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The Impact of Open Space and Potential Local Disamenities on Residential Property Values in Berks County, Pennsylvania

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Executive Summary

This research project estimated the impact that surrounding land use and potential local disamenities have on residential property values in Berks County, Pennsylvania. An implicit house price function was estimated based on 8,090 single family houses sold between 1998 and 2002, using regression analysis. Information on surrounding land use, proximity to potential local disamenities, and structural attributes of the houses were used to explain variation in house prices.

Within 400 meters of the house, the land use that has the most positive impact on house price was open space, followed by large-lot single family residential land. Commercial, small-lot single family residential, and multi-unit residential were less desirable. The least desirable land use within 400 meters of the house was industrial. Also, open space on parcels that are covered by conservation easements, including agricultural conservation easements, has a less-positive amenity impact than open space not covered by such easements. This does not necessarily mean that easements cause nearby property values to decrease. It may be that farms with agricultural conservation easements tend to be managed more intensively, which may be seen as less attractive by nearby homeowners.

Between 400 and 1600 meters away from the house, the land use with the most positive amenity impact on house price was commercial, followed closely by large-lot single family residential. Of open space uses, only land that is owned by Local, State or Federal Government and land that is covered by conservation easements have a statistically significant positive amenity value.

Several potential local disamenities were found to have a negative impact on nearby house prices. Of the potential local disamenities investigated, the impact of landfills on house price was largest, and extended the farthest (up to 3200 meters). A landfill located 800 meters from a house decreases that house's sale price by an estimated 6.9%. The impact of a large-scale animal production facility (over 200 animal equivalent units or aeu's) on house price was about one half to two thirds as large as that from a landfill (4.1% at 800 meters), and did not extend as far (up to 1600 meters). The impacts on house price from mushroom production and from the regional airport were much less (0.4% and 0.2%, respectively, at 800 meters). The impact from high-traffic roads was small, and extended only a short distance. No significant impact was found for sewage treatment plants.

Additional analysis attempted to investigate whether different types of animal production facilities had different impact on nearby house prices. Differences in the impact due to differences in the size of the operation (number of aeu's) were not statistically significant. Further, medium-sized production facilities (200 to 300 aeu's) were found to have a statistically significant negative effect on house prices when considered apart from larger facilities. Similarly, the impact did not vary significantly by species (poultry, swine, and beef/dairy). An analysis of proximity of animal production facilities and residential properties showed that the

density of single family homes around animal production facilities was lower than the average for rural parts of the county. An implication is that some potential for conflicts is avoided due to the way in which these land uses are located on the land.

The total impact on surrounding house prices was calculated for a landfill, the regional airport, and an animal production facility. The average impact on the value of 3342 houses located within 3200 meters was $2442 (all values are in 2002 dollars). The total impact on all houses was $8,162,000, which is 2.6% of the assessed value of the affected properties. The average impact of the regional airport on 2256 houses located within 1600 meters of the airport runway and its flight paths was $104, and the total impact on the value of these properties was $235,000, or 0.1% of the assessed value of the affected properties. This calculation does not include 2391 properties located near the airport within the City of Reading. The average impact of a single animal production facility on 119 single family residences located within 1600 meters of the facility $1,803. The total impact on all 119 houses is $215,000, or 1.7% of the assessed value of the affected houses. These figures are intended as illustrations, and should not be considered averages for similar facilities. The impact from any given landfill, airport, or animal production facility will depend on the number of houses located near the site, and on the market value of those houses absent the facility.

The study area chosen, Berks County, was well suited to this type of analysis, in terms of data availability and the diversity and dispersed spatial pattern of land uses and agricultural production. The research method should be extended to more study areas, to see if differences in population density, demographics, or type and amount of open space and agricultural production influence the results. Until more research is conducted in more counties, care should be taken in extrapolating the results from this research to other regions.

The Impact of Open Space and Potential Local Disamenities on Residential Property Values in Berks County, Pennsylvania

I. Introduction and Project Objectives

Increased attention is being focused throughout the Northeast U.S. on how land use is changing over time. Concerns over urban "sprawl," with its patchy, diffuse pattern of development, include the loads placed on the transportation infrastructure, the costs of delivering local services, the impacts on natural systems, and the effects on the aesthetic and cultural value of the landscape. As residential development occurs in rural areas, traditional as well as more modern and larger-scale agriculture can become located in close proximity to residences, leading in some cases to conflict over land uses and property rights. Local authorities whose responsibility it is to manage and regulate growth and development need information on the relative desirability of alternative land use patterns. Property values provide one way to measure community members' preferences over land use patterns, as revealed through markets.

