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Determinants of Farmland Value

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Introduction

The movement of America's population away from central cities into adjacent rural counties has generated a series of difficult policy challenges for federal, state and local governments. This great dispersal from the central cities, which has taken place since World War II, and has accelerated since the 1970s (Brown et al 1984:789), reversed a trend of movement from rural areas to the cities seen earlier in the century (Lockeretz, 1989:205; Vesterby and Heimlich, 1991:279). People leave central cities for many lifestyle and quality of life reasons including the perceived advantages of country life with its slower pace, healthier environment, lower crime rates and less expensive lifestyle (Nelson, 1986:310-311). However, this demographic trend also hastens the loss of prime farmland as agricultural land is converted to residential and commercial use (AFT 1994; Vesterby and Heimlich, 1991:283). Farming by its nature is land intensive, requiring large tracts of land for viable operation while generating less monetary return per unit of land than does any other land use. This makes it virtually impossible for a farmer to outbid competitors. Land conversion can cause problems for rural communities by exacerbating water pollution and other environmental problems, increasing the net cost of community services that must be provided for new residents, driving the values of agricultural land up and leaving farmers with a sense of impermanence which inhibits their investment in the land's productive capacity (Lockeretz, 1989:205-206; Vesterby and Heimlich, 1991:279).

A variety of policy tools have been used by states and localities to control or guide farmland conversion, with varying degrees of success. These tools range from indirect approaches such as taxation policies which differentially assess agricultural land on the basis of its production value to more direct approaches, such as zoning, the purchase of development rights and other land use controls (Coughlin et al, 1978:165; Forkenbrock and Fisher, 1983:25; Libby, 1996). Tax incentives to encourage farmers to remain active and viable are effective only if farmers consider the tax incentive to be more attractive than the added value of an alternative use of their farmland. Zoning that limits potential uses of land through regulation is predictably unpopular with the owners involved and may lead to legal action if lost economic opportunity is viewed as particularly onerous (Fischel, 1985). PDR has been criticized as a one time "cashing in" of development value, with too little attention to future land uses, land needs, or the interests of future owners.

The role of property value in policy making is one of such great importance that a majority of land use policy center around the definition of what exactly private property is, and how much government control of land use is legal or acceptable (Caldwell, 1987). The intersection between private property rights and public claims to land as a social good is one of increasing contentiousness. This is especially apparent as scientific advances clarify the role of land in maintaining a safe, clean environment and as economic studies show land value as deriving chiefly from its social value. These very real social benefits meet an increasingly contentious political climate that emphasizes individual values and land rights. Understanding the components of the value of land may shed light on this important question.

Economic literature suggests that property derives value from three different sources. First, the production value of land reflects its ability to provide consumers with goods and services through the extraction of minerals or organic goods as food and fiber. This value agrees with the notion that property value comes from the creative combination of land, labor, capital and management to produce something that people will pay for, generating income for the property owners. Returns to land as a productive resource are fairly easily measured. Consumptive value, in which individuals derive intrinsic enjoyment from the location or quality of land, and speculative value, in which the "returns" to land are based on potential future sales for development[1], are less easily determined. While both consumptive and speculative values entail social interactions in the definition of land value, productive outputs of land involve not only market interactions, but also vast natural ecosystems which are themselves affected by social interactions (Caldwell 1987; Libby, 1996). Therefore, even though land is seen as private property over which government, and thus society, has a limited role, land value results from social and political interactions within a structure of institutions and rules that create both opportunity and obligations for people.

Determinants of Land Value

Previous studies that have looked at the determinants of land value tend to group variables into clusters of factors. Included are variables that affect the production capabilities of the land, those that consider the location of the land in relation to certain services, certain non-production characteristics of the land such as the presence of a house on the property, and characteristics of land buyers and sellers. In addition, the value of land is affected by public policies that are implemented by states and localities.

Public Policies: Agricultural Zoning

Virtually all public policies employed by states and localities have an effect on land values by influencing the distribution of income-earning opportunity. The most obvious policy that directly affects potential returns to land is zoning (Pogodzinski and Sass, 1990:304). Because zoning limits the uses to which land may be put and mandates certain land use standards, owners are limited in their ability to develop their land as they see fit. Zoning may also constrain certain negative land use impacts that would decrease the value of the land (Pogodzinski and Sass, 1990:304-307).

There are two fundamental approaches to state and local agricultural zoning: inclusive and exclusive zoning. Although the exact format varies, inclusive agricultural zoning typically involves large minimum lot sizes, entitlement to the construction of single family homes on preexisting or newly formed and conforming lots, no requirements to demonstrate farm production and a wide range of land uses (NALS, 1981:110-121; Nelson,1990:134). The technique is frequently used to designate building areas for development with agriculture as an intermediate use. On the other hand, exclusive agricultural zoning is much more constraining in its approach, prohibiting non-farm activities and dwellings and mandating a large minimum lot size at a level considered necessary to sustain a viable farming operation (NALS, 1981:121-122; Nelson, 1990:135).

