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## **Net Buyers, Net Sellers, and Agricultural Landowner Support for Agricultural Zoning**

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## **Net Buyers, Net Sellers, and Agricultural Landowner Support for Agricultural Zoning**

### ***Abstract***

Agricultural zoning and land use restrictions are long-standing approaches for controlling non-agricultural development. Agricultural landowners may contest agricultural zoning if they expect zoning to reduce land prices on restricted land. However, it is common to find agricultural landowners on both sides of this issue. A prevailing economic explanation for variation in landowner support is that the price effect of zoning varies across land parcels and therefore, zoning may increase the value of some lands zoned for agricultural use. In this paper, we provide an additional explanation for variation in agricultural landowner support. We use the concepts of net buyers and net sellers of land to suggest that the utility effect of changing land prices depends on an agricultural landowner's position in the agricultural land market. Hence, even in situations where all agricultural landowners expect zoning to reduce agricultural land prices, some subset of agricultural landowners – i.e., net buyers – may benefit. Survey data from agricultural landowners is used to model the probability that an agricultural landowner will support agricultural zoning. The empirical findings are consistent with our hypothesis that net buyers and net sellers of agricultural land will differ in their support for agricultural zoning.

## **Introduction**

Farmers and farmland feature prominently in debates about land preservation and growth management. Farmland preservation initiatives and public support for farming as an occupation are widespread and historic. These dual objectives – farmland preservation and support for farmers – are not always in harmony. Agricultural zoning is initiated to preserve farmland, but some farmers and landowners express concerns that zoning reduces land prices and thereby diminishes their well being.

While there is evidence that zoning reduces the prices of land to which it applies (Knapp; Vaillancourt and Monty), the presumption that restrictive zoning necessarily reduces the land prices, of lands to which zoning directly applies, is too simplistic. Groves and Helland's empirical analysis indicates that residential zoning raises the value of homes best suited for residential development but reduces the value of homes with relatively higher potential for commercial development. With respect to agriculture, Henneberry and Barrows' empirical analysis suggests that farmland prices may increase as a result of agricultural zoning if the land is relatively more suitable for agricultural production than non-agricultural development. Henneberry and Barrows note that a positive zoning effect is consistent with the observation that, in some areas of the United States, strict agricultural zoning is generally supported by farmers.

Given the aforementioned literature, one may be tempted to presume that landowners are more likely to support zoning if zoning increases land prices and are less likely to support if zoning reduces land prices. But this presumption, as we shall discuss, is also too simplistic. Anticipating our theoretical model, the utility effect of changing land prices can not be ascertained without characterizing the manner in which the landowner is using the land, and land use varies greatly within the agricultural sector. Forty-two percent of farmland in the United

States is held by those who do not farm (Hoppe and Wiebe). Thirty-four percent of farmers are paying some form of land rent; approximately twenty-seven percent are characterized as part owners and seven percent are tenant farmers. Approximately sixty-five percent of farmers farm only the land they own (USDA-NASS).

The theoretical framework we develop in this paper is also relevant to studies that examine support for land use controls other than zoning. Numerous studies examine willingness to support policies that preserve farmland (see, e.g., Beasley, Workman and Williams; Bergstrom, Dillman and Stoll; Drake; Halstead; Deaton, Norris, and Hoehn). However, in each of these studies wealth is assumed to be exogenous and the net use of a resident's land is not considered. Ignoring the effect of a landowner's position in the land market may not be appropriate. After all, the ownership and net use (lessee, lessor, etc.) of land may vary significantly across landowners, and farmland preservation efforts may affect property values (see Irwin and Bockstael). In these situations, resident support for farmland preservation will depend on the perceived amenity benefits *and* the interplay between a landowner's position in the land market and changing land prices. The latter relationship is the primary focus of our theoretical model.

The model we present in the next section builds on, and is influenced by, the Cooley and LaCivita theory of growth controls. The model set-up and subsequent derivations link government efforts to preserve farmland to two effects experienced by the landowner: (1) a capitalization effect, (2) an effect on farm profits, and (3) an amenity effect. The impact on utility of the former effect depends on whether one is a net buyer or a net seller of land services. For the purposes of our theoretical section, net buyers are those who use more land services than their initial endowment. The net buyer must access land services (by direct purchase of land or

renting) in the land market. Net sellers, on the other hand, consume less land services than their initial endowment and are assumed to sell or lease the remainder.

Our empirical analysis examines landowner support for agricultural zoning. We use data from 1,037 surveys completed by owners of agricultural land in Kent County, Michigan and explicitly test hypotheses derived from our theoretical framework. The empirical findings are consistent with our primary hypothesis that net buyers and net sellers of land differ in their likely support for agricultural zoning for a given effect of zoning on land prices.

