The Pennsylvania State University

The Graduate School

College of Agricultural Sciences

# THE EFFECTS OF AGRICULTURAL CONSERVATION EASEMENTS ON RESIDENTIAL PROPERTY VALUES

A Thesis in

Agricultural, Environmental, and Regional Economics

by

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Submitted in Partial Fulfillment
of the Requirements
for the Degree of

Master of Science

December 2008

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**ABSTRACT**

Agricultural Conservation Easements (ACEs) have become a common tool to protect viable farmland threatened by urban sprawl. A hedonic pricing study shows that when a conservation easement is placed on a farm, the value of surrounding residential properties increases. However, because ACE programs target the most productive farmland, the land chosen for ACE's tends to generate fewer amenities and more disamenities than average farmland. To maximize the public benefits from protecting farmland through ACEs, preservation programs should consider the amenities generated by farmland in their ranking process.

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**Introduction**

According to the American Farmland Trust (AFT) more than six million acres of farmland were developed between 1992 and 1997. As development occurs in exurban areas, more of our food will be produced in "urban-influenced" areas and less fertile lands will need to be used to grow much of that food (AFT 2007b). This is important because Agriculture as a viable local industry is being threatened by development, and along with consumers, will experience increased prices and lower quality and fewer crop yields. As more agricultural land is lost to development, the viability of local agriculture will be harder to sustain, due to the need for a critical mass of agricultural activity, like support suppliers and market channels, to support the local agricultural industry. In a study conducted by the AFT (2005), many farmers and processors discussed how their profits have been declining because of high input costs, lack of change in market prices, and loss of infrastructure. It is possible to adapt to these changes, as long as farmers change their practices and/or policy makers control urban sprawl and protect viable farmland.

Some people, like Fischel (1982), disagree that urban development represents a threat to agricultural lands. Lynch (2006) found that the scale of agricultural activity did not impact the loss of farmland in the decade leading up to 1997, though she did find that the health of the local economy impacted the rate of farmland conversion. Barkley (2001) argues that even if there is no farmland crisis in the U.S., there would still be public interest in protecting farmland that yields the greatest environmental benefits.

Governments have begun taking action to preserve farmland and control urban sprawl through regulatory and incentive-based approaches. Regulatory policies include agricultural protection zoning, nonagricultural planning and zoning, and urban service boundaries, while incentive-based policies include preferential tax assessment, and purchase / transfer of development rights (Heimlich 2001).

According to the AFT, preserving land through the purchasing of an Agricultural Conservation Easement (ACE) is the most promising tool to handle urban sprawl, because it is non-regulatory and compensates landowners. Nationwide, ACE programs have enrolled 1.1 million acres of farmland at an approximate cost of $2.3 billion (AFT 2007a). By 2005, the Pennsylvania Agricultural Conservation Easement Purchase Program (ACE) purchased agricultural conservation easements on about 318,000 acres of farmland in the Commonwealth (Berks County Agricultural Land Preserve Board). The overall goal of the program, according to the Pennsylvania Department of Agriculture (PDA), is to support agriculture and preserve farmland against future development by ensuring that farmers throughout the Pennsylvania Commonwealth have quality agricultural lands to provide agricultural products for people in the state and nation (PDA 2007).

The Pennsylvania ACE program works to protect farmland that meets certain criteria, which are laid out in the program's farmland ranking system. Farmers who want to participate in the program go through a ranking process, which ranks the farms based on soil evaluation, development potential, farmland viability, and clustering potential. Soil evaluation, which evaluates the overall productivity of the soils on the farmland, comprises the highest weight (40%) of the ranking analysis. Farmland viability, which measures the current and future productiveness of a farm, and clustering potential, which measures the neighborhood surrounding a farm (focuses on other preserved farms or agricultural security areas nearby), each account for 25% of the farm rank. Development potential measures the development pressures on a farm and provides 10% of the farm rank (Chester and York County Farm Boards 2008).

Even though the goal of the Pennsylvania ACE program is to support and preserve viable agriculture, other amenity benefits are indirectly generated from having the farmland preserved.

These amenity benefits generated from agricultural land include wildlife habitat, groundwater recharge, and open space (Ready and Abdalla 2005). However, the ranking system applied by the state and individual county boards does not give any weight to these other environmental amenity values.

If farmland does generate positive amenity values to those who live nearby, then preservation of those benefits through purchase of an ACE should be capitalized into nearby residential property values. Irwin (2002), in a study conducted in Maryland, found that residential properties located within 400 meters of land preserved through conservation easements sold for higher prices than similar properties located near agricultural land that was not eased. However, Ready and Abdalla (2005), in a similar study conducted in southeastern Pennsylvania, found a negative impact of agricultural easements on nearby property values. They speculate that this result was because the county farmland preservation boards target farms that are the most productive, and that those farms might be less desirable to live near than the average farm. Other studies (Abeles-Allison and Connor 1990; Palmquist, Roka, and Vukina 1997; Herriges, Secchi, and Babcock 2003; and Ready and Abdalla 2005) have found that intensive agriculture, including animals, can depress nearby property values. Ready and Abdalla also found that eased farms were more likely to have large animal operations on them than uneased farms. If farms that are eased are different in character than farms that are not eased, then comparing property values of houses located near eased farms with houses located near uneased farms will capture both the impact of the easements and the impact of the differences in farm characteristics.

This study's objective is to measure the effects of agricultural conservation easements on nearby residential property values, while holding farmland characteristics constant. A hedonic price function is used to estimate these effects on single family detached homes in two counties in southeastern Pennsylvania. Differences in farm characteristics are controlled for by comparing sales of residential properties located near farms that had already been eased to sales of properties located near farms that would be eased in the future.

In one of the two study counties, the study found that houses located within 400 meters of a farm that would be eased in the future sold for less than houses not located near such a farm, indicating that farms that meet easement criteria have a negative impact on nearby residential property values. However, houses located near a farm that has already been eased sold for more than houses located near a farm that would be eased in the future, indicating that signing the actual easement contract and preserving the open space does have a positive impact on nearby property values. In the second study county, the presence of past or future easements did not have a significant impact on housing prices.

**A Review of Previous Research**

*Hedonic Pricing Function*

The theory underlying hedonic pricing models was developed by Rosen (1974). Hedonic price functions center around a market of buyers and sellers, whose interactions create a price function for a good based on its attributes. First, a vector, **z**, is used to capture the attributes of homes. Then a hedonic price function, $P(\mathbf{z})$, relates prices and characteristics in a product (housing) market. Buyers' preferences of choosing **z** are revealed by a hedonic price function (Rosen 1974). In the context of real estate markets, the sale price of a home captures values of local amenities and disamenities, which can be used for evaluating policy trade-offs between open space preservation and development land uses (Irwin 2002).

The hedonic house price model used in this study, which is similar to the one used by Irwin, is written as:

$$P_i = f(\mathbf{S}_i, \mathbf{N}_i, \mathbf{L}_i, \mathbf{D}_i, \boldsymbol{\beta}),$$

where $P_i$ is natural log of the single-family residential sales price of the $i^{th}$ property, $\mathbf{S}_i$ is the vector of a house's structural characteristics, $\mathbf{N}_i$ is the vector of neighborhood/locational variables, $\mathbf{L}_i$ is the vector of land use variables occurring within specified neighborhood radii, and measuring the proportion of the surrounding land that falls within each type of land use, $\mathbf{D}_i$ is the vector of disamenity variables measured in distance from each residential property, and $\boldsymbol{\beta}$ is the vector of parameters to be estimated by the model.

*Impact of Open Space and Agriculture on Property Values*

Many hedonic pricing studies have found that agriculture and other types of open space can have positive impacts on property values (Garrod and Willis 1992; Tyrvainen 1997;

Geoghegan, Wainger, and Bockstael 1997; Tyrvainen and Miettinen 2000; Leggett and Bockstael 2000; Silver 2000; Irwin 2002; and Ready and Abdalla 2005). However, several studies about intensive agriculture show that agriculture can have a negative impact on property values (Abeles-Allison and Connor 1990; Palmquist, Roka, and Vukina 1997; Herriges, Secchi, and Babcock 2003; and Ready and Abdalla 2005).

Some studies focused their research on the effects of forested open space. Garrod and Willis (1992) studied the effect of countryside characteristics on rural house prices in the United Kingdom, around the Forest of Dean. The results showed that the proximity to woodland and water raises house prices 7% and 5%, respectively. Tyrvainen (1997) studied urban forest benefits in Joensuu, Finland and found that urban forests provided amenity benefits to surrounding properties and the benefits were shown in the property prices. Tyrvanian and Miettinen (2000) analyzed sales data from 590 terraced apartment houses in Salo Finland to estimate the value of urban forest benefits in apartment prices. The study found that a 1 km increase in distance to nearest forest decreased the price of an apartment by about 5.9% and prices for apartments which could view forests were about 4.9% higher.

Other studies found impacts of all types of open space. Geoghegan, Wainger, and Bockstael (1997) use spatial indices to study the influence of diversity and fragmentation on how humans value the landscape around residential real estate in the Patuxent Watershed, in central Maryland, in 1990. They found that the marginal contribution of more open space is positive in a home's immediate neighborhood (.1 km) and negative the further the open space is from a house. Furthermore, as the amount of forestry and agriculture in the 1 km buffer increases, the selling price of a house decreases.

Leggett and Bockstael (2000) used a hedonic price function to find evidence of water quality's effect on sales of waterfront property values in Anne Arundel, Maryland from 1993 to 1997. They placed land use variables into the categories of densely developed, developed at a low density, water or wetlands, and open space or forests within ¾ mile of each residential property, in order to measure the effects of each on property values. One of the findings showed that increasing open space around a residential property increases its value.

Irwin (2002) analyzed 55,799 residential properties in Anne Arundel, Howard, Calvert, and Charles counties in central Maryland in order to find out if open space carries a premium and if the amenities of different types of open space have different marginal values. She created open space land use categories by first deciding if the land was preserved or developable, then deciding if the ownership was public or private, and finally land use type (developable forests, crops, and pasture land). She found that open space within 400 meters of a house had a positive impact on the property value, while residential, commercial, and industrial land uses within 400 m had a negative impact.

Ready and Abdalla (2005) analyzed 8,090 single family detached residential properties in Berks County, Pennsylvania to measure the value of local amenity and disamenity impacts of agriculture. Open space land use categories used in their study consisted of land that is considered crop, pasture, or grass, open space owned by the public, vacant open space that is zoned for development, and open space that has a conservation easement on it. They concluded that within 400 meters of a single family detached house, open space, which included agricultural open space, had a positive impact on property values.