The overall goal of this study was to estimate the impact of neighboring land use on residential property values. Categories of neighboring land uses addressed were open space (versus developed uses) and land uses that may be seen as locally undesirable due to perceived or actual disamenities. The latter category of potential local disamenities included: landfills, airports, mushroom production, large-scale animal production, sewage treatment plants, and high-traffic roads.

The above goal was accomplished in two phases. First, a GIS database on land use and residential property values was developed for a county in Southeastern Pennsylvania, a region characterized by highly productive agricultural land but also by continuing development pressure and a rapid rate of farmland loss.

In the second phase, an implicit house price function was estimated to explain variation in the sales price of single-family residential properties. Explanatory variables included: structural characteristics of the properties (square feet of living space, lot size, etc.), factors that vary spatially by local government (school district quality, zoning, etc.), measures of proximity to employment centers, measures of surrounding land use, and proximity to potential local disamenities. Based on the estimated implicit house price function, the marginal impacts of surrounding land use and local disamenities on residential property values were calculated.

II. Previous Research

Many papers have used implicit pricing models to analyze the effects of open space and/or local disamenities on residential property values. However, results from these papers are mixed due to different kinds of open space considered, specification of the open space variables, and differences across study regions. The study closest to this one in purpose and method is that done by Irwin (2002).

In an implicit pricing analysis of residential properties in Maryland, Irwin measures the proportion of area within 400 meters of each house in different land uses. Irwin finds that

compared to residential, commercial or industrial uses, open space located within 400 meters of a residential property has a positive impact on that property's price. Further, pasture and cropland generate higher amenity benefits to nearby residences than forested open space. Finally, both permanent conservation through easements and public ownership increase the positive impact that open space has on neighboring residential prices.

In addition to open space, we investigate in this project the impact on nearby residential property values of several different types of potentially undesirable facilities and land uses. These include sewage treatment plants, landfills, high-traffic roads, airport runways, mushroom production facilities and large-scale animal production facilities. Particular attention is paid to the potential local disamenity associated with animal production, as this is an activity that would be allowed on land that is covered by an agricultural conservation easement.

Few implicit price studies have been conducted that specifically address the amenity impact of animal production on residential property values. Abeles-Allison and Connor (1990), in a study of property values near large hog operations in Michigan, found that house values decreased by $1.74 for each additional hog within a 2 kilometer radius of the house. They did not find significant impacts outside of 2 kilometers. One limitation of this study is that it only included eight hog operations that had received multiple odor complaints. Property value impacts from these eight operations might well be greater than those from other operations that did not receive complaints.

Palmquist et al (1997) measured the impact on residential property values of hog production in the coastal plain of North Carolina, where some of the largest animal production facilities in the nation are located. For each residential property, the total amount of hog manure produced within ½ mile, within 1 mile, and within 2 miles was determined. They found that house price was negatively affected by the concentration of hogs near the house, and that the negative impact on house price from a single hog operation could be as large as 8.4%.

The Michigan study assumed that the negative impact from a livestock operation on house prices increased proportionally with the number of livestock located near the house. The North Carolina study assumed that the impact from hog production was tied to the total tons of manure generated within each ring around the house. One issue that is addressed in this project is the relationship between the impact of animal production on house price and the scale of animal production near the house. Second, the Michigan and the North Carolina studies are both restricted to hog operations. This project includes poultry, swine, and beef and dairy operations. Finally, the Michigan and North Carolina studies investigated the impact of animal production on house price in isolation. This study estimates the impacts from several potential local disamenities simultaneously, as well as from open space versus developed land use.

III. The Study Area: Berks County

Berks County occupies an area (864 square miles) between Philadelphia and Harrisburg in southeastern Pennsylvania. Today in Berks County, farming remains a very important sector amidst a surbanizing country-side and a diversifying economy. Currently, about 40% of the county's land is devoted to agriculture. An additional 34% is in other, mostly forested, open

space uses. As of 1997, Berks County had 221,511 acres in farmland, 187,645 acres in crop production, and 1,586 farms yielding total farm sales of almost $248 million. It ranked third in Pennsylvania in number of farms, cash receipts from agriculture products, layers, swine, corn grain, soybeans, and apples. It ranked fourth statewide in dairy, broilers, cattle and calves, peaches, nursery and greenhouse crops (includes mushrooms), and barley. Animal agriculture is significant to Berks County's agriculture. Fifty-two percent of the market value of agricultural products sold is livestock. In addition 35% of the market value is nursery and greenhouse, including mushrooms. Mushrooms are the largest market value crop grown (US Census of Agriculture 1997).

More recent growth patterns reflect suburban sprawl outward from Reading as well as development in rural land beyond suburban areas, leading to increasing conflicts between rural residents and agriculture production over issues, such as odor, flies, chemical use, and farm traffic. To reduce rural-urban conflict and increase the viability of the county's agricultural industry, Berks County has developed a suite of land use management tools to encourage landowners and municipalities to protect farming and related industries.