### ***Theoretical Framework***

We develop a theoretical model that links changes in land use policy to changes in individual utility. We derive explicit relationships between land use policies (i.e., changes in governance) and individual utility. In our framework, farmland preservation is achieved by government policy which places constraints on how agricultural land can be developed. Farmland preservation has direct and indirect effects on utility. The direct effect results from the increased level of amenities provided by farmland. The indirect effect results from changing land prices, a result that affects individuals as users of priced land services and as holders of land assets.

An individual gains utility from consuming a private good,  $x$ , land services,  $l$ , and public good environmental amenities,  $a$ . The market price for private goods is  $p_x$ , and the per-unit price of privately consumed land services is  $p_l$ . The land services provided by housing and privately-owned recreational land directly enter the utility function. The land services provided by agricultural land in production are factors of production and enter the farmer's profit function. We assume that both markets are competitive. An individual earns income  $w$  from labor and receives payments  $p_l$  from land holdings (land endowment),  $\bar{d}$ . Farmers and non-farmers are assumed to earn an equivalent wage,  $w$ . We assume that the wage is set in a broader market than

the jurisdiction and it is not affected by changes in land use policy. The price of the commodity produced by an agricultural landowner who is also a farmer is,  $p_c$ . With respect to the commodity the agricultural landowner is a price taker. The individual chooses private goods and land services in order to maximize utility subject to the budget constraint. The maximum level of utility given prices and income,  $y$ , is summarized by an indirect utility function ( $V$ ):

$$(1) \quad V(p_x, p_l, y; a) = \max_{x,l} u(x, l; a) \text{ s.t. } y = w + \pi(p_c, p_l) + p_l \bar{d}.$$

Income,  $y$ , is the sum of wages,  $w$ , farm level profits,  $\pi$ , and income from land holdings,  $p_l \bar{d}$ .

To keep the model simple we assume that the level of the public good amenity,  $a$ , is determined by local farmland preservation,  $f$ . The amount of farmland preservation is in turn determined by local governance,  $g$ . Local governance includes rules and regulations that influence the bundle of rights associated with land ownership. These rules and regulations can limit or expand the amount of farmland preserved in the local jurisdiction. These relationships are specified as follows:

$$(2) \quad \begin{aligned} a &= a(f), \quad a' > 0, \quad a'' < 0 \\ f &= f(g), \quad f' > 0, \quad f'' < 0. \end{aligned}$$

By including a farm level profit function we are able to take into consideration the effect of a change in a land use policy on agricultural landowners who also farm. Economic profit in equilibrium is assumed to be zero. As stated earlier, the return to farmers' and non-farmers' labor is assumed to be equivalent and exogenously determined. Thus, wages are held constant with respect to changes in amenities and land prices. The price of the commodity produced,  $p_c$ , is also assumed to be exogenous to the model. Changes in land prices are not exogenous to the

model and, while economic profits remain zero, changes in land prices can affect demand for land as an input in production.

Migrations into and out of the local jurisdiction are assumed to respond to changes in amenities and land prices. Because amenities are valued, land prices are expected to rise and fall with the level of amenities. In our model we assume that the level of amenities, a function of the level of farmland preserved,  $f$ , is ultimately a function of government policy. Governance also affects land prices directly through rules and regulations that affect the allowable uses of land and the transactions costs associated with trading and holding land. The indirect and direct relationship between governance and land prices is assumed to be as follows:

$$(3) \quad p_l = p_l(a(f(g)), g).$$

Substituting equations two and three into the indirect utility function expresses indirect utility as a function of goods prices, wages, land endowment, and governance,

$$(4) \quad V(p_x, p_l, y; a) = V(p_x, p_l(a(f(g)), g), y; a(f(g))),$$

$$\text{where } y = w + \pi((p_c, w, p_l(a(f(g)), g)) + p_l(a(f(g)), g)\bar{d}.$$

We take the total derivative of equation 4 with respect to a change in governance,  $dg$ , to model the effect that changes in governance, regarding agricultural land use, have on individual

utility. Recall that  $p_x$  is a numeraire good and  $\frac{dp_c}{dg} = \frac{dw}{dg} = 0$  by assumption.

$$(5) \quad \frac{dV}{dg} = \left( \frac{\partial V}{\partial p_l} \frac{\partial p_l}{\partial g} + \frac{\partial V}{\partial p_l} \frac{\partial p_l}{\partial a} \frac{\partial a}{\partial f} \frac{\partial f}{\partial g} \right)^A + \left[ \left( \frac{\partial V}{\partial y} \frac{\partial y}{\partial p_l} + \frac{\partial V}{\partial y} \frac{\partial y}{\partial \pi} \frac{\partial \pi}{\partial p_l} \right) \left( \frac{\partial p_l}{\partial g} + \frac{\partial p_l}{\partial a} \frac{\partial a}{\partial f} \frac{\partial f}{\partial g} \right) \right]^B + \left( \frac{\partial V}{\partial a} \frac{\partial a}{\partial f} \frac{\partial f}{\partial g} \right)^C.$$

The total derivative is expressed in three parenthetical terms denoted by: A, B, and C.