It is important to briefly discuss the studies of Irwin (2002) and Ready and Abdalla (2005), because they both used instrumental variables to account for endogeneity in the independent variable, the amount of land that is undeveloped. The amount of undeveloped land will tend to be endogenous to house prices. That is, in areas with higher house prices, there will be greater pressure to develop land, so less will be left undeveloped. Failure to control for this endogeneity will bias Ordinary Least Squares (OLS) estimates. In this case, the OLS estimate on the coefficient for undeveloped open space will be biased downward. However, the focus of this study is on the impact of ACE's, the location of which should not be strongly influenced by house prices. Still, it is important to note that the parameter on undeveloped land estimated in this study may be biased downward due to endogeneity.

*Impact of Conservation Easements on Property Values*

Some studies analyzed the effects of conservation easements on property values. The impact of open space protected from development by a conservation easement on nearby property values should be at least equal to, if not more positive than the impact of non-preserved open space, because the amenity benefits generated by the open space are guaranteed into the future. Riddel (2001) studied publicly-purchased open space in Boulder, Colorado. The open space purchased under this program is made available for public recreation, and is no longer actively farmed. She found that purchase of open space had a positive impact on nearby residential property values, but that it took time for the impact to be fully capitalized in house prices.

Two studies specifically analyzed the effects of privately owned land with conservation easements on property values. Irwin (2002) found that conservation easements on open space had a positive impact surrounding residential property values. She found that converting one acre of developable pastureland to privately-owned conserved land increased the value of a nearby residential property $3,307. In that study, conservation easements included both agricultural easements and easements for other purposes, such as wildlife protection or recreation.

Ready and Abdalla (2005) also found that open space, including agricultural open space, within 400 m had a positive impact on property values. However, they found that land with agricultural conservation easements had a significant negative impact on nearby property values, compared to developable land that was not eased. They reasoned that this result occurs because easements are targeted toward productive farmland. Such land is usually intensively managed with pesticide and manure application. Eased farms were also more likely to have large animal operations. Ready and Abdalla argue that the type of farm chosen by the agricultural land preservation board will tend to generate less positive amenities and more negative amenities to nearby neighbors.

Neither the Irwin study nor the Ready and Abdalla study controls for differences in the characteristics of eased farms versus uneased farms. The goal of the study is to measure the impact of agricultural conservation easements while holding constant the characteristics of nearby farms. This will be done by comparing the property value impact of farms that have already been eased to the impact of farms that will be eased in the future.

**Methodology**

The study area consisted of two Pennsylvania counties, Chester and York. Chester County, located west of Philadelphia, had a population of 482,112 in 2006, which is an 11% increase from 2000, and 168,165 acres of farmland in 2002. York County, located west of Chester County, had a population of 416,322 in 2006, which is a 9% increase from 2000, and 285,336 acres of farmland in 2002 (Census 2008 and Census of Agriculture 2008). The population densities (people per square mile) of Chester and York counties are 637.7 and 460.5, respectively. Chester County has an animal population density (animal units per acre) of 0.52, while York County has an animal population density of 0.38. By contrast, the studies by Irwin and Ready and Abdalla had animal population densities of 0.15 and 0.71, respectively. These numbers show that York County is less densely populated in people and animals and has a higher proportion of farmland than Chester County.

Both Chester and York counties have been aggressive in purchasing agricultural conservation easements. By 2008, Chester County spent $130 million purchasing 23,567 acres of farmland, while York County spent $50 million purchasing 33,108 acres of farmland (Chester and York County Farm Boards). This means the amount paid for easements in York County was about $1,522 per acre, compared to $5,527 per acre in Chester County.

The approach used in this study to identify the impact of ACE's on nearby property value was to estimate a hedonic price function on residential sales. This required construction of two databases: a set of maps showing land use and easements in each county and a dataset on residential property sales.

*Data Sources – Land Use and Easements*

The Chester and York County Assessment Offices provided digitized parcel maps and Computer Assisted Mass Appraisal (CAMA) files containing assessment data for each parcel. The assessment data includes a land use code for each parcel. The second data source for construction of the land use maps was the Pennsylvania Gap Analysis Program (GAP) analysis (Environmental Resources Research Institute 1998), which provided a digitized map showing all lands with some degree of protection against future development.

Using the assessor's land use codes and the GAP analysis map, a baseline map was created for each county, reflecting conditions in 2007. Each parcel was assigned to one of the following 7 land use categories:

- Single family detached residential (Residential)
- Other types of residential (OtherRes) including town or row homes, multi-family residential properties, and mobile homes on private lots.
- Commercial land (Commercial) including land used for retail, office buildings, parking lots, utilities, schools, other government buildings, apartments and condominiums, churches, and recreational facilities other than outdoor recreation facilities such as golf courses and hunting clubs.
- Industrial land (Industrial) including factories, junkyards, quarries, and other industrial-type uses.
- Private land used for outdoor recreation activities (Recreation) including golf courses, private ballfields, and hunting clubs,
- Currently undeveloped land including farmland, forests, and vacant land that is protected from development (Preserved), according to the GAP analysis.
- Currently undeveloped land including farmland, forests, and vacant land that is not protected from development (Developable), according to the GAP analysis.

Open water and roads were excluded from the maps. Tables showing the amount of land designated to each land use category for each land use map can be found in the appendix (Tables 5 and 6).

Historical land use maps were constructed using the 2007 map as the baseline. The most important development force has been residential construction. Maps showing land use in 2003, 1999, and 1995 were constructed by backing out residential properties based on year of construction, and recoding those parcels to be developable land. For each residential property included in the hedonic regression, surrounding land use was measured based on the map closest in time to that property's sale date. The total amount of land in each land use category was measured within 400 meters and within 800 meters of each residential parcel. These were then converted to proportions.

The GAP analysis does not include land conserved by ACE's. For each county, the locations and dates of all ACE's were obtained from the county Agricultural Land Protection Boards. Two easement measures were constructed for each residential property. To capture the impact of proximity to eased farmland, the total amount of land that is eased at the time of sale was measured within 400 meters and within 800 meters of each residential parcel (EaseSale). To capture the impact of proximity to farmland that is suitable for easement, the total amount of land that was ever eased (before or after the sale) was measured for the same buffer distances (EaseEver). By including both measures, the impact of actual easements on residential property values can be estimated holding constant the impact of proximity to land suitable for easements.

### *Data Sources – Residential Properties*

The CAMA file obtained for each county also includes information on residential parcels that was used to construct the house price dataset, such as structural characteristics of a house, age and year built, last date of sale, sale price, and assessed value. A complete list of variables assembled for each residential property is provided in Table 1.

In addition to structural characteristics of each house, several location-specific variables were developed. Population density (in 2000) was measured at the block group level. A measure of school district quality was developed based on Pennsylvania System of School Assessment (PSSA) standardized test scores. The score for each district was determined by averaging the advanced and proficient level proportions for math, reading, and writing over three grade levels (5, 8, and11). Average scores were divided by 100 for scaling.

For each single-family detached residential house considered in the study, the distances to three possible local disamenities were measured, the nearest railroad, the nearest interstate, and the nearest major road (roads with greater than 10,000 vehicles per day). Any negative impact from these transportation facilities was assumed to be limited to within 1 mile of the facility. Accordingly, the distance measures were truncated at 1 mile. To control for regional variation in house prices, dummy variables were also constructed that indicated whether a house was located within 1 mile of each of these three types of potential disamenity. Estimated coefficients on the dummy variables could be positive or negative, depending on spatial variation in factors unrelated to the disamenties in question. However, if the estimated coefficient on the continuous distance measure is positive, that is evidence that the potential disamenty in question is having a local depressing effect on the prices of the closest located houses.

To capture commuting costs, distances were measured to major centers of employment. For York County, these were Baltimore, Harrisburg, and York. For Chester County, these were Philadelphia and Wilmington. Based on goodness of fit measures, these distances were log-transformed before inclusion in the hedonic model.

To capture temporal variation in house prices, year-of-sale dummies were included in the hedonic regression. To capture differences in local services and tax rates, township dummies were also included.

*Regression*

House prices were inflated to 2007 dollars using the Office of Federal Housing Enterprise Oversight house price index. The dependent variable for the regression equation was the natural log of the real house price (SaleValue).

The hedonic model was estimated for "typical" single family detached residential properties sold between 1995 and 2007. To exclude "atypical" houses, the following inclusion criteria were used:

1) Lot size between 0.05 and 5 acres, to exclude town and row homes with zero lot lines large properties with nonresidential uses.
2) Residential living area between 600 and 10,000 square feet.
3) Total rooms between 6 and 25.
4) Number of bedrooms between 1 and 6.
5) Number of full bathrooms between 1 and 6.
6) Number of half bathrooms cannot exceed 3.
7) The ratio of the sale price divided by the assessed value between 0.67 and 1.50. This rule ensures that a) the sale was an arms length sale and b) the property as it was sold was similar to the property as it is described in the assessor's database.

**Results**

The hedonic price function for Chester County was estimated using 46,847 single family detached residential properties sold between 1995 and 2007. The hedonic price function for York County was estimated using 26,837 single family detached residential properties sold between 1995 and 2007. Average sale prices and average values of the independent variables are shown in Tables 1 and 2.

Regressions were run using land use measures within 400 meters and within 800 meters of each house. The regressions using 400 meter measures outperformed those using 800 meter measures, so they are presented here. Regressions using both measures were not robust, due to collinearity. Results of the hedonic price regressions using the 400 meter land use measures are shown in Table 3. An F-test for a hedonic regression run on both counties showed, at a 1% level of significance, that the parameter values were different between the two counties, and therefore it was not appropriate to combine the models. The $R^2$ statistics for the Chester and York County models are 0.9029 and 0.8633, respectively. Since a log-linear model was used, coefficient values can be interpreted as the percent increase or decrease in house price (divided by 100) due to a one-unit change in an explanatory variable.

Most of the coefficients of the structural characteristics of the house were of the expected sign and significantly different from zero. The only exception was lot size in York County, which was not of the expected sign and was not significantly different from zero. This perverse result could be due to collinearity. In models without the township dummy variables, lot size had a positive and significant impact on house prices, as would be expected. Public water service increased house price, while public sewer service decreased house price. These results could be due to their high correlation, making it hard to determine their individual effects. In both counties, basements that covered the full dimensions of a house were preferred to any other type or finish of basement. Houses in Chester County experienced price increases if the house had any type or finish of attic. Houses in York County experienced the same effects on prices as Chester County, except unfinished attics were preferred to no attic at all. Shorter commuting distances to Philadelphia and Wilmington in Chester County and Baltimore and Harrisburg in York County are associated with higher house prices. Proximity to the City of York was not an amenity for people living in York County. In both models, population density was negative and had a significant impact on house prices, which means house prices decrease as the population density increases. PSSA average, in both counties, was positive and had a significant impact on house prices, which means house prices were higher in school districts with higher average PSSA scores. This result could be due to 1) higher demand for housing in better school districts; 2) higher property tax revenues in school districts with higher property values; 3) higher performance by children in higher income families, who tend to be located in higher priced districts; or 4) a combination of all three reasons.