The "Purchase of Agriculture Conservation Easements" and development of "Effective Agriculture Preservation Zoning" are the two approaches which are viewed as providing the agriculture resource base needed for future production. In its 1991 county comprehensive plan, the county set the goal of preserving 200,000 acres of farmland through these two programs. Specifically, the county desired to preserve large contiguous areas (minimum of 500 acres) with existing agricultural productivity. In addition, the Planning Commission initiated an Agricultural Zoning Incentive Program in 1997 to encourage municipal adoption of effective agricultural zoning (Myers and Auchenbach 2002).

IV. Data and Methods

The implicit house price function was estimated using 8,090 residential properties that were sold between 1998 and 2002. To focus on the rural/urban fringe, houses located in the City of Reading and New Morgan Borough were excluded from the analysis. Data on house sales and characteristics were obtained from a county-wide parcel map maintained by the Berks County Office of Assessment. For each house in the analysis, information was collected on the sale price of the house, the size of the house, the lot size, the number of bedrooms, the number of bathrooms, whether the house has a basement, whether some of the finished area in the house is located in an attic, the exterior façade of the house, whether the house has central air conditioning, the physical condition of the house, the year of construction, the year sold, and whether the house had public water and/or public sewer. Nominal sale prices were inflated to 2002 dollars.

A county-wide land use map was constructed based on the parcel map. Categories of land use were open space, residential, commercial, and industrial. For each house included in the analysis, the amounts of land in each land use within 400 meters of the house and within 1600 meters of the house were measured. Within the category of residential use five subcategories were defined, small-lot single family (less than 0.2 acres), medium-lot single family (0.2 to 0.5 acres), large-lot single family (0.5 to 1.5 acres) and very large-lot single family (over 1.5 acres).

Within the category of open space, the amount of open space that is in crop, pasture or grass cover (as opposed to forested or open water), the amount of open space owned by government entities, the amount of open space that is currently vacant but zoned for developed use, and the amount of open space covered by conservation easements were measured.

The locations of potential disamenities were determined and mapped. There are four landfills located in Berks County, one regional airport, twenty-seven sewage treatment plants (not counting plants located in the City of Reading), seventy-four properties that have been used for mushroom production, and seventy-one large-scale animal production operations, defined here as housing more than 200 animal equivalent units (aeu's), as defined for each species by the Pennsylvania Nutrient Management Act (Act 6 of 1993) (Beegle 1997).

For each house, the proximity of the house to potential local disamenities was measured. For landfills, mushroom production facilities, and high-traffic roads, the distance to the closest landfill, facility, or road was measured. For the regional airport, the distance to a line extending two miles from either end of the main runway was measured. For sewage treatment plants and animal production facilities, the location to each plant or facility was measured.

For each potential local disamenity, an index of proximity was constructed. These indices have the property that the impact on house price decreases as the distance from the house to the local disamenity increases, reaching 0 at a defined distance. For sewage treatment plants and animal production facilities, the indices have the additional property that each plant or facility can impact house price independently of other plants or facilities.

Other databases used in the analysis included information on elevation and slope, soils, location of streams, zoning, school district, and commuting distance to regional employment centers, Reading, Allentown and Philadelphia.

The implicit house price function was estimated using an instrumental variables approach, similar to that used by Irwin (2002). The instrumental variables approach is used to avoid potential bias in the estimation due to a form of relatedness, termed endogeneity, between land use and house prices.

V. Results of Statistical Analysis of Residential Property Values

Regression Results - House Characteristics

Complete regression results are presented in the longer, technical report. The variables included in the estimated implicit house price function explained about 87 percent of the variation in house price. All of the coefficients for the structural characteristics of the house were statistically significant different from zero, and of the expected sign. The following characteristics are associated with higher house price: more square feet, more bathrooms, more bedrooms, existence of a basement, a brick, stone or masonry exterior, central air conditioning, better physical condition, and newer construction. For a given size, a house is worth less if some of its finished area is in an attic. Houses located in school districts with higher average 12^{th} grade PSSA test scores had higher sale prices.

Houses on more sloped lots are worth less. Elevation in and of itself does not influence house price, but elevation relative to the surrounding terrain does. Houses that sit above the surrounding terrain are worth more than those that sit below the surrounding terrain. Public water service increases house value, but public sewer service does not. The high correlation between these two features made it more difficult to distinguish their individual effects. House prices did not increase as fast as inflation during the study period (real prices declined over time). Shorter commuting distance to Allentown and Philadelphia are associated with higher house prices, but shorter distance to Reading was not seen as a positive amenity. Zoning has little impact on house price.