Parenthetical term, A, expresses changes in indirect utility that result from changes in consumption of private land services brought about by changes in the price of land services. The



price of land services is directly influenced by both regulation (the most left hand term) and changes in the level of surrounding amenities. This latter effect is a pecuniary externality that is capitalized into the price of land. The second parenthetical term, B, expresses how indirect utility changes due to changes in the level of income. Because wages are assumed to be exogenous to the model, changes in income are brought about by changes in the price of land.

The third parenthetical term, C, examines the amenity benefit of increased levels of preserved farmland. We assume the net effect of bracket C is positive. Hence, changes in governance that increase the quantity of farmland augment surrounding amenities and thereby enhance utility.

Equation five can be simplified so as to illuminate the relationship between utility, the capitalization effect, and net use of land services. We rearrange terms in equation five and employ Roy's identity (Varian, p.106) to identify,  $-l^h$ , where  $l^h$  is the level of land services consumed for private household use and recreation. We also use the notation,  $-l^a$ , to symbolize the negative of the factor demand for land in agricultural production; the partial of the profit function with respect to the input price,  $p_l$ , for land services. Finally, the partial of the income with respect to farm level profits is assumed to be equal to one. Equation five is now expressed as:

$$(6) \quad \frac{dV}{dg} = \left[ (\bar{d} - l^h - l^a)^D \left( \frac{\partial p_l}{\partial g} + \frac{\partial p_l}{\partial a} \frac{\partial a}{\partial f} \frac{\partial f}{\partial g} \right)^E \left( \frac{\partial V}{\partial y} \right) \right]^F + \left( \frac{\partial V}{\partial a} \frac{\partial a}{\partial f} \frac{\partial f}{\partial g} \right)^C.$$

We use this equation, equation six, to facilitate a more refined discussion of the relationship between net use of land and the utility effect associated with a change in governance. Brackets F and C contain terms that describe, respectively, the net effect on indirect

utility that results from changes in the price of land and the level of amenities. Bracket F is comprised of two important effects, which we identify using sub-brackets D and E. The first term, bracket D, describes the relationship between an individual's own use of land and initial level of land ownership or land endowment. If the individual's use of land,  $l^h + l^a$ , equals the initial endowment,  $\bar{d}$ , the entire term contained in bracket F equals zero. In this situation the change in indirect utility will be entirely due to changes in the level of amenities provided by the farmland preserved. Alternatively, however, the individual may be a net buyer,  $\bar{d} - l^h - l^a < 0$ , or net seller of land,  $\bar{d} - l^h - l^a > 0$ . For the purposes of our theoretical framework we assume that some landowners are net buyers and some are net sellers.

Bracket E describes how the change in government efforts to preserve farmland affects the price of land. As in equation five, the model allows for two capitalization effects. The first effect is represented by the most left-hand term in bracket E. This effect results from rules and regulations that alter the set of services which land can supply to its owners. For example, the development services provided by land are altered in a zoning scenario. As we noted in the introduction, in our discussion of zoning, the sign of this term may be positive or negative.

The second term in bracket E relates changes in governance to changes in land prices through the pecuniary externality effect of increased amenities. For example, agricultural zoning may increase the amount of farmland and in turn generate amenity benefits that become capitalized into property prices. We assume that publicly preserved farmland is an amenity and, therefore, bracket E is expected to be greater than or equal to zero.

We infer an interesting point from equation six: *So long as landowners differ in their net uses of land (i.e., net seller, net buyer), a land use policy's effect on utility will vary across landowners, even in scenarios where a land use policy increases (decreases) land prices.* Stated

again, using the relationships identified in equation six, the utility effect of bracket F may be positive or negative regardless of whether bracket E, the capitalization effect, is positive or negative. This implies, for example, that a farmer who is purchasing greater amounts of land services than her endowment may be pleased to learn that land prices will uniformly fall as a result of a land policy. Conversely, the uniform decline in land prices is unlikely to please her if she consumes less of her endowment of land services and sells (or rents) the remaining portion.

In the following sections we use the model to develop specific hypotheses and examine these hypotheses using a survey of agricultural landowners. We apply our framework to examine agricultural landowners' support for agricultural zoning. However, the above theoretical framework can be applied to a variety of property owners (e.g., residential homeowners) facing a number of different land use policies such as agricultural zoning.