### *Major Roads, Railroads, and Interstates*

After controlling for regional differences, houses located closer to a railroad in York and Chester counties tended to increase property values the further the house was from the railroad out to 1 mile. Houses located closer to a major road or interstate in Chester County experienced increases in prices going out to 1 mile. The impact of major roads and interstates in York County was of the same sign, but was not statistically significant. Of the three potential disamenities considered, railroads had the biggest negative impact on nearby property values in York County, while in Chester County it was interstates, specifically the Pennsylvania Turnpike (I-76). Proximity to sewage treatment plants was also investigated but was not found to be related to house prices.

*Surrounding Land Use*

The omitted land use class was Residential. The land use coefficient estimates in Table 3 represent then the marginal impact of a change in the proportion of each type of land on house price, compared to having that land in single family residential use.

In both counties, Industrial land had the largest negative impact on nearby property values of any land use studied. Commercial land use also had a significant, negative impact on nearby property values. Land in Other Residential use had a significant negative impact on property values in York County, but there was no significant difference between it and residential land in Chester County. Recreational land had a significant positive impact in Chester County, but had a significant negative impact in York County. Both the Recreational and the Other Residential land use categories include a wide variety of land uses, and it is not clear a priori whether their impact should be positive or negative. The differences between the two counties for these two land use categories could reflect local differences in the types of land uses included. York County is less developed and has lower average income than Chester County. It could be that less desirable recreational uses (such as shooting ranges) are less common in Chester County than in York County, while more desirable recreational uses (such as golf courses) make up a higher proportion of the recreational lands.  A similar effect could be occurring in the Other Residential category.

Developable land has a significant positive impact on nearby property values in both counties. For both counties, the coefficient on Preserved land is positive and larger than the coefficient on Developable land, suggesting that preservation of open space has a positive marginal impact on nearby property values, though the estimated coefficient is not statistically different from zero for York County, and is not significantly different from the coefficient for

Developable land in either county. It should be noted that the estimated coefficient for Developable land may be biased downward due to endogeneity.

### *Agricultural Conservation Easements*

County Farmland Preservation Boards target farmland that is the most productive when choosing land to preserve. This type of farmland may generate more positive or more negative amenity impacts than other types of undeveloped land. The variable EaseEver measures the amount of undeveloped land within 400 meters of the residential property that had been eased by the end of the study period. Therefore, all land in the EaseEver category is suitable for easements, according to the Farmland Conservation Board's criteria. To measure the differential amenity impact of land that meets the ACE criteria, we would ideally compare the impact of land in the EaseEver category to the impact of land that does not meet the ACE criteria. Unfortunately, we cannot identify as a distinct land category all land that does not meet the ACE criteria. Instead, the Developable category includes land that is privately owned, does not have protection from development according to the GAP analysis, and that did not have an ACE by the end of the study period. The Developable category will therefore include all developable land that does not meet the ACE criteria, but will also include some land that does meet those criteria. The comparison of the regression coefficients for the EaseEver category and the Developable category will therefore understate the difference between land suitable for an ACE easement and land unsuitable for an ACE easement.

In York County, the estimated coefficient for EaseEver is negative, and statistically significant, while the estimated coefficient on Developable is positive and statistically significant, indicating that houses located within 400 meters of a farm that would be eased in the future had lower property values than similar houses surrounded by Developable land that would not be eased. This suggests that land that is suitable for an ACE generates fewer amenities and/or more disamenities to nearby residents than the typical farmland that would be included in the Developable category. The estimated coefficient on EaseSale, however, indicates that houses located near a farm that has already been eased were worth more than houses located near a farm that would be eased in the future. This indicates that the signing of an easement contract has a positive impact on nearby residential property values. The net impact of living near a farm with an ACE is the sum of these two coefficients. For York County, this sum is positive and significantly different from zero, meaning that houses located near a farm with an ACE sell for higher prices than houses located near typical Developable land. In fact, the net impact of farmland with an ACE (0.06034) is similar to the impact of Preserved land (0.04623), and the two are not significantly different.

In Chester County, the presence of past or future easements did not have a significant impact on housing prices. However, the coefficients for EaseSale and EaseEver have large standard errors. Comparing across counties, the coefficient on EaseSale is not significantly different between the two counties. However, the impact of signing an easement is significantly lower in Chester County than in York County ($p<0.01$).

*House Price Simulations*

It is possible to predict the impact of different nearby land uses on a typical residential property. Consider a house that would be worth $200,000 if it were completely surrounded by other single family residential homes. How would its value be different if it were located near a farm instead? Suppose that 50 acres of the farm were located within 400 meters of the boundaries of the residential parcel. That represents about ¼ of land surrounding the house. Table 4 shows how the house's value would differ, depending on the characteristics of the farm.

In York County, a house that would be worth $200,000 if it were surrounded by Residential land would be worth $751 more if ¼ of the surrounding land was Developable. In

Chester County, the house would be worth $1,432 more due to the presence of the farm. Both impacts are statistically significant. In contrast, if that developable land was preserved through means other than an ACE, the house would be worth $2,325 more in York County and $5,283 more in Chester County. Here, the impact is statistically significant only for Chester County.

In York County, if the 50 acres were suitable for an ACE, but no ACE had been signed yet, then the house would be worth $4,053 less than if it were surrounded by Residential land and the difference is statistically significant. However, if the land suitable for an ACE actually did get an ACE, then the house's value would increase by $7,093, so that it would be worth $3,040 more than it would if it were surrounded by Residential land. This impact on nearby property values is larger than that found for land conserved by means other than an ACE, though the difference in estimates is not statistically significant. For Chester County, land suitable for an ACE did not have a significant impact on house prices, with or without an ACE in place. However, the results did show that land conserved by means other than an ACE had a significantly more positive impact on nearby property values than did land conserved through an ACE.

**Discussion**

The results show that agricultural land can have positive or negative impacts on surrounding properties, depending on its characteristics. In both study counties, privately owned, developable open space, including agricultural open space, had a positive impact on surrounding property values within 400 meters of a house. Land with a non-agricultural conservation easement had a higher positive impact on nearby property values than did developable land, though this difference was statistically significant in only one of the two counties.

Land that is suitable for an ACE, but that did not have an ACE, had a negative impact on nearby property values in York County. As Ready and Abdalla (2005) explained, it could be because the land is actively farmed or could include large animal operations on the farm. So, this land may not be as desirable to live near as a farm that is less intensively managed.

However, when land becomes eased through the signing of an ACE, the impact on nearby property values is positive and significant in York County. In fact, the positive impact from signing the ACE is large enough to outweigh the negative impact associated with the type of farmland being eased, so that the net impact of eased farmland is positive, and very close to the impact from land preserved through means other than an ACE.

The results for York County differ from those found by Ready and Abdalla, who found that houses located near an ACE sold for lower prices than houses not located near an ACE. The results found here are similar to those of Irwin, who found that preserved land, including both land with an ACE and land preserved through other means, had a positive impact on nearby property values. Some of the differences among this study, the Ready and Abdalla study, and the Irwin study may be due to differences in the types of agriculture that occur in the study areas. The Ready and Abdalla study area had a higher animal density than in either of our counties, while the Irwin study area had a lower animal density. This could help explain why eased land had a positive effect in Irwin's study and a negative effect in the Ready and Abdalla study. Our study shows that the positive impact applies to both types of land preservation, through ACE's or through other means.

Whether farmland preserved through the ACE program generates positive amenity benefits has important policy implications. Duane (2006) argues that ACE's generate public benefits that are not taken into account by programs solely aimed at preserving viable farmland. He argues that since public funds are used to preserve this viable farmland, it is important to maximize the public benefits from ACE programs, including amenity benefits. The policy will ensure that people benefit from the agricultural land they are preserving and therefore be more likely to support agriculture practices.

In York County, land with ACE's had a positive impact on nearby property values, showing that an ACE program can generate amenity benefits while preserving viable farmland. However, the negative coefficient associated with land suitable for an ACE suggests that the ACE program is targeting preservation of farms that generate less amenity benefits than the average farm. Farmland preservation boards may not be getting the maximum positive impact from preserving farmland, because they are targeting land based on its productivity, and not considering the amenity values of the land. Farmland preservation boards could increase the overall benefits generated from their programs by giving some rating points to amenities generated by the farmlands they are considering for easement.

While these results are suggestive, the inconsistency between the two counties suggests that they may be locally specific. As noted before, Ready and Abdalla, in a third southeastern Pennsylvania county, found results regarding ACE's inconsistent with those found here. Further research is needed to explore why different results are found in different study areas. Second, the possibility of endogeneity in an independent variable may have biased some of the regression results, though endogeneity in the quantity of open space should not be an important issue in the location of ACE's. In order to control for this type of endogeneity, it is necessary to find suitable instrumental variables that are correlated with levels of development but that are not correlated with house prices, a difficult task. Third, there may be potential endogeneity in who applies for an ACE. We assumed farmers are randomly selected when they apply for an ACE, but maybe only certain types of farmers will apply for an ACE, which is hard to account for in the model.

To conclude, the results from one of the two study counties suggest that while farmland preserved through ACE programs generates positive amenity benefits to nearby residents, the farmland selected for ACE programs tends to be less desirable to live near than average. We argue that this is because farmland preservation boards target farms for preservation based on their productivity, rather than basing the selection on the amenities generated by the land. If ACE programs would change their focus to include amenity benefits from preservation as a ranking criterion, the total public benefit from ACE programs could be increased. This will help generate support for ACE programs in the surrounding communities and therefore help generate more revenue for the program to preserve more farmland.