Of particular interest are the results related to lot size. The relationship between house price and lot size is shown in Figure 1. The price of a house built on a 0.1 acre lot is normalized to equal 1.0. Figure 1 shows how the house price will increase as the lot size increases. So, for example, a house built on a 1 acre lot will cost 32% more than the same house built on a 0.1 acre lot. The marginal impact of additional lot size decreases, however, so that a house built on a 5 acre lot is worth only a little bit more than a house built on a 3 acre lot. This relationship can help inform developers and planners when considering density of a new residential development.

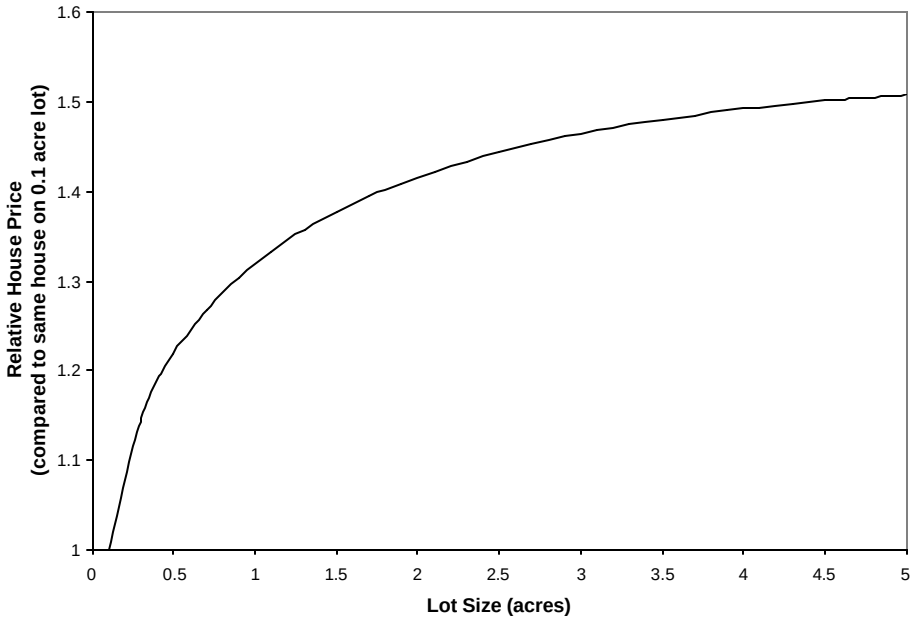

Figure 1. Relative house price as a function of lot size.

Regression Results - Surrounding Land Use

Table 1 summarizes the impact that neighboring land use has on house price. All impacts are measured relative to industrial use. In other words, for every acre of land within 400 meters of the house that is in forested, privately-owned open space, the house's price is 0.276% higher than it would have been if that acre of land had been in industrial use instead. The significance level states how confident we can be that the number listed is actually different from zero, and not

simply the result of sampling error. Two asterisks indicate a result that is statistically signficant at the 5% level, one asterisk a result that is significant at the 10% level, and "n.s." a result that is not significantly different from 0 at the 10% level.

Table 1. Marginal Impacts of Land Use on House Price

Distance From House	Within 400 meters		400 to 1600 meters	
Land Use Type	% Impact on House Price	Signif. Level	% Impact on House Price	Signif. Level
Privately-owned Forested Open Space	0.276	**	-0.008	**
Govt-owned Forested Open Space	0.281	**	0.0123	**
Privately-owned Grass, Pasture, and Crops	0.2373	**	0.000562	n.s.
Eased, privately-owned grass, pasture, crops	0.162	**	0.011	**
Vacant privately-owned Open Space	-0.091	n.s.	-0.002	n.s.
Single Family Residential - Small Lot	0.0284	n.s.	0.0087	**
Single Family Residential - Medium Lot	0.1927	**	0.0032	n.s.
Single Family Residential - Large Lot	0.2405	**	0.0293	**
Single Family Residential - Very Large Lot	0.2143	**	0.0305	**
Other (Non-Single Family) Residential	0.0383	n.s.	0.013	*
Commercial	0.1089	n.s.	0.0328	**

** - statistically significant at the 5% level
* - statistically significant at the 10% level
n.s. - not statistically significant

Within 400 meters of the house, the land use with the largest positive amenity impact is forested, government-owned open space. However, forested, privately-owned open space has a similarly-high amenity value, and the difference between the two is not statistically significant. Open space in grass, pasture, and crops is less valued than forested open space, but again the difference is not statistically significant. Eased open space is less valued than noneased open space, and here the difference is statistically significant. Vacant open space is the least valued, and has in fact a more negative impact on land values than industrial land.

Medium, Large, and Very Large lot residential development has a positive impact on house price, relative to industrial use. Differences among these three groups are not statistically significant. Small-lot residential use and non-single family residential use have lower amenity value, and are not statistically distinguishable from industrial use.