### **A Choice Model of an Agricultural Landowner's Decision to Support Agricultural Zoning**

In a choice setting, an agricultural landowner's decision to support agricultural zoning occurs when:

$$(7) \quad V_i^1(P_x, P_l^1, Y^1; a^1) - V_i^0(P_x, P_l^0, Y^0; a^0) > 0.$$

Superscript  $1$  indicates the price, income, and amenity levels after an agricultural zoning policy has been implemented. Superscript  $0$  identifies the equilibrium prices, income, and amenity levels that exist prior to agricultural zoning. The individual is assumed to have perfect knowledge of his or her equilibrium level of utility before and after zoning. In equation six we described the set of relationships that determine whether the land use policy is likely to result in higher levels of indirect utility. Within the theoretical framework these relationships determine whether  $V_i^1 \succ V_i^0$ .

As discussed earlier, we are particularly interested in examining how differences in land ownership – i.e., net buyer and net seller – affect utility and influence support for land use policy. Recall that the net effect of bracket F in equation six depends on the signs of both brackets D and E. Bracket D characterizes a landowner as a net buyer, a net seller, or consumer of her endowment of land services. Bracket E captures both the direct and indirect effects of zoning on land prices. Regardless of the sign of bracket E, the net effect of bracket F depends on the sign of bracket D. Therefore, given a zoning policy and holding the direct amenity affect, bracket C, constant, the difference between  $V_i^1$  and  $V_i^0$  will vary depending on the net use of land. This point is made more clearly in table one.

Table one provides an overview of the potential utility effect of a land use policy that changes the land price. The first column categorizes a landowner as either a net seller or a net buyer. The second column describes a situation in which the price of land increases as a result of a policy to preserve farmland. The marginal net effect on  $V_i^1$  depends on whether the landowner is a net buyer or a net seller. Based on the theoretical model, a net seller's indirect utility increases with the price of land; a net buyer's indirect utility is reduced. Conversely, price declines are expected to increase  $V_i^1$  marginally for net buyers and diminish  $V_i^1$  for net sellers.

We use a probit model to examine our net buyer and net seller hypotheses. The probit model uses a maximum-likelihood technique and is well established in the economics literature. Using this technique we estimate the  $\beta$  coefficients for a set of explanatory variables,  $x$ , including two categorical variables that identify net sellers and net buyers. The probability that a landowner will support a land use control,  $y \neq 0$ , is assumed to follow a cumulative normal distribution,  $\Phi$ , and the  $\Pr(y = 1|x) = \Phi(x\beta)$ .

## Survey

In March 1998, Michigan State University Extension mailed a survey to 3076 Kent County landowners. One thousand thirty-seven responses were returned (a thirty-three percent response rate). Kent County has traditionally been one of the more important agricultural counties in the state, but agriculture is threatened by the rapidly expanding metropolitan area of the city of Grand Rapids, which is located in Kent County. Between 1990 and 2000, the population growth rate in Kent County was nearly twice that of the state of Michigan (U.S. Census Bureau, n.d.). Population growth in Kent County and the associated spread of development into traditionally rural areas have heightened concerns about farmland preservation. In 2002, Kent County passed an ordinance to establish a Purchase of Development Rights program. Although county funding has not been forthcoming, a combination of federal, private and township funds enabled the purchase of permanent easements for three farms in 2004. While county funding remains problematic, the county goal is to permanently preserve 25,000 acres by 2013, or approximately twenty-five percent of farmland in the county (Wills).

For the 1998 survey, agricultural landowners were identified using USDA Farm Services Agency records. The survey was designed to improve understanding of agricultural landowners' perceptions of land use issues and appropriate land use policies. The stated objectives of the survey were: (1) to obtain opinions of agricultural landowners on farmland preservation issues; (2) to generate information for elected officials concerning the opinions of landowners; and (3) to the extent possible, determine the educational needs of agricultural landowners (Extension Bulletin, 1998).

The mail survey consisted of sixty questions. Most questions asked respondents to indicate *how concerned* or *how strongly* they felt about an issue or statement. For example, respondents were asked how concerned they were about urban sprawl. Respondents selected

from the categories “very concerned,” “concerned,” “not very concerned,” “not concerned at all,” and, “no opinion.” Several questions asked respondents to indicate whether or not they would favor government land use policies designed to preserve farmland. Finally, a number of questions were designed to gather demographic information and assess agricultural landowners’ current and future expectations related to land use.

We did not design the survey, and it was not developed to test hypotheses related to our theoretical interests. However, the survey did generate a great deal of information uniquely suited to our theoretical interests. Most importantly, the survey was targeted to agricultural landowners and gathered information about their support for agricultural zoning and their current and future expectations about land use. As a result, the survey provides data that enables us to examine our primary hypothesis that net buyers’ and net sellers’ support for land use policies differ in situations where the effect on land prices faced by each is the same.

