***	(0.000)	-0.002	***	(0.000)
$Size^2$	0.000	***	(0.000)	0.000	***	(0.000)
% Irr	0.005	***	(0.001)	0.005	***	(0.001)
% Past	*-0.005*	***	*(0.001)*	*-0.004*	***	*(0.000)*
% Home	*0.036*	*	*(0.021)*	*0.032*	*	*(0.173)*
Crop Index	*0.008*	***	*(0.001)*	*0.007*	***	*(0.001)*
Mort	*-0.022*		*(0.067)*	*0.001*		*(0.061)*
S&P 500	*-0.000*		*(0.000)*	*0.001*		*(0.003)*
Region Fixed Effects	*Yes*			*Yes*		
Month Fixed Effects	*Yes*			*Yes*		
Year Fixed Effects	*Yes*			*Yes*		
R^2	*0.133*			*0.157*		
Number of Observations	*5,098*			*5,957*		

Robust standard errors are in parentheses. *, **, and *** indicate significance at the $p< 0.1$, $p<0.05$, $p<0.01$ levels, respectively.

[1]Parcel characteristics were selected for inclusion based on the correlation table A3 found in the Appendix. Models specifications including quadratic distance variables (Distance & Distance^2) and county-level fixed effects were evaluated as a robustness check. The authors found no significant difference in the results from each and thus presented the model results seen above. [3]Tables A1 and A2 in the Appendix present the result for the alternative model specifications

APPENDIX

Table A1. Regression Results with Quadratic Distance Model

Variable	Coefficients								
	Model 1			Model 2			Model 3		
Band$_{0\text{-}25}$	0.015	***	(0.005)	-			-		
Band$_{25\text{-}50}$	0.004		(0.005)	-			-		
Band$_{50\text{-}75}$	0.003		(0.005)	-			-		
Band$_{75\text{-}100}$	0.008		(0.005)	-			-		
Distance	-			-0.001	***		-		
Distance2	-			0.000	***		-		
In (1/Distance)	-			-			0.05	***	(0.017)
Size	-0.003	***	(0.000)	-0.003	***	(0.000)	-0.002	***	(0.000)
Size^2	0.000	***	(0.000)	0.000	***	(0.000)	0.000	***	(0.000)
% Irr	0.005	***	(0.001)	0.005	***	(0.001)	0.005	***	(0.001)
% Past	-0.005	***	(0.001)	-0.004	***	(0.001)	-0.004	***	(0.000)
% Home	0.036	*	(0.021)	0.031	*	(0.021)	0.032	*	(0.173)
Crop Index	0.008	***	(0.001)	0.007	***	(0.001)	0.007	***	(0.001)
Mort	-0.022		(0.067)	-0.023			0.001		(0.061)
S&P 500	-0.000		(0.000)	-0.000	*		0.001		(0.003)
Region FE	Yes			Yes			Yes		
Month FE	Yes			Yes			Yes		
Year FE	Yes			Yes			Yes		
R^2	0.133			0.157			0.157		
Number of Observations	5,098			5,957			5,957		

Robust standard errors are in parentheses. *, **, and *** indicates significance at the p< 0.1, p<0.05, p<0.01 levels, respectively.

Table A2. Regression Results with Quadratic Distance Model (County FE)

Variable	Coefficients								
	Model 1			Model 2			Model 3		
$Band_{0\text{-}25}$	0.006	*	(0.003)	-			-		
$Band_{25\text{-}50}$	0.004		(0.002)	-			-		
$Band_{50\text{-}75}$	0.001		(0.002)	-					
$Band_{75\text{-}100}$	0.002		(0.002)	-			-		
Distance	-			-0.004		(0.004)	-		
Distance^2	-			0.000		(0.004)	-		
In (1/Distance)	-						0.015		(0.020)
Size	-0.002	***	(0.000)	-0.002	***	(0.000)	-0.002	***	(0.000)
Size^2	0.000	***	(0.000)	0.000	***	(0.000)	0.000	***	(0.000)
% Irr	0.004	***	(0.001)	0.005	***	(0.001)	0.005	***	(0.001)
% Past	-0.004	***	(0.001)	-0.003	***	(0.000)	-0.003	***	(0.000)
% Home	0.043	*	(0.041)	0.036	*	(0.017)	0.036	*	(0.169)
Crop Index	0.005	***	(0.001)	0.008	***	(0.001)	0.005	***	(0.001)
Mort	-0.031		(0.065)	-0.001		(0.059)	0.007		(0.059)
S&P 500	-0.000		(0.000)	-0.000	*	(0.000)	-0.001		(0.000)
County FE	Yes			Yes			Yes		
Month FE	Yes			Yes			Yes		
Year FE	Yes			Yes			Yes		
R^2	0.264			0.254			0.254		
Number of Observations	5,098			5,957			5,957		

Table A3. Parcel Characteristic Correlation Matrix

Variable	NCCPI	Sand Index	Silt Index	Clay Index	Organic Matter Index	Available Water Capacity Index	% Crop	% Irrigated	% Pasture	% Home
NCCPI	1									
Sand Index	-0.332	1								
Silt Index	0.246	-0.584	1							
Clay Index	0.252	-0.478	0.557	1						
Organic Matter Index	0.251	-0.39	0.461	0.757	1					
Available Water Capacity Index	0.108	-0.11	0.795	0.286	0.204	1				
% Crop	0.145	-0.136	0.09	-0.135	-0.246	0.153	1			
% Irrigated	-0.089	0.161	-0.065	-0.112	-0.128	0.044	-0.139	1		
% Pasture	-0.062	-0.022	0.013	0.154	0.228	-0.098	-0.489	-0.076	1	
% Home	0.037	0.004	0.009	0.012	0.021	0.008	-0.021	-0.003	0.041	1