Commercial land use within 400 meters of the house has a more positive impact than small-lot and non-single family residential, but the difference between commercial use and industrial use is not statistically significant.

All of the house price impacts listed in Table 1 are calculated relative to industrial use. The impact of a change in land use from one non-industrial use to another non-industrial use can be calculated by taking the difference in the values listed in Table 1. So, for example, conversion of one acre of privately-owned open space with grass, pasture or crop cover to small-lot single family residential would decrease nearby house values by (0.2373-0.0284)=0.2089%. This difference is statistically significant at the 5% level.

Other differences are statistically significant as well. The amenity impact of privately-owned, forested open space is significantly higher than for industrial use, commercial use, small and medium lot single family residential use, and non-single family residential use. The amenity impact of privately-owned grass, pasture and cropland is significantly larger than that for small lot single family residential, non-single family residential, commercial, and industrial land. The marginal implicit price for eased, privately-owned grass, pasture and cropland is significantly larger than that for small lot single family residential, non-single family residential, and industrial land.

To summarize, within 400 meters of a house, the surrounding land use that has the highest amenity impact is open space. Whether that open space is forested or in grass, pasture or crops does not matter much. Whether that open space is owned by the government does not matter much. If the open space is eased, it has a smaller positive impact on house price. Among developed land uses, the neighboring land use with the most positive amenity impact is medium or larger lot single family residential. The land uses with the least positive impact on house price are small lot residential, non-single family residential, commercial, industrial, and vacant land.

Moving farther from the house the picture changes somewhat. Marginal implicit prices for land uses between 400 and 1600 meters from the house are generally an order of magnitude smaller than those for land use within 400 meters. This makes sense not only because the land use is located farther from the house, and is therefore less noticeable to the occupants, but also because one acre of land represents a smaller proportion of the total located at that distance.

Still, land use between 400 and 1600 meters from the house does impact house price. At that distance, the land use with the most positive impact on house price is commercial, closely followed by large and very large lot residential. Of open space uses, only eased or government-owned open space has a significant positive impact on price relative to industrial use. Grass, pasture and crops have a significantly more positive impact than forested open space, but the difference is small.

Comparing land uses between 400 and 1600 meters from the house, while open space uses are significantly less attractive than commercial or large or very large lot single family residential use, eased or government-owned open space is significantly higher-valued that industrial land. However, marginal implicit prices for land uses located farther from 400 meters from the house

should be interpreted with caution. Land use within 400 meters from the house is highly correlated with land use outside 400 meters, making statistical inference difficult.

To summarize, the ideally-situated house would be immediately surrounded by open space, with commercial properties (stores and offices) located 400 to 1600 meters away. While open space with conservation easements is viewed less positively than open space without such easements if the parcel is located within 400 meters of the house, such easements are perceived as a positive amenity if the parcel is located between 400 and 1600 meters from the house.

Regression Results - Potential Local Disamenities

Of potential local disamenities, landfills, high-traffic roads, the regional airport, mushroom production, and large-scale animal production facilities (over 200 animal equivalent units or aeu's) were all found to have a statistically significant negative impact on nearby house prices. No significant impact was found for sewage treatment plants.

Of the potential local disamenities investigated, landfills had the largest impact on house price. Investigation of the spatial limit of the disamenity impact showed that the impact of landfills on house price extended to 3200 meters from the house, but not farther. The impact a landfill has on nearby house prices is shown in Table 2. Mushroom production and the regional airport had a much smaller impacts on house prices. For these two local disamenities, the impact was determined to extend up to 1600 meters from the house.

Table 2. House price impacts by distance from the house.

	Distance from the House			
	500m	800m	1200m	2400m
Landfill	-12.4%	-6.9%	-3.8%	-0.8%
Airport Runway	-0.3%	-0.2%	-0.1%	
Mushroom Production	-0.8%	-0.4%	-0.1%	
Animal Production	-6.4%	-4.1%	-1.6%	

Three issues were considered in estimating the potential local disamenity impact from animal production. First, is the disamenity impact proportional to the number of animals near the house, or proportional to the number of building clusters near the house? Second, does the disamenity impact depend only on the closest building cluster, or does it depend on farther clusters as well? Finally, how far from a building cluster does the price effect of the disamenity impact extend?

To address the first issue, the two different proximity indices were constructed, one based on the number of unique production facilities located close to the house, the other based on the number of aeu's housed in those facilities. A facility is defined as a cluster of buildings located within 400 meters of each other. Based on analysis of both indices, the building-cluster based index was better at statistically explaining house price variation than the aeu-based index.