Table 1. Hedonic Price Regression Variables—House Characteristics, Location, and Disamenity

| | **Mean Value** | | |
|---|---|---|---|
| **Variable** | **Chester County** | **York County** | **Description** |
| SaleValue | 453,480 | 241,079 | Value of house sales. |
| LotSize | 0.7931 | 0.5945 | Size of property in acres. |
| ResArea | 2668 | 1992 | Square footage of residential space. |
| BsmtArea | 120.2 | 104.3 | Total square footage of basement. |
| Floors | 1.786 | 1.644 | Number of floors. |
| NumBedRm | 3.667 | 3.392 | Number of bedrooms. |
| NumFullBath | 1.998 | 1.666 | Number of full bathrooms. |
| NumHalfBath | 0.864 | 0.6007 | Number of half bathrooms. |
| TotalRooms | 7.881 | 7.025 | Total number of rooms. |
| AttachedGarage | 35.06 | 25.29 | Square footage attached garage space. |
| DetachedGarage | 3.519 | 8.177 | Square footage of detached garage space. |
| Age | 21.01 | 31.56 | Year of sale minus year the house was built, except minimum year built set to 1900 |
| Historic | 0.0187 | 0.0266 | =1 if house built before 1900, 0 otherwise. |
| Pool | 0.0839 | 0.0493 | =1 if house has a swimming pool. |
| Remodeled | 0.0827 | 0.0139 | =1 if house ever remodeled. |
| CentralAir | 0.7741 | 0.6797 | =1 if house has central air. |
| Fireplace | 0.7797 | 0.5487 | =1 if house has at least one fireplace. |
| MultiFireplace | 0.0926 | 0.0541 | =1 if house has more than one fireplace. |

| | | | |
|---|---|---|---|
| FullBasement | 0.9110 | 0.9152 | =1 if house has a full basement |
| BasementCrawl | 0.0056 | 0.0082 | =1 if house has a crawl space basement. |
| BasementPartial | 0.0559 | 0.0603 | =1 if house has a partial basement. |
| NoBasement | 0.0275 | 0.0162 | =1 if a house does not have a basement. |
| NoAttic | 0.8595 | 0.7895 | =1 if house has no attic |
| UnfinAttic | 0.0543 | 0.1425 | =1 if house has an unfinished attic. |
| FinAttic | 0.0481 | 0.0561 | =1 if house has a finished attic. |
| PartFinAttic | 0.0321 | 0.0116 | =1 if house has a partially finished attic. |
| FullWalkAttic | 0.0061 | 0.0004 | =1 if house has a full walking height attic. |
| PublicWater | 0.7164 | n.a. | =1 if house has public water supply. |
| PublicSewer | 0.6636 | n.a. | =1 if house serviced by public sewer system. |
| Gas | 0.5596 | n.a. | =1 if house has natural gas service. |
| DistWilm | 3.213 | n.a. | Natural log distance to Wilmington. |
| DistPhil | 3.451 | n.a. | Natural log distance to Philadelphia. |
| DistBalt | n.a. | 3.98 | Natural log distance to Baltimore. |
| DistHburg | n.a. | 3.371 | Natural log distance to Harrisburg. |
| DistYork | n.a. | 2.02 | Natural log distance to York. |
| PSSAavg | 0.7883 | 0.7169 | PSSA average score per school district. |
| PopDens | 14.97 | 20.77 | Population density (1000 people per sq. mile). |
| RailMile | 0.3753 | 0.2699 | =1 if house within a mile of a railroad. |
| RoadMile | 0.456 | 0.2244 | =1 if house within a mile of a major road. |
| InterstateMile | 0.0885 | 0.1984 | =1 if house within a mile of an interstate. |
| Rail | 0.7876 | 0.8557 | = distance to nearest railroad (max value of 1) |
| Road | 0.7553 | 0.888 | = distance to nearest major road (max value of 1) |

| | | | |
|---|---|---|---|
| Interstate | 0.959 | 0.9099 | = distance to nearest interstate (max value of 1) |
| Year Dummies | | | Dummy variables for year of sale<br><br>(12 variables for years 1995 to 2006) |
| Township<br><br>Dummies | | | Dummy variables for township/borough<br><br>(72 in Chester County, 71 in York County) |

Table 2. Hedonic Price Regression Variables—Surrounding Land Use

| | **Mean Value** | | |
|---|---|---|---|
| **Variable** | **Chester County** | **York County** | **Description** |
| Residential400 | 0.5102 | 0.4487 | Proportion of land within 400 meters of the house in single family detached residential use |
| OtherRes400 | 0.0253 | 0.0523 | Proportion…in other residential uses |
| Commercial400 | 0.1178 | 0.1014 | Proportion…in commercial uses |
| Industrial400 | 0.02 | 0.0294 | Proportion…in industrial uses |
| Recreation400 | 0.0144 | 0.0273 | Proportion…that is in recreation uses |
| Developable400 | 0.2906 | 0.3219 | Proportion…that is undeveloped but developable |
| Preserved400 | 0.0034 | 0.0014 | Proportion…that is undeveloped and preserved through programs other than ACE |
| EaseSale400 | 0.0064 | 0.0063 | Proportion…that has ACE in place at time of sale |
| EaseEver400 | 0.0084 | 0.0083 | Proportion…that will ever have ACE in place |

Table 3. Hedonic Price Regression Results—House Characteristics, Location, Surrounding Land Use, and Disamenities

| | Chester County | | York County | |
|---|---|---|---|---|
| Variable | Parameter Value | Standard Error | Parameter Value | Standard Error |
| House and locational characteristics | | | | |
| Intercept | 12.63275** | 0.079 | 11.84498** | 0.16741 |
| LotSize | 0.08138** | 0.00129 | -0.000633 | 0.0013 |
| ResArea | 0.000199** | 0.000001 | 0.000288** | 0.000003 |
| BsmtArea | 0.000149** | 0.000003 | -0.0002** | 0.000005 |
| Floors | -0.04641** | 0.00241 | -0.07103** | 0.00316 |
| NumBedRm | -0.00407* | 0.00164 | -0.00787** | 0.00228 |
| NumFullBath | 0.02082** | 0.0017 | 0.052** | 0.00265 |
| NumHalfBath | 0.02339** | 0.00193 | 0.04755** | 0.00256 |
| TotalRooms | 0.01159** | 0.000933 | 0.01013** | 0.00147 |
| Age | -0.00318** | 0.0000586 | -0.00293** | 0.00007 |

| | | | | |
|---|---|---|---|---|
| Historic | 0.14441** | 0.00607 | 0.07132** | 0.00725 |
| AttachedGarage | 0.00163** | 0.000045 | 0.0016** | 0.000059 |
| DetachedGarage | 0.00108** | 0.000051 | 0.00135** | 0.000052 |
| Pool | 0.03618** | 0.00259 | 0.0536** | 0.00497 |
| CentralAir | 0.04186** | 0.00243 | 0.0679** | 0.00324 |
| Remodeled | -0.000274 | 0.00279 | 0.04543** | 0.00909 |
| Fireplace | 0.05116** | 0.00202 | 0.06795** | 0.00251 |
| MultiFireplace | 0.04768** | 0.00276 | 0.03642** | 0.00499 |
| BasementCrawl | -0.08985** | 0.00931 | -0.1061** | 0.01173 |
| BasementPartial | -0.03207** | 0.00324 | 0.02571** | 0.00448 |
| NoBasement | -0.11015** | 0.00441 | 0.17235** | 0.00846 |
| UnfinAttic | 0.039999** | 0.00337 | 0.0396** | 0.00417 |
| FinAttic | 0.00594 | 0.00358 | 0.02802** | 0.00514 |
| PartAttic | 0.03245** | 0.00427 | -0.01295 | 0.01009 |
| FullWalkAttic | 0.000672 | 0.00909 | -0.08168 | 0.05173 |

| | | | | |
|---|---|---|---|---|
| PublicWater | 0.04083** | 0.00271 | | |
| PublicSewer | -0.00588* | 0.00282 | | |
| Gas | 0.04602** | 0.00186 | | |
| DistWilm | 0.05675** | 0.00998 | | |
| DistPhil | 0.22902** | 0.01278 | | |
| DistBalt | | | -0.011805** | 0.03356 |
| DistHburg | | | 0.04384** | 0.01267 |
| DistYork | | | 0.04669** | 0.00493 |
| PSSAavg | 0.37243** | 0.07163 | 0.00329** | 0.000958 |
| PopDens | -0.00101** | 0.000059 | -0.00226** | 0.00065 |
| Surrounding land use-- within 400 m (omitted land use = Residential) | | | | |
| OtherRes | 0.01915 | 0.01597 | -0.11921** | 0.01903 |
| Commercial | -0.01858** | 0.00628 | -0.013107** | 0.01189 |
| Industrial | -0.19603** | 0.01601 | -0.24564** | 0.01909 |
| Recreation | 0.18659** | 0.01323 | -0.03464* | 0.01695 |
| Developable | 0.02853** | 0.00481 | 0.01499* | 0.0073 |
| Preserved | 0.10428** | 0.02387 | 0.04623 | 0.05093 |
| EaseSale | -0.01283 | 0.03715 | 0.14224* | 0.05289 |

| | | | | |
|---|---|---|---|---|
| EaseEver | -0.02546 | 0.03248 | -0.09689* | 0.04671 |
| Local Disamenities | | | | |
| RailMile | -0.02502** | 0.00314 | -0.00111 | 0.00536 |
| RoadMile | 0.00795** | 0.00279 | 0.01018* | 0.00516 |
| InterstateMile | 0.03124** | 0.00503 | 0.01343** | 0.00519 |
| Rail | 0.01907** | 0.00508 | 0.08357** | 0.00885 |
| Road | 0.04446** | 0.00408 | 0.01186 | 0.00858 |
| Interstate | 0.16714** | 0.00899 | 0.01169 | 0.00918 |

*, ** indicate significance at the .05 and .01 levels respectively.

Table 4. Impact of a change in land use on 50 acres within 400 meters of a house that would otherwise sell for $200,000. 95% Confidence intervals in parentheses.

| Surrounding Land Use | Chester County | York County |
|---|---|---|
| Developable Land | $201,432<br>($200,957, $201,907) | $200,751<br>($200,034, $201,470) |
| Land preserved through means other than an ACE | $205,283<br>($202,896, $207,698) | $202,325<br>($197,338, $207,437) |
| Land suitable for an ACE, but without an ACE | $200,154<br>($196,992, $203,366) | $195,947<br>($191,516, $200,480) |
| Land with an ACE | $199,513<br>($197674, $201,368) | $203,040<br>($200,359, $205,757) |

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## Appendix A

## Details on the Pennsylvania ACE Program

The Pennsylvania Agricultural Conservation Easement Purchase (ACE) program functions as follows (Chester and York County Farm Boards 2008). To be considered for an ACE, a farm must first meet the following eligibility requirements:

1. The farmland must be located in an Agricultural Security Area (ASA) of 500 acres or more.
2. At least 50% of the soils in Capability Class I through IV must be present and available for agricultural production.
3. The total land to be eased must amount to at least 50 acres, unless the farmland produces a unique crop to the region or there are adjacent parcels that are permanently protected by a conservation easement.
4. In York County, the farmer must have a soil and water conservation plan at the time of the application. In other counties, the plan must be drawn up before the final contract is agreed upon and the farmer can collect money for the easement.

If an application is deemed eligible by the county farm board, then the farm will be put through a ranking process.