In the remainder of this section we describe the variables used in our empirical analysis and develop a set of testable hypotheses. Table 2 shows a list of variables and their hypothesized effects on the probability that a respondent will support agricultural zoning. The dependent variable, *zoning*, is a categorical measure indicating whether or not an agricultural landowner would support a zoning proposal. Survey respondents were asked, “Would you favor government restriction of development on your land in order to preserve farmland?” Fifty-eight percent of the respondents indicated that they would “be opposed,” whereas only twenty-two percent indicated that they “would be in favor.” Zoning equals 1 if respondents indicate “I would be in favor;” all other categories (opposed or no opinion) were assigned the number zero. We suspect that asking respondents whether they would support development restrictions on their own land to preserve farmland is a more appropriate approach than asking their opinions about strict

agricultural zoning. The survey revealed that 52% of respondents were not familiar with the concept of exclusive agricultural zoning. There are no examples of exclusive agricultural zoning (where only agricultural uses are permitted) in Michigan. However, some townships are using large minimum lot sizes (e.g., one non-farm house per 80 acres) as a means of supporting agricultural land uses.

One of our primary arguments is that heterogeneity in support for agricultural zoning arises because of differences in how landowners use their land. Our theoretical framework implies that net buyers and net sellers differ in their support for strict agricultural zoning given the same effect of zoning on land prices. In the theoretical model, a net buyer (net seller) is someone who consumes more (less) than her endowment of land. In our empirical model we assume that a net seller is someone who plans to sell her land for development. Survey respondents were asked, “What are your potential future plans for the agricultural land you own?” Four options were presented: (1) continue to own or rent as farmland, (2) transfer the farm on to the next generation, (3) sell the land to another farmer, (4) sell the land for development, (5) other. Twenty-five percent of the survey respondents indicated that they planned to sell their land for development. A categorical variable for net seller, *net seller*, is used to identify respondents who plan to sell their land for development.

The *net buyer* variable was more difficult to measure because no single question in the survey explicitly establishes whether or not a landowner plans to buy more land. Therefore, we use responses from three survey questions, all of which address future land-use expectations, to identify a subset of respondents we characterize as net buyers (i.e., likely to purchase and/or rent additional land). When asked about future plans (discussed in the preceding paragraph), 56% of the respondents indicated that they will continue to own or rent as farmland. A categorical

variable, *farmer*, identifies this subset of respondents as one, all else as zero. Survey respondents were also asked, “Do you plan to make major capital investments (buildings, machinery, or *land*) over the next five years [emphasis added]?” Twenty-six percent of respondents indicated “yes,” and the remaining seventy-four percent indicated either “no” or “not sure.” A categorical variable, *capital*, designates all yes responses as one; all others are set equal to zero. Finally, twenty percent of the respondents were currently renting land from others. A categorical variable, *lessee*, designates this set of respondents as one, all else as zero. We use the intersection of these three variables – i.e., someone who plans to remain in farming, plans on making a capital investment, *and* is currently renting land – to identify a subset of respondents whom we identify as net buyers. Seven percent of respondents – who supplied responses to all three questions – are categorized as *net buyer*. Given rapid rates of urbanization in Kent County, we were not surprised by the relative distribution of *net sellers* to *net buyers* in the survey sample.

We use equation six to clarify the hypothesized relationship between the probability that a landowner will support zoning and the *net buyer* and *net seller* variables. Bracket D, in equation six, is expected to be negative for a net buyer and positive for a net seller. However, taken by itself, the sign of bracket D is not a clear indication of the effect of zoning on utility. Rather, the utility effect depends on the interaction of bracket D (net use) and bracket E (the effect of zoning on the price of land). As discussed earlier, we expect net sellers and net buyers to respond differently given a similar change in land prices. For example, assume that agricultural zoning reduces the value of all farmland (the sign of bracket E is negative). Despite this negative effect, the sign of the total effect (bracket F) is hypothesized to be positive when the landowner is a net buyer and negative when the landowner is a net seller.



We have already discussed, in the introduction, the important argument that agricultural zoning does not necessarily reduce agricultural land prices. However, there may be some situations, particularly in rapidly urbanizing areas, where all agricultural land parcels have a higher value in non-agricultural development than in agriculture use. For our study area, Kent County, Michigan, we expect zoning to reduce agricultural land prices. Development rights purchases made in Kent County illustrate the differences between market value of farmland and the value of farmland where development is precluded (agricultural use value). These differences are substantial. The four farms that have sold development rights (three in the county program in 2004, one in the state program in 2000) are located at various distances from Grand Rapids and in different agricultural production regions. The differences between market value and agricultural use value range from approximately \$1500/acre to \$4200/acre (Wills 2004; Harlow 2004). Even in a township with zoning restrictions of one house per 80 acres in its agricultural zones, the difference between the market value and the agricultural value was \$2400 per acre. The significant costs of purchasing development rights suggest to us that agricultural zoning would reduce agricultural land prices and that this effect is likely to occur across most, if not all, zoned parcels.