Next, we investigated whether only the closest building cluster generates house price impacts. The building cluster index was divided into two parts, one containing information only on the closest building cluster, the other containing information on all other building clusters located

within 1600 meters of the house. In a regression that includes both of these indices, the estimated coefficients on both indices were negative, and not significantly different from each other. We conclude that all building clusters within 1600 meters can have an impact on house price.

We then investigated the spatial extent of the disamenity impact from large-scale animal production. A model was estimated that included two indices, one including all building clusters within 1600 meters of the house, the other including all building clusters located between 1600 and 3200 meters from the house. The estimated coefficient on the first index is negative and statistically significant, but the coefficient on the second index is positive, indicating that the disamenity impact from animal production does not extend past 1600 meters. Similarly, Palmquist et al. (1997) found that hog operations located between ½ and 1 miles from the house had a statistically significant negative impact on house price but that operations between 1 and 2 miles from the house did not .

We conclude that the best index for measuring the disamenity impact of large-scale animal operations is a building-cluster-based index and includes all building clusters within 1600 meters of the house. Table 2 shows the impact of an animal production facility (one building cluster) on the sale price of a nearby house. An outer limit to the impact of 1600 meters is imposed, so the impact from animal production facilities is assumed to be zero past that point. Because very few houses are located within 500 meters of a building cluster, we have little confidence in using the model to predict impacts for such distances. We would presume that the impact would be no less than 6.4%, but cannot, based on our data, predict how much greater it might be.

To investigate whether the scale of the operation at a building cluster influences its disamenity impact, building clusters were divided into three groups: Medium (200 to 300 aeu's), large (300 to 600 aeu's) and very large (more than 600 aeu's). Of the 71 facilities identified in Berks County, 32 fall into the medium size category, 30 fall into the large category, and 9 fall into the very large category. No information is available on the location of smaller operations (less than 200 aeu's). A house price function was estimated that modeled the impact of each size class separately. That estimation showed that the medium-sized facilities, considered by themselves, have a significantly negative impact on nearby house prices. The estimated impacts of large and very large facilities were negative, but were not statistically significant, likely because a limited number of such facilities exist in Berks County. However, pairwise comparison among the three size classes showed no statistically significant differences.

A similar approach was used to investigate whether the impact of an animal production facility on nearby house prices depended on the species of the animals housed at the facility. The impact was found to be highest for poultry, intermediate for hogs, and lowest for dairy and beef cattle. However, the differences among species were not statistically significant. To investigate whether managerial care influences the house price impact from an animal production facility, facilities located on farms that have a detailed conservation plan on file with the conservation district were compared to facilities located on farms without such plans. Whether a farm has a conservation plan is an admittedly imperfect indicator of the amount of care the operator takes in managing the operation to minimize off-farm impacts. The property value impact of facilities

located on farms without conservation plans is larger than the impact of facilities located on farms with conservation plans, but the difference was not statistically significant.

Because differences among facilities related to size, species, or presence of a conservation plan were not statistically significant, we favor a model that does not distinguish among facilities. The amenity impacts listed in Table 2 apply to all facilities larger than 200 aeu's.

Proximity of Housing and Animals

The total impact that an animal production operation has on residential property values depends on the location of residences relative to the operation. There are no setback requirements when constructing animal barns, though manure handling facilities must be located at least 100-300 feet from property boundaries, depending on slope. In this section, we measure how many houses are located close to animal facilities, and compare this spatial distribution to what would be expected if animal facilities were randomly located.

The following analysis is done for the 60 animal building clusters that are located at least 1600 meters from the county's border. For each building cluster, the number of single-family houses located within 400 meters, within 800 meters and within 1600 meters was determined. The average numbers of houses are given in Table 3.

Table 3. Number of houses located near animal facilities

Distance	Animal Facilities	Randomly-Chosen Points
400m	2.64	16.79
800m	16.70	60.32
1600m	105.86	238.24

For comparison purposes, 60 random points were selected in the county. These were located on parcels that were in privately-owned open space use and that were at least 5 acres is size. These are the types of parcels where animal operations are likely to be located. Table 3 shows that the actual animal facilities tend to be located in areas that have few houses. The number of houses located within 400 meters and within 800 meters of actual animal facilities is about ¼ of that which would be expected if these facilities were locating themselves randomly in the landscape.

Part of the reason why there are fewer houses near animal facilities than would otherwise be expected may be due to the effect of agricultural zoning and Agricultural Security Areas (ASA's). Fifty-nine of the 71 animal production facilities (83.1%) are located in ASA's. In contrast, of the privately-owned open space parcels of at least 5 acres in size, only 37.6% of the land (by area) is located within ASA's.