All farms that are submitted for consideration are rated according to published criteria. The rating process is divided into the two categories of land evaluation and site evaluation. Land evaluation accounts for 40 percent of the farms rating. The United States Department of Agriculture soil classes are used to determine the quality of a farm’s soils and the ability of a farm to be productive. Site evaluation is broken down into the categories of development potential, clustering potential, and farmland viability. Development potential, which accounts for 10 percent of the overall ranking, considers the following development pressure factors: availability of sewer and water, road frontage, extent of non-agricultural land use in the area, local land use plans, and proximity of farmland to growth areas (or rural villages). Together, these development pressure factors determine how the surrounding land management will affect the farm and if there are threats to the farmland from development Farms are given higher ratings if they experience more pressure to be developed. Farmland viability, which accounts for 25 percent of rank weight, focuses on the actual productivity of the farmland. The measures for farmland viability include potential for continued agricultural production, suitability of the farm for perpetual preservation, the implementation of a soil and water conservation plan, contiguous farm size, annual gross farm income, farm capital improvements, and proximity to historic sites. In order to be considered, it is important for farms to be large, make a high sufficient income, use conservation plans, and generally be mostly economically viable. The historic site proximity measure gives extra points to farms near environmental, scenic, cultural, or historical lands, because these lands are deemed compatible with agricultural practices and therefore prioritized. Clustering potential, which accounts for the last 25 percent of the rank, focuses on the farmland and its proximity to other farms and eased farms. The measures of clustering potential are the farm's compatibility with the county's landscapes, the proximity to preserved farms, proximity to other applicants, percent of land enrolled in the ASA adjacent to the farm, and acreage of preserved farmland within a mile of the farm. Together, all of the above measures constitute the ranking of farms under the site assessment part of the rank.

After the farms are rated, they are ranked, and the highest scoring farms are appraised to determine their agricultural and their market values. The county farm board makes an offer to the landowner, based on a conservation easement value determined from the appraisal. A landowner is allowed to have an independent appraiser assess the land. Then landowner is contacted and is given 30 days to accept or reject the board's offer. If the applicant agrees to accept the board's offer, then a contract is signed the State Agricultural Land Preserve Board considers the farm and makes a decision to approve or reject the ACE. If the state board approves the farm, then a signed deed of easement is obtained by the State and/or County Board. Finally, the easement funds are transferred to the landowner.

**Appendix B**

**Details on the Study Areas**

Figure 1. Map of the study area.


The study area, York and Chester counties, is located in southeastern Pennsylvania and is within close proximity to the major employment centers (Baltimore, Harrisburg, Philadelphia, Wilmington, and York) shown in Map 1. In 2007, York County had about 20% of its total land converted to residential and other types of residential, while about 64% of the total land remained developable. Chester County, also located in southeastern Pennsylvania, had about 35% of its total land converted to some kind of residential use, while about 43% of the total land remained developable. A visual representation of current land uses in the two counties, which can be found in Figures 2 and 3, shows that Chester County is more densely populated and more developed, compared to York County. Even though Chester County is 11.1% proportionally smaller in total land mass than York County, it has a higher proportion of its total land in residential land use (35% residential) than York County (20% residential), and its commercial land use proportionally outweighs the commercial land use in York by 2 to1. York County has more industrial land and more land for recreational purposes than Chester County. Also, the total amount of preserved land is higher in York County. The breakdown of land uses for each county's land use year maps are given in Tables 4 and 5.

Figure 2. Map of the land uses in Chester County.

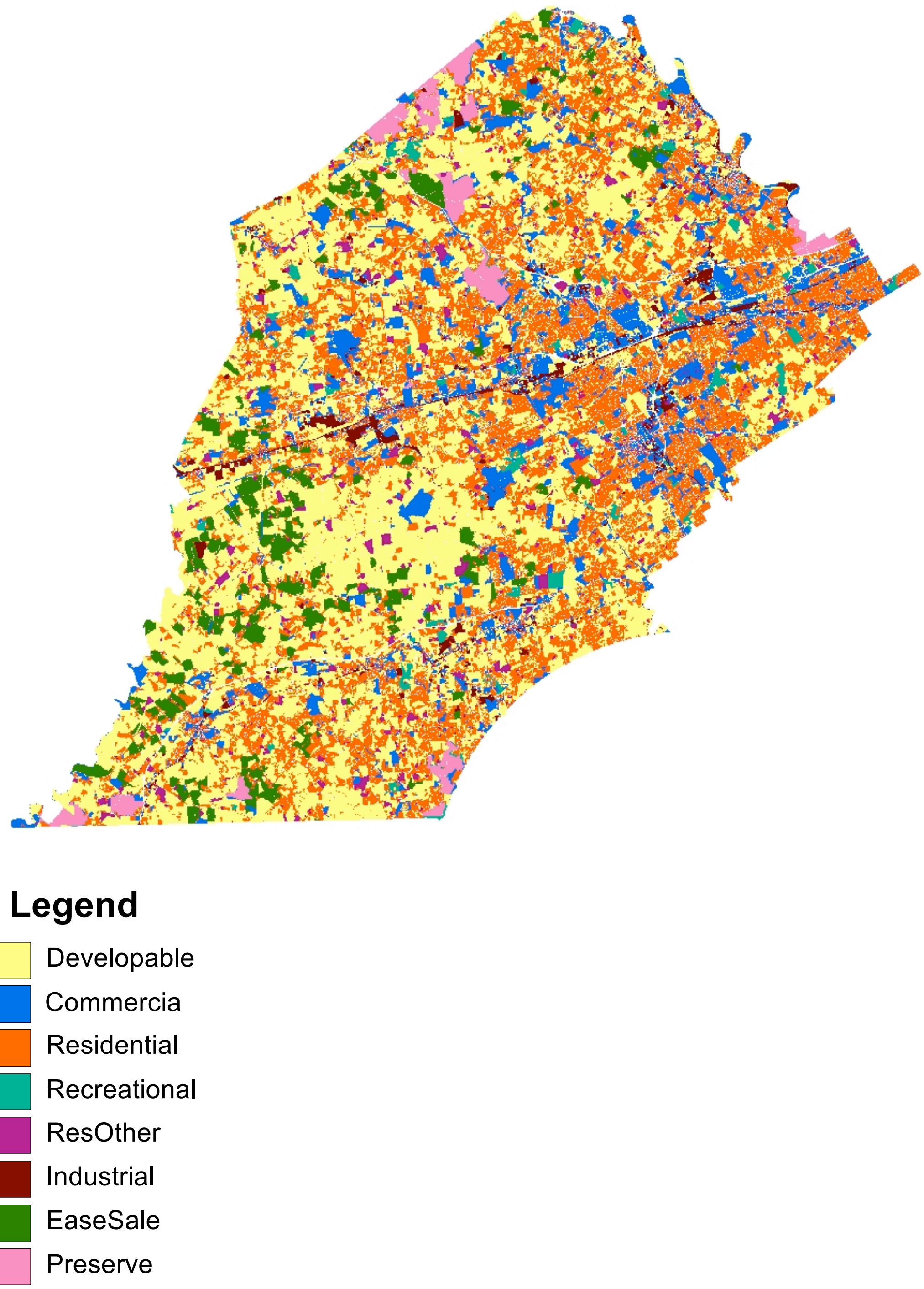

Figure 3. Map of the land uses in York County.

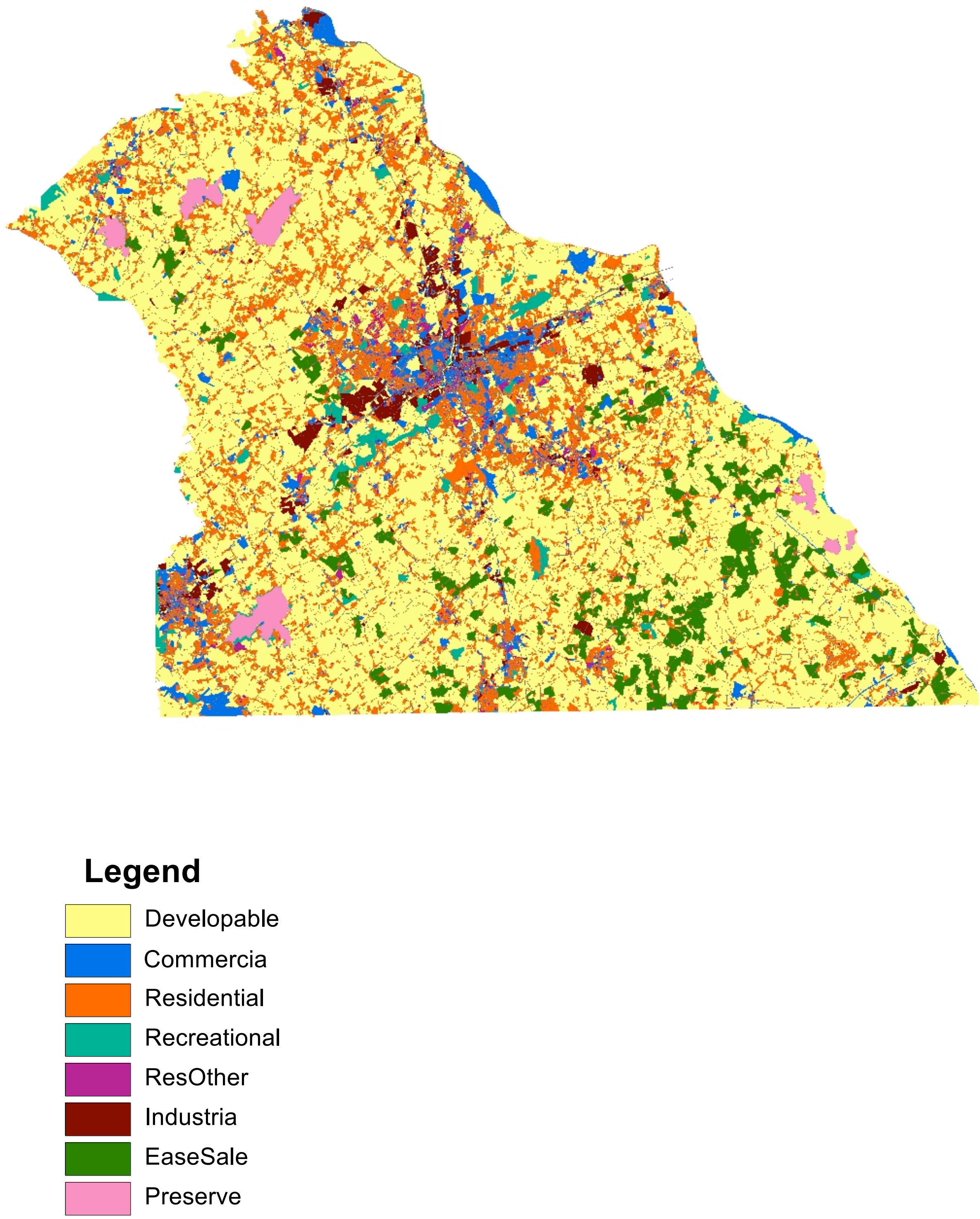

Figure 4. Map of the Agricultural Conservation Easements in Chester County.