As discussed earlier, we expect net sellers and net buyers to respond differently when facing the same change in land prices. This difference is illustrated in equation six. Despite the assumed negative sign for bracket E, the sign of the total effect (bracket F) is positive when the landowner is a net buyer and negative when the landowner is a net seller. Thus, we hypothesize that net sellers are less likely to support zoning; net buyers, on the other hand, are more likely to support zoning. Hence, the coefficients of *net seller* and *net buyer* are expected to be, respectively, negative and positive.

Our assumption that zoning would reduce agricultural land prices is also consistent with the expectations of many survey respondents. Seventy-four percent of the survey respondents agreed or strongly agreed with the statement “My land is more valuable for development than for farming.” We incorporate this expectation using a categorical variable, *dev value*. *Dev value* identifies the subset of respondents who indicated that their land is more valuable in development. We hypothesize a negative sign for the coefficient of *dev value*; respondents are less likely to support zoning if they expect their land has greater value in development.

Support for zoning is also expected to depend on perceived amenity benefits. In equation six, this effect is represented by bracket C. An increase in the amount of publicly preserved farmland is expected to have positive amenity benefits to landowners. Forty-two percent of respondents indicated that they were “very concerned” about the loss of open space. The remaining categories include ‘concerned’, ‘not-very concerned’, ‘not-very concerned at all’, ‘and no opinion’. A categorical variable, *amenity*, is used to differentiate respondents who were very concerned about the loss of open space in Kent County. All else equal, we hypothesize *amenity* to have a positive influence on the probability that a respondent will support zoning. Hence, the sign of its coefficient is expected to be positive.

Five additional variables are used in the regression analysis:  $\ln(acre)$ , *farm-income*,  $\ln(own)$ , *gender*, *age*. The  $\ln(acre)$  variable measures the natural log of the number of acres owned by the respondent. We hypothesize this variable to have a negative influence on the probability that a landowner will support zoning. In an urbanizing situation where the capitalization effect of zoning is expected to be negative, the magnitude of the negative capitalization effect is augmented by the amount of land owned. *Farm-income* is a categorical variable that equals one if a respondent indicated that greater than 75% of his or her family

income comes from the farm; the remaining responses (less than 25%, 25-50%, 50-75%) are set equal to zero. This subset of respondents may have relatively more productive land and, therefore, may expect greater gains to zoning than other landowners. (A similar argument is made by Henneberry and Barrows.) For this reason, we hypothesize a positive sign for the coefficient of *farm-income*; respondents who receive greater than seventy-five percent of their income from farming are expected to have a greater probability of supporting zoning.

The  $\ln(own)$  variable measures the natural log of the number of years the respondent, or the respondent's family, has owned agricultural land in Kent County. We include this variable as an exploratory variable to examine whether a respondent's agricultural heritage influences support for zoning. *Gender* is a categorical variable that equals one if a respondent is female. Finally, the survey categorized the age of the respondent using four categories: (1) under 35; (2) 35-50, (3) 51-65; and (4) over 65. Roughly 66% of the respondents designated themselves as 51 years of age or older. The categorical variable, *age*, differentiates the subset of respondents who are 51 or older from those respondents younger than 51.

## **V. Empirical Results**

Table 3 provides summary statistics for the variables used in the regression. Twenty-two percent of the respondents are categorized as being in support of agricultural zoning. Twenty-five percent of the respondents indicated that they intended to sell their land for development and are therefore categorized as net sellers. Seven percent of the sample is categorized as net buyers. The relatively higher number of net sellers is unsurprising given that seventy-four percent expected their land to be more valuable in development than in its current use. Forty-two percent of the sample indicated that they were very concerned about the loss of open space. Mean acres owned was approximately 120 with a standard deviation of 176. The distribution

was skewed to the right as a result of a few very large landowners and a large number of landowners with small acreage. Only a small percentage (15%) of respondents indicated that greater than seventy-five percent of their income came from farming. Thirty-two percent of the sample was greater than fifty-one years of age and only fifteen percent of the surveys were completed by women. Fifty-six percent of the respondents plan to continue farming or renting farmland; twenty-six percent indicated that they planned to make a capital investment. Only 20% were currently renting land.

Table 4 provides a summary of the regression results. The non-parenthetical terms in the columns indicate the expected marginal effect of a unit change in the variable on the probability that a landowner will support zoning (i.e. *zoning* = 1), holding all other variables constant. The parenthetical terms report robust standard errors. Two regressions are reported. The first regression does not include the variables that were used to categorize the subset of respondents as net buyers. The second regression includes these variables in order to assess their separate effects.

The results reported in regression one and regression two support hypotheses derived from the theoretical model. Since the regression results are similar we provide interpretive results for regression one. We will use regression two to more fully examine the variables used to construct net buyer. Marginal effect estimates are considered statistically significant if their p-value is less than .05.