It is also interesting to look at the relationship between agricultural conservation easements (ACE's) and location of animal production. Twenty-two of the 71 animal production facilities are located on farms with ACE's. In contrast, of the privately-owned open space parcels of 5 acres or more, only 8.8% (by area) are under ACE's. We conclude that animal production

facilities have a tendency to locate on farms with ACE's (or conversely, that farms with ACE's are more likely to have animal production facilities).

Illustrative Calculations of the Impact of Potential Local Disamenities on Property Values

The total impact that a potential local disamenity has on residential property values depends on the location of the residences relative to the local disamenity, and on the value that the residences would have absent the local disamenity. In this section, we calculate the total impact of a landfill, the regional airport, and an animal production facility on neighboring residential property values. The numbers presented here are illustrations, and should not be interpreted as averages. The information on the location of mushroom production facilities is not specific enough to allow a similar calculation for mushroom production.

The landfill in Exeter Township is chosen to serve as an illustrative example. For each house located within 3200 meters of the landfill, the percent decrease in house price due to the landfill's presence was calculated. This percent price decrease was then multiplied by the total assessed value of the house, to give the dollar impact on house price due to the landfill. Assessed values were used because recent sale prices are not available for all properties. Because there were few house sales observations in the hedonic price analysis where the house was located less than 500 meters from a landfill, the predicted house price impacts are less reliable for such houses. To be conservative for residences located very close to the landfill, the percent impact on house price is set equal to the impact on a house located 500 meters from the landfill.

For the 1561 residences located within 1600 meters of the landfill, the average house price impact from the landfill is $3,937 (all values are in 2002 dollars). For the 1781 houses located between 1600 and 3200 meters away from the landfill, the average house price impact is $1,132. The average impact on all 3342 houses is $2442, for a total impact on all houses within 3200 meters of $8,162,000, which represents 2.6% of the assessed value of those properties.

The disamenity impact from the regional airport was determined to extend 1600 meters from a line extending two miles from either end of the main runway. There are 1246 single family houses located within 800 meters of the flightpath, and a total of 4647 single family houses located within 1600 meters. Of these, however, 2391 are located with the City of Reading. Because the hedonic price function was estimated only for residences outside the City of Reading, it should not be used to calculate property value impacts within the City.

For each of the remaining 2256 single family residences located outside of the City of Reading and within 1600 meters of the runway or flight path, the impact on property value was calculated. For consistency with the analysis on landfills and animal production facilities, houses located within 500 meters of the runway and flightpath are treated as if they were located exactly 500 meters away. The average house price impact from the airport was $104, and the total impact on the 2256 residences was $235,000, which is 0.1% of the assessed value of those 2256 houses. However, this is a partial estimate of the total impact of the airport, as it only counts the impacts on houses located outside of the City of Reading.

We choose an animal production facility for analysis that is close to the average in terms of its location relative to houses, with 119 houses located within 1600 meters and 17 houses located within 800 meters. For each house, the percent decrease in price due to the animal production facility is calculated, and this is multiplied by the house's assessed value. No houses were located within 500 meters of this animal production facility.

For this illustrative case, the average house price impact due to the animal production facility is a decrease in value of $1,803. The total impact on all 119 houses is $215,000, which is 1.7% of the total assessed value of the 119 houses. This total is intended as an illustration, and should not be viewed as an average value for all animal facilities. The impact from any given facility will depend on the number of houses near the facility, the location of those houses relative to the facility, and the value of those houses.

It should be noted that this estimate of the impact on property values does not include amenity or disamenity impacts that are not tied to house location. For example, price differentials for houses located near a large-scale animal production facility would not capture benefits or costs experienced by commuters or tourists who travel past such facilities, or any negative impact on water quality that is experienced downstream from the facility.

VI. Conclusions and Future Directions

Key Findings of This Research

The important conclusions from this research include:

1) Surrounding land uses do have the potential to impact the sales prices of nearby parcels. In Berks County, we found both nearby land uses and proximity to potential local disamenities impact the sale prices of single family houses.

2) Within 400 meters of a house, open space is the most desirable surrounding land use, followed by large-lot residential use. Commercial and small and multifamily residential use are less desirable. One implication is that conversion of open space to commercial, industrial, small-lot residential, or multi-family residential will have a negative impact on house prices within 400m.

3) Within 400 meters, privately-owned open space with conservation easements have a less positive impact on house price than privately-owned open space without easements. The act of purchasing a conservation easement may not in itself drive neighboring house prices down. Rather, it may be that conservation easements tend to be associated with a certain type of open space (actively-farmed, productive farmland) that is less desirable as a near neighbor. Consistent with this explanation is the finding that open space within 400 meters that is covered in grass, pasture or crops has a lower amenity value than forested open space, though the difference in estimated amenity values is not quite significant.