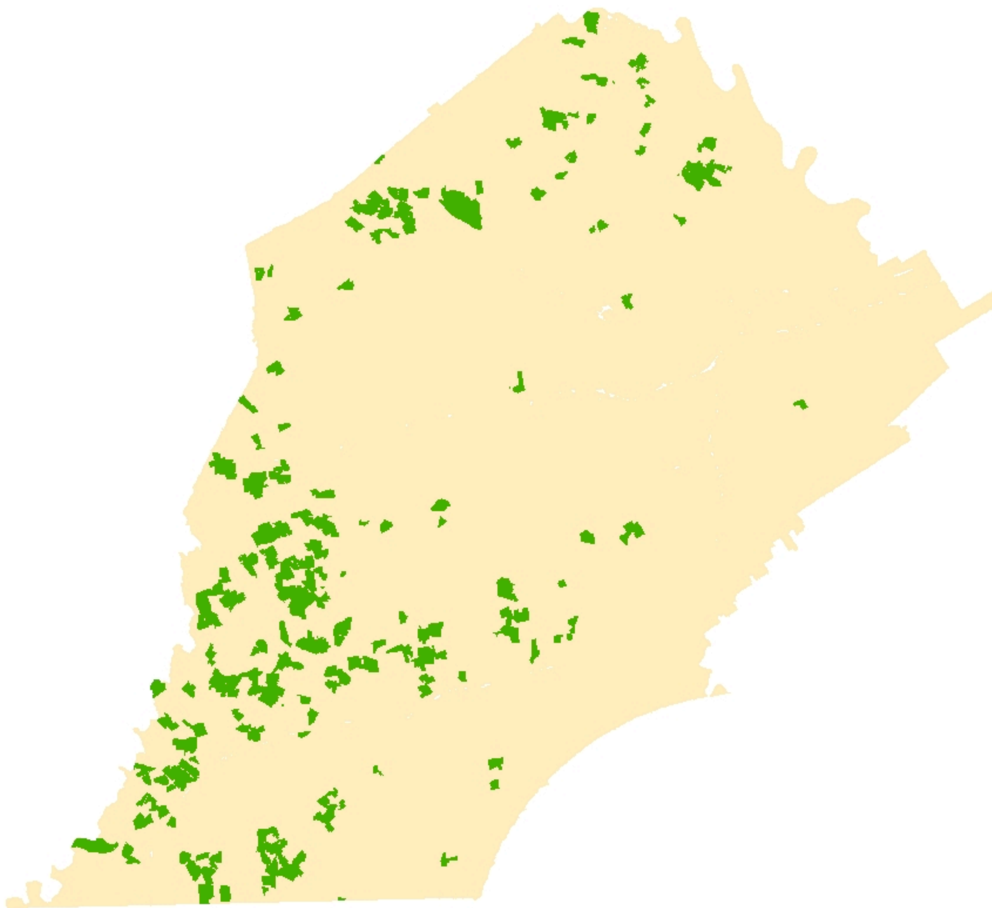

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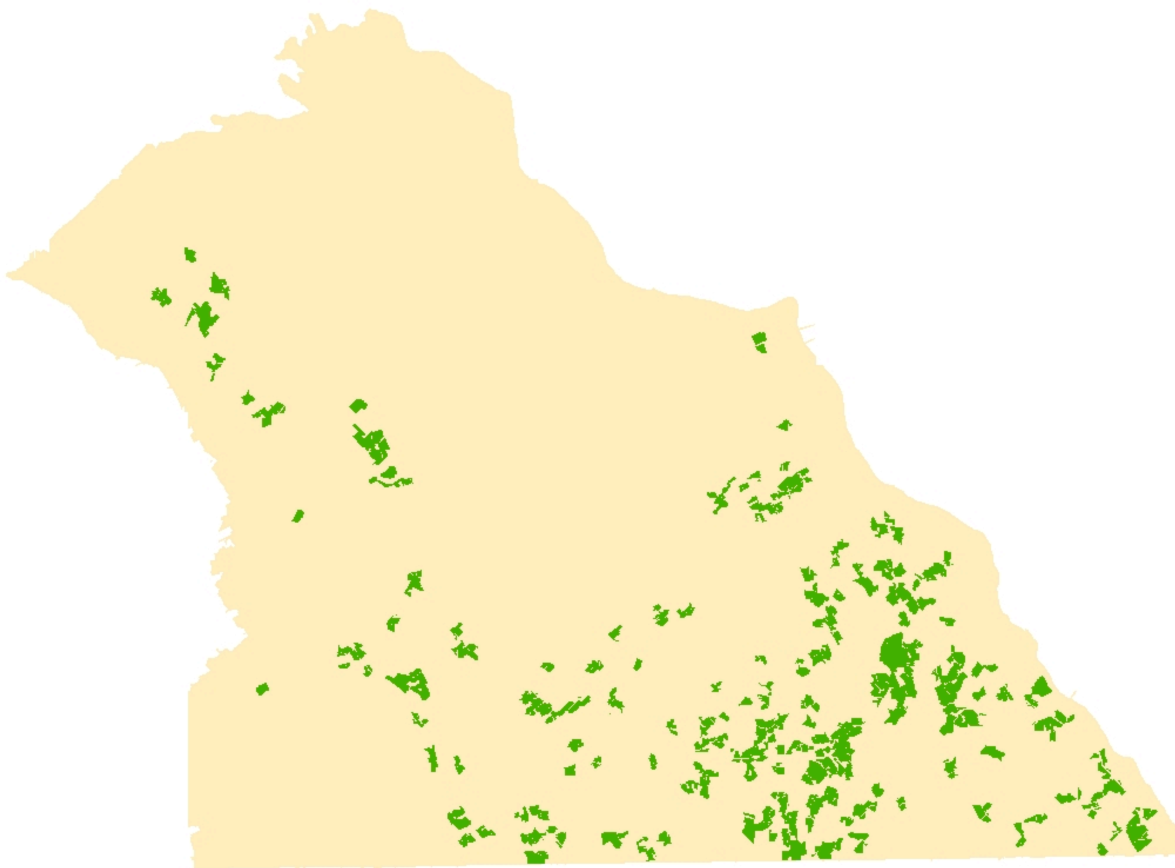
Figure 5. Map of the Agricultural Conservation Easements in York County.



Lands with agricultural conservation easements in Chester and York counties accounted for about 6% of the total land in each county. Easements for each county are shown on Figures 4 and 5. Table 7 reports the total number of observations (single family detached residential houses) used in the hedonic pricing models that had some amount of land with an ACEs within 400 meters. In both Chester and York, about 8% of house sale observations were within 400 meters of an ACE.

Table 5. Chester County land uses in proportion of total land for each land use map year.

| | **Land Use Maps (in Square Miles)** | | | |
|---|---|---|---|---|
| **Landuse** | **2007** | **2003** | **1999** | **1995** |
| Residential | 31.8% | 30.7% | 28.4% | 25.9% |
| OtherRes | 3% | 3% | 3% | 3% |
| Commercial | 10.8% | 10.8% | 10.8% | 10.8% |
| Industrial | 2.1% | 2.1% | 2.1% | 2.1% |
| EaseSale | 5.4% | 4.4% | 2.5% | 1.4% |
| Developable | 43.1% | 45.3% | 49.4% | 52.9% |
| Recreational | 1.5% | 1.5% | 1.5% | 1.5% |
| Preserved | 2.2% | 2.2% | 2.2% | 2.2% |
| Total | 100% | 100% | 100% | 100% |

Table 6. York County land uses in square miles for each land use map year.

| | Land Use Maps (in Square Miles) | | | |
|---|---|---|---|---|
| **Landuse** | **2007** | **2003** | **1999** | **1995** |
| Residential | 18.5% | 17.6% | 16.6% | 15.4% |
| OtherRes | 1.2% | 1.2% | 1.2% | 1.2% |
| Commercial | 4.5% | 4.5% | 4.5% | 4.5% |
| Industrial | 2.3% | 2.3% | 2.3% | 2.3% |
| EaseSale | 5.8% | 4.6% | 2.8% | 1.3% |
| Developable | 64% | 66.2% | 69.1% | 71.6% |
| Recreational | 2.1% | 2.1% | 2.1% | 2.1% |
| Preserved | 1.6% | 1.6% | 1.6% | 1.6% |
| Total | 100% | 100% | 100% | 100% |

Table 7. Residential properties near eased land in Chester and York counties.

| | Chester County | York County |
|---|---|---|
| Total Observations | 46,847 | 26,837 |
| Observations at 400 level | 3,792 | 2,140 |
| Observations at 800 level | 7,450 | 4,363 |

**Appendix C**

**Full Regression Results**

Table 8. Full Hedonic Price Regression Results for the 400 and 800 meter model runs for Chester County—House Characteristics, Location including year and township variables, Surrounding Land Use, and Disamenities. The $R^2$ statistics for the 400 and 800 models are both 0.9029.

| | Chester 400 m | | Chester 800 m | |
|---|---|---|---|---|
| Variable | Parameter Value | Standard Error | Parameter Value | Standard Error |
| Surrounding land use | | | | |
| OtherRes | 0.01915 | 0.01597 | 0.11634** | 0.02303 |
| Commercial | -0.01858** | 0.00628 | 0.00811 | 0.00793 |
| Industrial | -0.19603** | 0.01601 | -0.2048** | 0.01917 |
| Recreation | 0.18659** | 0.01323 | 0.21658** | 0.01597 |
| Developable | 0.02853** | 0.00481 | 0.0513** | 0.00645 |
| Preserved | 0.10428** | 0.02387 | 0.0963** | 0.01903 |
| EaseSale | -0.01283* | 0.03715 | -0.04257 | 0.03684 |
| EaseEver | -0.02546 | 0.03248 | 0.00948 | 0.03213 |
| Local Disamenities | | | | |
| RailMile | -0.02502** | 0.00314 | -0.02329** | 0.00313 |
| RoadMile | 0.00795** | 0.00279 | 0.00822** | 0.00279 |
| InterstateMile | 0.03124** | 0.00503 | 0.03271** | 0.00503 |
| Rail | 0.01907** | 0.00508 | 0.01798** | 0.00515 |
| Road | 0.04446** | 0.00408 | 0.04662** | 0.00411 |

| | | | | |
|---|---|---|---|---|
| Interstate | 0.16714** | 0.00899 | 0.16347** | 0.00905 |
| House and Locational Characteristics | | | | |
| Intercept | 12.63275** | 0.079 | 12.7296** | 0.07981 |
| LotSize | 0.08138** | 0.00129 | 0.081** | 0.00127 |
| ResArea | 0.000199** | 0.000001 | 0.000199** | 0.000001 |
| BsmtArea | -0.000149** | 0.000003 | -0.000149** | 0.000003 |
| Floors | -0.04641** | 0.00241 | -0.04804** | 0.00241 |
| NumBedRm | -0.00407* | 0.00164 | -0.00413* | 0.00164 |
| NumFullBath | 0.02082** | 0.0017 | 0.02116** | 0.0017 |
| NumHalfBath | 0.02339** | 0.00193 | 0.02348** | 0.00193 |
| TotalRooms | 0.01159** | 0.000933 | 0.0117** | 0.000934 |
| Age | 0.00318** | 0.000059 | 0.00319** | 0.000058 |
| Historic | 0.14441** | 0.00607 | 0.14552** | 0.00606 |
| AttachedGarage | 0.00163** | 0.000045 | 0.00162** | 0.000045 |
| DetachedGarage | 0.00108** | 0.000051 | 0.00107** | 0.000051 |
| Pool | 0.03618** | 0.00259 | 0.03652** | 0.00259 |
| CentralAir | 0.04186** | 0.00243 | 0.04242** | 0.00243 |
| Remodeled | 0.000274 | 0.00279 | 0.000513 | 0.00279 |
| Fireplace | 0.05116** | 0.00202 | 0.05108** | 0.00202 |
| MultiFireplace | 0.04768** | 0.00276 | 0.04829** | 0.00277 |
| BasementCrawl | -0.08985** | 0.00931 | -0.08827** | 0.00931 |
| BasementPartial | -0.03207** | 0.00324 | -0.03214** | 0.00324 |
| NoBasement | -0.11015** | 0.00441 | -0.10866** | 0.00441 |
| UnfinAttic | 0.039999** | 0.00337 | 0.04026** | 0.00337 |