The regression results are consistent with our hypothesis that net sellers are less likely to support zoning. The probability of supporting zoning associated with being categorized as a net seller is reduced by fourteen percentage points. On the other hand, the probability of supporting zoning associated with the net buyer is increased by twenty-two percentage points. Both

variables are statistically significant. As hypothesized, the coefficient estimates of *net buyer* and *net seller* have opposite signs.

The marginal effect estimate for *dev value* is negative. Respondents who indicated that their land had greater value in development are less likely – a reduction of thirteen percentage points – to support zoning. This finding is statistically significant and consistent with the hypothesis that, all else equal, landowners are less likely to support agricultural zoning if it restricts their capacity to develop land that has relatively greater value in development than in agricultural use. The marginal effect estimate for the *amenity* variable is positive and statistically significant; being categorized as one who is very concerned about the loss of open space increases the probability of supporting zoning by approximately twenty percentage points.

In the preceding section the variables *net seller*, *net buyer*, *dev value*, and *amenity* were directly linked to our theoretical model. Each of these variables was statistically significant and the signs of the coefficients were consistent with our hypotheses. Net sellers were expected to react negatively to a zoning policy that would reduce the value of the land they were selling. On the other hand, net buyers were expected to respond more favorably to zoning because they would face lower prices in their bids to purchase or rent additional land. All else constant, however, landowners hesitate to support zoning if they expect the value of their land is greater in development. Finally, as hypothesized, concerns about open space are expected to increase the probability of support for zoning through the amenity effect (see bracket C in equation six).

The remaining variables were not directly linked to our theoretical model. Nonetheless, it is standard to include a number of demographic variables that might help explain variation in preferences amongst respondents. However, the additional variables –  $\ln(\text{acres})$ , *farm-income*,  $\ln(\text{own})$ , *age*, and *gender* – are not statistically significant and the magnitudes of the coefficient

estimates are small. Nevertheless, all of the variables have a directional effect consistent with our hypotheses.

In table 4, regression two includes the variables *farmer*, *capital*, and *lessee*. In a Venn diagram, the intersection of *farmer*, *capital*, and *lessee* identifies the subset of respondents we categorized as net buyers. The purpose of regression two is two-fold. First, we want to make sure that the subset identified as net buyers has a probability effect that is unique. Second, we want to examine whether the results are sensitive to the inclusion of the three variables. None of the variables are statistically significant. Moreover, the inclusion of these variables does not alter the statistical significance or qualitative interpretation of the *net buyer* coefficient; the magnitude of the coefficient changes slightly. Table 5 provides a correlation matrix for the *net buyer*, *farmer*, *capital*, and *lessee* variables. Despite moderate correlation between these variables, their omission from regression one does not appear to bias the statistical and qualitative interpretations of the *net buyer* coefficient. For this reason, we conclude that the *net buyer* variable identifies a unique subset of respondents. The lack of apparent bias in regression one is likely due to the fact that the variables are only moderately correlated and the marginal effect estimates for *farmer*, *capital*, and *lessee* are small.

#### *Sensitivity Analysis*

Additional sensitivity analyses examine the robustness of the regression results presented in table 4. The *net buyer* and the *net seller* variables were conceptualized as mutually exclusive categories but their construction does not necessarily insure that they are. Fourteen respondents indicated that they planned to sell land for development and, in addition, were categorized as being a net buyer. This is not implausible given the many different buying and selling options available to landowners. The regressions were run again omitting these fourteen respondents.

The qualitative interpretations and statistical significance of the variables did not change.

Moreover, the changes to the magnitudes of the marginal effect estimates are slight.

We are concerned that the survey was sent to a number of non-agricultural landowners. The executive summary of the survey report suggested that the survey was sent to agricultural landowners with greater than 10 acres of land. However, some survey responses indicated to us that smaller, non-agricultural landowners were likely to have been included in the sample. For this reason, we re-estimated our regressions dropping any respondent who did not provide information on the amount of land owned in agricultural production. (Many respondents provided information on total land owned but did not indicate the amount of land in agricultural production. We assume, for the purposes of the sensitivity analysis, that these respondents were not agricultural landowners.) Three hundred and eighty-eight observations were dropped, reducing the total number of observations in the regression to 536. The signs and the statistical significance of the coefficient estimates remain the same as those reported in table one. The magnitudes of the estimates of the marginal effects are changed only slightly. For example, the marginal effect estimates for *net seller* and *net buyer* were -.13 and .23, respectively.

## **Implications**

The impact that land-use policies will have on farmers and agricultural landowners is often a source of great debate. It is not uncommon to find agricultural landowners on either side of a farmland preservation initiative. One popular perception is that farmers' support for agricultural land use policies depends on the policy's effect on land prices. Our findings support this perception.