4) The impact of open space that is zoned for residential, commercial or industrial use, but that has not yet been built, is statistically indistinguishable from the impact of industrial use, and is

significantly worse than medium or large-lot residential use. This may be a short-term decrease in house price, reflecting the uncertainty and disruption that accompany new construction.

5) Between 400 and 1600 meters from a house, commercial is the most attractive land use, followed by large-lot residential, and then open space. Of open space uses, grass, crops and pasture are preferred to forested open space and eased open space is preferred to uneased open space, both results opposite to the results for open space within 400 meters of the house. Outside 400 meters, government-owned open space is preferred to privately-owned, uneased open space. We can therefore characterize the ideal house as being immediately surrounded by forested open space, but with commercial uses (offices and shopping) located within one mile of the house. At all distances, small-lot and multifamily residential use is less attractive than large-lot residential development.

6) The statistical analysis was able to measure impacts on house prices from potential local disamenities. Among the potential local disamenities investigated, landfills and large-scale animal production facilities had the largest negative impact on house prices. Mushroom production and the airport had smaller negative impacts. High-traffic roads had a small negative effect that extended only a short distance from the road. No impact could be identified for sewage treatment plants.

7) Specific to large-scale animal production facilities, we found a significant impact within 1600 meters from such facilities, but not farther than 1600 meters. We find that facilities with between 200 and 300 aeu's are large enough to have a negative impact on neighboring house prices. However, we were not able to draw firm conclusions about whether the negative impact varies by species of animal, size of operation, or whether the operator has developed a detailed conservation plan.

8) Single family residences tend not to be located near large-scale animal production facilities. It is not known whether this is the result of decisions made by animal producers to locate in areas with fewer houses, by decisions made by developers not to build homes near animal facilities, or whether each group is locating on land with different attributes, resulting in a natural separation. Nor can we determine whether this separation is a result of policy measures such as Agricultural Security Areas or Effective Agricultural Zoning. However it has occurred, this separation tends to mitigate the impact that animal production facilities have on property values.

9) The total impacts of one landfill, the airport, and one animal production facility on nearby house prices were calculated, as illustrations. The total impact of a landfill on the value of 3342 properties located within 3200 meters was calculated to be $8,162,000, or 2.6% of the assessed value of the affected properties (in 2002 dollars). The impact of the regional airport on 2256 properties located within 1600 meters of the runway and flight path was calculated to be $235,000, or 0.1% of the assessed value of the affected properties. The total impact of an animal production facility on 119 properties located with 1600 meters was calculated to be $215,000, or 1.7% of the assessed value of those properties. These estimates capture only those impacts that fall on residents who live near the facilities. They do not include costs of impacts that occur farther from such facilities, such as impacts on downstream water quality, or positive or negative amenity impacts on tourists or commuters who travel past such facilities. These calculations are

illustrative, but should not be viewed as averages for similar facilities. The total impact from a given facility like these will depend on the number of houses located near the facility, the distance between the facility and the houses, and the market value the houses would otherwise have.

Strengths and Limitations of the Research

The study area chosen, Berks County, was well suited for this study. First, Berks County has well-developed GIS data resources, and local officials and their staff were very helpful to the project. Second, Berks County has a high proportion of open space that is in ASA's and a high proportion enrolled in ACE's, and these lands are spread broadly throughout the county. This is important because it allows us to identify the impact of these lands on house prices independent of other factors that vary spatially. Third, it was possible to map all animal production facilities in Berks County - a task that might be somewhat more difficult in another county.

At the same time, performing the analysis in only one county has its limitations. Berks County is still fairly well endowed with open space. It may be that the amenity value of open space near a house will be larger in a county where open space is more scarce. Restricting the analysis to only one county limited the number of animal operations included in the house price regression analysis. Extending this research approach to other counties will increase the amount of data, allowing more-precise estimation of the house price regression, and will allow us to determine to what extent the findings apply to other regions.

For these reasons, we recommend that the approach used in this study be expanded to a larger region. Specifically, the house price regression analysis should be broadened to include counties where open space is more scarce, and where animal production is located closer to residential areas. It is quite possible that the amenity value of open space will be higher in areas where open space is more scarce, and that the marginal impact of eased open space will be positive, as it was found to be in Maryland by Irwin (2002).

With more observations on house/animal interactions, we will also be better able to distinguish the relative impacts of different scales of animal operation, and different species. To the extent that operation-specific information can be collected without violating the privacy rights of the operators, that information could be also used to help explain variation in the disamenity impacts from animal production. Similarly, more-detailed information on mushroom production facilities would allow a more refined analysis of their impact on house prices.

Finally, until more research is conducted in more counties, care should be taken in extrapolating the results from this research project outside of Berks County. At this time, we have no a priori expectations about whether the impact of animal production facilities on house prices will be the same, larger, or smaller in other counties.

References

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