| | | | | |
|---|---|---|---|---|
| FinAttic | 0.00594 | 0.00358 | 0.0048 | 0.00358 |
| PartAttic | 0.03245** | 0.00427 | 0.03163** | 0.00427 |
| FullWalkAttic | 0.000672 | 0.00909 | 0.000923 | 0.00909 |
| PublicWater | 0.04083** | 0.00271 | 0.0405** | 0.00271 |
| PublicSewer | 0.00588* | 0.00282 | -0.00449 | 0.00283 |
| Gas | 0.04602** | 0.00186 | 0.04563** | 0.00186 |
| DistWilm | -0.05675** | 0.00998 | -0.06986** | 0.01004 |
| DistPhil | -0.22902** | 0.01278 | -0.24278** | 0.01287 |
| PSSAavg | 3.72435** | 0.71633 | 3.64963** | 0.71887 |
| PopDens | -0.00101** | 0.000056 | -0.000965** | 0.000056 |
| Y2006 | 0.03871** | 0.00441 | 0.0386** | 0.00441 |
| Y2005 | 0.05782** | 0.0044 | 0.05742** | 0.0044 |
| Y2004 | 0.05969** | 0.00438 | 0.05896** | 0.00438 |
| Y2003 | 0.0671** | 0.00446 | 0.06595** | 0.00446 |
| Y2002 | 0.04035** | 0.00452 | 0.03958** | 0.00452 |
| Y2001 | 0.02226** | 0.00463 | 0.02155** | 0.00463 |
| Y2000 | 0.0114* | 0.00468 | 0.01067* | 0.00469 |
| Y1999 | -0.01849** | 0.00471 | -0.01976** | 0.00472 |
| Y1998 | -0.05761** | 0.00478 | -0.05947** | 0.00478 |
| Y1997 | -0.05662** | 0.00504 | -0.05933** | 0.00505 |
| Y1996 | -0.03524** | 0.00512 | -0.03772** | 0.00514 |
| Y1995 | -0.04434** | 0.00541 | -0.04649** | 0.00542 |
| Caln | 0.03476* | 0.01393 | 0.02738 | 0.01413 |
| Birmingham | 0.14306** | 0.01916 | 0.1261** | 0.01915 |

| | | | | |
|---|---|---|---|---|
| Charlestown | 0.25064** | 0.01566 | 0.24583** | 0.01566 |
| Ebradford | 0.12063** | 0.01387 | 0.11374** | 0.01386 |
| Ebrandywine | 0.05513** | 0.01205 | 0.05527** | 0.01206 |
| Ecaln | 0.08707** | 0.01309 | 0.08272** | 0.01317 |
| Ecoventry | -0.05394** | 0.01287 | -0.05358** | 0.01289 |
| Efallowfield | -0.07621** | 0.014 | -0.08078** | 0.01415 |
| Egoshen | 0.22169** | 0.0137 | 0.2113** | 0.01371 |
| Emarlborough | 0.10569** | 0.01663 | 0.09645** | 0.01664 |
| Enantmeal | 0.09705** | 0.01647 | 0.09239** | 0.01647 |
| Enottingham | -0.08602** | 0.00948 | -0.08591** | 0.00953 |
| Epikeland | 0.0507** | 0.01221 | 0.04691** | 0.01222 |
| Evincent | -0.02873** | 0.01141 | -0.02417* | 0.01144 |
| Ewhiteland | 0.17985* | 0.01526 | 0.17909** | 0.01534 |
| Easttown | 0.34693** | 0.01836 | 0.33499** | 0.01835 |
| Elk | -0.01816** | 0.01567 | -0.01986 | 0.01571 |
| FranklinC | 0.0061 | 0.0124 | 0.00713 | 0.0124 |
| Highland | -0.05373* | 0.02658 | -0.05726* | 0.02666 |
| Kennett | 0.17447** | 0.01415 | 0.16011** | 0.01425 |
| Londonbritain | 0.05329** | 0.01377 | 0.04673** | 0.01387 |
| Londongrove | -0.03645** | 0.01209 | -0.04657** | 0.01212 |
| Londonderry | -0.04562** | 0.01405 | -0.04876** | 0.01424 |
| Loxford | -0.08707** | 0.0128 | -0.09211** | 0.01284 |
| Newgarden | 0.13765** | 0.01311 | 0.12786** | 0.01314 |
| Newlondon | -0.0135 | 0.01088 | -0.01366 | 0.0109 |

| | | | | |
|---|---|---|---|---|
| Newlin | 0.05843* | 0.02301 | 0.04803** | 0.023 |
| Ncoventry | -0.03347** | 0.01137 | -0.03706* | 0.01143 |
| PennC | -0.00215 | 0.01118 | -0.01246 | 0.01123 |
| Pennsbury | 0.14804** | 0.02058 | 0.12899** | 0.02059 |
| Pocopson | 0.08141** | 0.01991 | 0.06676** | 0.0199 |
| Sadsbury | 0.00318 | 0.01532 | 0.00618 | 0.01544 |
| Schuylkill | 0.11699** | 0.01218 | 0.11308** | 0.01224 |
| Scoventry | 0.00635 | 0.01297 | 0.00484 | 0.01302 |
| Thornbury | 0.09657** | 0.01633 | 0.07855** | 0.01635 |
| Tredyffrin | 0.34418** | 0.01793 | 0.3332** | 0.01793 |
| Uoxford | -0.09517** | 0.01403 | -0.10042** | 0.01414 |
| Uuwchlan | 0.10812** | 0.0118 | 0.0986** | 0.01185 |
| Uwchlan | 0.11921** | 0.01198 | 0.11693** | 0.01201 |
| Valley | 0.00557 | 0.014 | 0.00535 | 0.01411 |
| Wallace | 0.10383** | 0.01361 | 0.10166** | 0.01362 |
| Warwick | 0.00875 | 0.01552 | 0.00476 | 0.01557 |
| Wbradford | 0.01313 | 0.01202 | 0.00571 | 0.01202 |
| Wbrandywine | 0.02844* | 0.0139 | 0.02748 | 0.01404 |
| Wcaln | -0.01477 | 0.01398 | -0.01753 | 0.01412 |
| Wfallowfield | -0.07009** | 0.0166 | -0.07523** | 0.01665 |
| Wgoshen | 0.12041** | 0.01348 | 0.11387** | 0.01351 |
| Wmarlborough | -0.07834 | 0.04782 | -0.08946 | 0.04782 |
| Wnantmeal | 0.02475 | 0.01467 | 0.02384 | 0.01477 |
| Wnottingham | -0.07661** | 0.01638 | -0.07448** | 0.01642 |

| | | | | |
|---|---|---|---|---|
| Wpikeland | 0.16681** | 0.01318 | 0.16243** | 0.01318 |
| Wsadsbury | -0.08379** | 0.0163 | -0.08863** | 0.01642 |
| Wvincent | 0.18489** | 0.01188 | 0.18161** | 0.01187 |
| Wwhiteland | 0.15497** | 0.01264 | 0.14633** | 0.01267 |
| Westtown | 0.10486** | 0.01465 | 0.09513** | 0.0147 |
| Willistown | 0.24178** | 0.01633 | 0.23064** | 0.01632 |
| Coatesville | -0.14775** | 0.01503 | -0.1498** | 0.01515 |
| Atglen | -0.01272 | 0.01571 | -0.00935 | 0.01577 |
| Avondale | 0.03057 | 0.02374 | 0.02709 | 0.02378 |
| Downingtown | 0.08239** | 0.01356 | 0.06915** | 0.01358 |
| Elverson | 0.22921** | 0.01421 | 0.22389** | 0.01428 |
| Honeybrookboro | 0.0109 | 0.01631 | 0.01421 | 0.01632 |
| Kennettsq | 0.15545** | 0.01436 | 0.14019** | 0.01445 |
| Malvern | 0.20894** | 0.01835 | 0.20695** | 0.01839 |
| Modena | -0.28582** | 0.04098 | -0.26091** | 0.04103 |
| Oxford | -0.0556** | 0.01151 | -0.05576** | 0.01161 |
| Parkesburg | -0.01204 | 0.01239 | -0.01088 | 0.01246 |
| Phoenixville | 0.04622** | 0.01213 | 0.03876** | 0.01216 |
| Scoatesville | -0.22011** | 0.025 | -0.20124** | 0.02524 |
| Springcity | -0.01535 | 0.01475 | -0.01825 | 0.01479 |
| Wchester | 0.2817* | 0.01556 | 0.27545** | 0.01558 |
| Wgrove | 0.01649 | 0.01558 | 0.0089 | 0.01563 |

*, ** indicate significance at the .05 and .01 levels respectively.