In this paper we offered an additional wrinkle to the aforementioned argument. Our theoretical model suggests that, irrespective of the effect zoning has on land values, agricultural

landowners' support for zoning may vary as a result of their net use of land. Renters and future buyers of land perceive the benefits of zoning differently than net sellers, given the same change in land prices. This has important implications for understanding landowner support for land use policies. Some policies are likely to be preferred by farmers and agricultural land owners who plan to sell their land, while another set of policies is likely to be preferred by a subset of farmers and agricultural land owners who plan to remain in agriculture and add to their land base or continue to rent land from others. In these situations, agricultural zoning, or the lack thereof, leads to an asymmetric distribution of gains and losses depending on the agricultural landowner's net use of land.

Future empirical research needs to further examine the extent to which preferences for land use policies differ depending on agricultural landowner's net use of land. To the extent that these preferences do differ, policy discussions may be elevated by a better understanding of the distributive impact of land use policies (both proposed and the status quo). A better understanding of the distributive effect of land use policies is especially important for the agricultural sector because agricultural landowners and those actively engaged in farming are not necessarily one in the same.



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Table 1: Marginal Utility Effect of Land Price Changes by Category of Landowner.

Category of Landowner	Price of land increases.	Price of land decreases.
Net seller $\bar{d} - l^h - l^a \succ 0$	Marginal increases in $V_i^1$ .	Marginal decrease in $V_i^1$
Net buyer $\bar{d} - l^h - l^a \prec 0$	Marginal decrease in $V_i^1$	Marginal increases in $V_i^1$ .

Table 2. Description and hypothesized signs of explanatory variables.

Variable	Description of Variable	Hypothesized Sign
<b>Dependent Variable:</b>		
Zoning	= 1 if respondent supports restrictions on his own land to preserve ; 0 otherwise.	NA
<b>Explanatory Variables:</b>		
net seller	= 1 if respondent plans to sell land for development; 0 otherwise	–
net buyer	= 1 if respondent plans to keep farming, make a capital investment, and currently rents land; 0 otherwise.	+
dev value	= 1 if respondent indicates that her land has greater value in development.	–
amenity	= 1 if respondent indicates that she is very concerned about the loss of open space.	+
ln(acre)	= natural log of the number of acres owned by survey respondent.	–
farm-income	= 1 if respondent indicates that greater than 75% of income comes from agriculture.	+
ln(own)	= natural log of the number of years respondent's family has held agricultural land in Kent County.	+
age	= 1 if greater than 51, 0 otherwise.	?
gender	= 1 if female, 0 otherwise.	?
<b>Variables used to construct the Net buyer Variable:</b>		
farmer	= 1 if respondent plans to continue farming or renting farmland; 0 otherwise.	+
capital	= 1 if respondent plans to make capital investments (buildings, machinery, or land); 0 otherwise.	+
lessee	= 1 if respondent is currently renting some land; 0 otherwise	+

Table 3. Summary statistics for variables; percentages by category (0,1), mean, & std. deviation.

Variable	Observations	Description	Survey Statistics
Zoning	932	1 0	22% 78%
net seller	1037	1 0	25% 75%
net buyer	938	1 0	7% 93%
dev value	969	1 0	74% 26%
amenity	957	1 0	42% 58%
acre	900	mean std. deviation	120 176
farm-income	1037	1 0	15% 85%
own	914	mean Std. Dev.	57 39
age	940	1 0	32% 68%
gender	864	1 0	15% 85%
farmer	1037	1 0	56% 44%
capital	938	1 0	26% 74%
lessee	1037	1 0	20% 79%

Table 4. Probit regressions: marginal effect coefficient estimates with robust standard errors ( ).

Variable	Regression 1	Regression 2
<i>Dependent Variable = Zoning</i>		
<i>Explanatory Variables</i>		
net seller	-.147* (.030)	-.149* (.030)
net buyer	.220* (.079)	.252* (.107)
dev value	-.136* (.038)	-.135* (.039)
amenity	.195* (.032)	.193* (.033)
ln(acre)	-.021 (.015)	-.020 (.015)
farm-income	.001 (.048)	.009 (.051)
ln(own)	.0001 (.017)	.001 (.017)
age	-.0347 (.033)	-.037 (.034)
gender	.028 (.043)	.028 (.043)
farmer	-----	-.017 (.034)
capital	-----	.020 (.041)
lessee	-----	-.041 (.047)
Number of observations	723	723
Wald chi2 (9)	99.66	103.04
Pseudo R-squared	.169	.171

\* indicates statistical significance at the .05 level.

Table 5. Correlation Matrix (n =723) of specific variables

	net buyer	farmer	capital	lessee
net buyer	1.000			
farmer	.2241	1.000		
capital	.4933	.1880	1.000	
lessee	.5489	.0794	.2047	1.000