Table 9. Full Hedonic Price Regression Results for the 400 and 800 meter model runs for York County—House Characteristics, Location including year and township variables, Surrounding Land Use, and Disamenities. The $R^2$ statistics for the 400 and 800 models are 0.8633 and 0.8625, respectively.

| | York 400 m | | York 800 m | |
|---|---|---|---|---|
| Variable | Parameter Value | Standard Error | Parameter Value | Standard Error |
| Surrounding land use | | | | |
| OtherRes | -0.11921** | 0.01903 | -0.19448** | 0.03158 |
| Commercial | -0.013107** | 0.01189 | -0.1269** | 0.01729 |
| Industrial | -0.24564** | 0.01909 | -0.18126** | 0.02019 |
| Recreation | -0.03464* | 0.01695 | -0.00877 | 0.02138 |
| Developable | 0.01499* | 0.0073 | 0.0022 | 0.01006 |
| Preserved | 0.04623 | 0.05093 | 0.03727 | 0.04196 |
| EaseSale | 0.14224 | 0.05289 | 0.17688 | 0.05674 |
| EaseEver | -0.09689* | 0.04671 | -0.15028** | 0.04986 |
| Local Disamenities | | | | |
| RailMile | -0.00111 | 0.00536 | 0.00416 | 0.00539 |
| RoadMile | 0.01018* | 0.00516 | 0.01374** | 0.0052 |
| InterstateMile | 0.01343* | 0.00519 | 0.0132** | 0.00522 |
| Rail | 0.08357** | 0.00885 | 0.0922** | 0.00912 |
| Road | 0.01186 | 0.00858 | 0.01547 | 0.00865 |
| Interstate | 0.01169 | 0.00918 | 0.00994 | 0.00926 |

House and locational characteristics

| | | | | |
|---|---|---|---|---|
| Intercept | 11.84498** | 0.16741 | 11.83356* | 0.16827 |
| LotSize | -0.000633 | 0.0013 | -0.000821 | 0.0013 |
| ResArea | 0.000289** | 0.000003 | 0.000289** | 0.000003 |
| BsmtArea | -0.0002** | 0.000005 | -0.0002** | 0.000005 |
| Floors | -0.07103** | 0.00316 | -0.0724** | 0.00316 |
| NumBedRm | -0.00787** | 0.00228 | -0.00782** | 0.00229 |
| NumFullBath | 0.052** | 0.00265 | 0.05223** | 0.00266 |
| NumHalfBath | 0.04755** | 0.00256 | 0.04771** | 0.00256 |
| TotalRooms | 0.01013** | 0.00147 | 0.01011** | 0.00148 |
| Age | -0.00293** | 0.00007 | -0.00298** | 0.00007 |
| Historic | 0.07132** | 0.00725 | 0.07053** | 0.00728 |
| AttachedGarage | 0.0016** | 0.000059 | 0.0016** | 0.000059 |
| DetachedGarage | 0.00135** | 0.000052 | 0.00135** | 0.000053 |
| Pool | 0.0536** | 0.00497 | 0.05363** | 0.00498 |
| CentralAir | 0.0679** | 0.00324 | 0.06888** | 0.00325 |
| Remodeled | 0.04543** | 0.00909 | 0.04581** | 0.00912 |
| Fireplace | 0.06795** | 0.00251 | 0.0692** | 0.00252 |
| MultiFireplace | 0.03642** | 0.00499 | 0.03656** | 0.005 |
| BasementCrawl | -0.1061** | 0.01173 | -0.10745** | 0.001176 |
| BasementPartial | -0.02571** | 0.00448 | -0.02486** | 0.0045 |
| NoBasement | -0.17235** | 0.00846 | -0.17169** | 0.00849 |
| UnfinAttic | 0.0396** | 0.00417 | 0.03935** | 0.00418 |
| FinAttic | -0.02802** | 0.00514 | -0.02576** | 0.00515 |

| | | | | |
|---|---|---|---|---|
| PartAttic | -0.01295 | 0.01009 | 0.01122 | 0.01012 |
| FullWalkAttic | -0.08168 | 0.05173 | -0.08084 | 0.05188 |
| DistBalt | -0.011805** | 0.03356 | -0.12219** | 0.03379 |
| DistHburg | -0.04384** | 0.01267 | -0.03839** | 0.01277 |
| DistYork | 0.04669** | 0.00493 | 0.0474** | 0.00508 |
| PSSAavg | 0.32904** | 0.09577 | 0.33428** | 0.09599 |
| PopDens | -0.00226** | 0.000065 | -0.0022** | 0.000064 |
| Y2006 | 0.02231** | 0.00539 | 0.02221** | 0.0054 |
| Y2005 | 0.0163** | 0.00542 | 0.01587* | 0.00543 |
| Y2004 | -0.01225* | 0.00558 | -0.01206* | 0.00559 |
| Y2003 | 0.02387** | 0.00574 | 0.0244** | 0.00575 |
| Y2002 | 0.01522* | 0.00597 | 0.01616** | 0.00599 |
| Y2001 | 0.03028** | 0.00626 | 0.03045** | 0.00628 |
| Y2000 | 0.06388** | 0.0066 | 0.06505** | 0.00662 |
| Y1999 | 0.06391** | 0.0065 | 0.06477** | 0.00652 |
| Y1998 | 0.06826** | 0.00671 | 0.06893** | 0.00673 |
| Y1997 | 0.06789** | 0.00705 | 0.06928** | 0.00707 |
| Y1996 | 0.07765** | 0.00727 | 0.07968** | 0.0073 |
| Y1995 | 0.06773** | 0.00745 | 0.06976** | 0.00747 |
| SpringGarden | 0.12132** | 0.02027 | 0.12003** | 0.02037 |
| York | 0.04583* | 0.0182 | 0.04557* | 0.01828 |
| Penn | 0.02412 | 0.01595 | 0.0172 | 0.01616 |
| Carroll | -0.0212 | 0.01977 | -0.02004 | 0.01987 |
| Cordorus | 0.05776* | 0.02381 | 0.05645* | 0.02386 |

| | | | | |
|---|---|---|---|---|
| Conewago | -0.0738** | 0.01781 | -0.07178** | 0.0179 |
| DoverTwp | -0.04734** | 0.01481 | -0.04854** | 0.01491 |
| Ehopewell | 0.10324** | 0.02007 | 0.10272** | 0.02017 |
| Emanchester | -0.08503** | 0.01575 | -0.07815** | 0.0158 |
| Fariview | 0.00584 | 0.02201 | 0.01258 | 0.02214 |
| Fawn | 0.0979** | 0.02081 | 0.09609** | 0.02088 |
| Franklin | -0.0483* | 0.02125 | -0.04824* | 0.02134 |
| Heidelberg | 0.07968** | 0.02015 | 0.07783** | 0.0203 |
| Hellam | 0.1136** | 0.01629 | 0.11208** | 0.01635 |
| Hopewell | 0.08007** | 0.01677 | 0.07482** | 0.01684 |
| Jackson | 0.00401 | 0.01604 | 0.00211 | 0.01609 |
| Lchanceford | 0.000368 | 0.02375 | 0.00208 | 0.02379 |
| Lwindsor | -0.00911 | 0.01501 | -0.00921 | 0.01504 |
| ManchesterTwp | 0.03346 | 0.01999 | 0.03488 | 0.02011 |
| Manhein | 0.11572** | 0.01978 | 0.11122** | 0.01993 |
| Monaghan | -0.00304 | 0.02354 | -0.000649 | 0.02364 |
| Newberry | -0.05304** | 0.01796 | -0.05087** | 0.01803 |
| Ncordorus | 0.02006 | 0.01524 | 0.01747 | 0.01528 |
| Nhopewell | 0.13052** | 0.02255 | 0.13144** | 0.02262 |
| Paradise | -0.02425 | 0.01975 | -0.02598 | 0.0198 |
| Peachbottom | 0.000593 | 0.02045 | -0.00436 | 0.02051 |
| ShrewsburyTwp | 0.08873** | 0.02236 | 0.0836** | 0.02241 |
| Springettsbury | 0.09577** | 0.0196 | 0.0989** | 0.01972 |
| Springfield | 0.08412** | 0.01994 | 0.08486** | 0.02 |

| | | | | |
|---|---|---|---|---|
| Warrington | 0.02365 | 0.02118 | 0.02483 | 0.0213 |
| Washington | -0.04367 | 0.02528 | -0.03734 | 0.02534 |
| Wmanchester | 0.05281** | 0.01587 | 0.05522** | 0.01601 |
| Wmanheim | 0.00891 | 0.01816 | 0.00377 | 0.01831 |
| WindsorTwp | 0.03963** | 0.01222 | 0.0405** | 0.01229 |
| Yorkcity | -0.02349 | 0.03457 | -0.02419 | 0.03467 |
| Crossroads | 0.06663 | 0.046 | 0.06564 | 0.04613 |
| Dallastown | -0.00994 | 0.02095 | -0.02208 | 0.02106 |
| Delta | 0.02225 | 0.03143 | 0.01072 | 0.03158 |
| Dillsburg | 0.02446 | 0.02222 | 0.02179 | 0.02239 |
| Doverboro | -0.06891** | 0.02216 | -0.07923** | 0.02226 |
| Eprospect | -0.05409* | 0.02745 | -0.06472* | 0.02752 |
| Fawngrove | -0.00221 | 0.03641 | -0.01204 | 0.03659 |
| Felton | 0.05966* | 0.02782 | 0.05682* | 0.02789 |
| Franklintown | -0.14363** | 0.03766 | -0.15159** | 0.0383 |
| Glenrock | 0.07986** | 0.02335 | 0.07038** | 0.02346 |
| Goldsboro | -0.0838** | 0.02802 | -0.08136** | 0.02815 |
| Hallam | 0.06608* | 0.02593 | 0.05324* | 0.02605 |
| Hanover | 0.18029** | 0.01822 | 0.17744** | 0.01862 |
| Jacobus | 0.0557* | 0.02289 | 0.04478 | 0.02302 |
| Jefferson | -0.05477 | 0.02975 | -0.05077 | 0.02988 |
| Lewisberry | -0.11912* | 0.05209 | -0.12428* | 0.05222 |
| Loganville | 0.04093 | 0.02633 | 0.03487 | 0.02643 |
| ManchesterBoro | -0.01656 | 0.01966 | -0.013 | 0.01989 |

| | | | | |
|---|---|---|---|---|
| Mountwolf | -0.04762 | 0.0249 | -0.04418 | 0.02505 |
| Newfreedom | 0.10693** | 0.02383 | 0.09576** | 0.02392 |
| Newsalem | 0.02416 | 0.02769 | 0.02045 | 0.02782 |
| Nyork | -0.06079* | 0.02711 | -0.0693* | 0.02737 |
| Railroad | -0.0673 | 0.05604 | -0.07081 | 0.05624 |
| Redlion | 0.00732 | 0.01471 | 0.00508 | 0.01498 |
| Sevenvalleys | -0.13691** | 0.03327 | -0.14427** | 0.03341 |
| ShrewsburyBoro | 0.09881** | 0.02301 | 0.09013** | 0.02311 |
| Springgrove | 0.05462** | 0.01994 | 0.0388 | 0.02003 |
| Stewartstown | 0.13114** | 0.01974 | 0.11953** | 0.01985 |
| Wellsville | -0.06829 | 0.04441 | -0.07579 | 0.04453 |
| Wyork | 0.17526** | 0.02036 | 0.16901** | 0.02043 |
| Windsorboro | -0.06623** | 0.02518 | -0.06879** | 0.02526 |
| Winterstown | 0.0447 | 0.03485 | 0.04887 | 0.03497 |
| Wrightsville | -0.01287 | 0.02171 | -0.02186 | 0.02179 |
| Yoe | -0.06793* | 0.02928 | -0.07025* | 0.02944 |
| Yorkanna | -0.04624 | 0.05829 | -0.04143 | 0.05847 |
| Yorkhaven | -0.24611** | 0.03697 | -0.26145** | 0.03718 |

*, ** indicate significance at the .05 and .01 levels respectively.