If the goal is farmland protection, the inclusive variety of agricultural zoning often leads to such "perverse outcomes" as rural sprawl and conversion or idling of prime agricultural land (Nelson, 1990:134). Large lot exclusive agricultural zoning, designed to control the conversion of farmland at the urban fringe to residential and other uses, is perceived as a more effective land use policy. Studies in Columbus, Ohio (Hushak, 1975), Brooklyn Park, Minnesota (Gleeson, 1979), Portland, Oregon (Knaap, 1985; Nelson, 1988), Salem, Oregon

(Nelson, 1985), Montreal, Quebec (Vaillancourt and Monty, 1985), and Beloit and Janesville, Wisconsin (Henneberry and Barrows, 1990) all show that large lot zoning has a significant negative effect on land prices.

The expected effectiveness of these zoning programs is often premised on the willingness of planning and zoning agencies to enforce their land use ordinances (Knaap 1985:32). This, in turn, may depend upon continued profitability of land use under the plan (Gleeson, 1979:362), while protecting the community's interest. There are five general agricultural zoning goals: keeping land in farming, protecting farm operations, protecting the agricultural economic base, reducing public service costs and saving environmentally sensitive lands (NALS, 1981:107-108). Although support for agricultural zoning is seldom overwhelming, farmers advocate this approach for the first three reasons, while the community members support it for the final two reasons (NALS, 1981:140-141). In essence, the reason for the success of agricultural zoning is due to each group wanting to avoid negative aspects of urban-rural conflict while retaining the benefits of their respective ways of life (Fischel, 1985:283-286).

Agricultural land owners in areas that may be developed without large lot zoning restrictions may experience increased land values due to lower taxes being capitalized into their farmland, as well as increased planning stability which allows for longer time horizons in the investment in the land's productive capacity. Likewise, for land owners in areas adjacent to agriculturally zoned areas there is an obvious increase in land values as well as greater certainty about the land's development potential (Henneberry and Barrows, 1990:251). At the same time, community members will pay less in taxes for the provision of public services while retaining open spaces implicit in bucolic rural lifestyles.

Production Values

It is generally assumed that land derives a good portion of its value from the characteristics of the parcel itself. The quality of the land may be affected by a variety of factors beyond such innate characteristics as the quality of the soil, its slope, and its erosiveness and flooding potential. Additional characteristics that have an impact include the size of the parcel, the amount of that land available for production purposes and the level of investment in factors that add to production values, such as roads and farm buildings.

Locational Factors

Location is an important determinant of land value. The price an individual will pay is influenced by access to various goods and services. The proximity of land to towns that offer amenities and services such as grocery stores, gas stations, educational facilities and video stores are expected to increase the value of land. In addition, population pressure from those nearby towns can be expected to increase rural land values (Chicoine, 1981; Dunford et al, 1985; King and Sinden, 1994; Nelson, 1986; Scharlach and Schuh, 1962; Xu et al, 1993).

Proximity to limited access highways, which may be used to transport both farm products and urban transplants who commute to work and enjoy the benefits of central cities, will enhance the value of the land. Therefore, it is expected that being near a highway exchange will add value to land (Chicoine, 1981; Dunford et al, 1985; Nelson, 1986; Peiser, 1989). In addition, proximity to state roads will likely have a positive effect on the value of land, as it allows for access to both towns and highways. However, strip development along those same state roads may have a price-depressing effect.

Buyer and Seller Characteristics

Obviously, the preferences of both buyers and sellers of land are reflected in the sale price. If the land attribute of central importance is its production value, its price will reflect relative productivity of alternative parcels (Dunford et al, 1985; King and Sinden, 1994). If, however, land is perceived as developable, the price ought to reflect its speculative value.

As can be expected, attempts to dissect the value of land in terms of theoretical concepts is difficult. Policies such as zoning affect productive, speculative or consumptive values of the land in positive or negative ways. Each of these values tend to affect the others in multiple ways, though the relative effects of each of these factors may be derived through statistical analysis of pertinent case studies, and inferences may then be drawn from the conclusions.

Case Study: DeKalb County, Illinois

DeKalb County, Illinois offers a prime case study of the relationship between urban and rural uses of land in the face of the growing urban five o'clock shadow of commuters desiring inexpensive land and lifestyles with limited negative aspects of city life. Located less than 65 miles from downtown Chicago and within 25 miles of suburban businesses and markets, DeKalb County provides urban transplants easy access to the Chicagoland metropolitan area. As a result, the city of DeKalb grew by 2,000 people from 1990 to 1995, to a population of 37,000 residents[2]. A survey of these new residents in 1992 showed that 35 percent moved from outside the county (Comprehensive Plan, 1995:24-30).

DeKalb County has historically been centrally involved with agricultural production, having some of the finest agricultural land in the world. The USDA Natural Resource Conservation Service has classified 98 percent of DeKalb County's land as prime farmland. This sets up a conflict between competing uses of the land, a conflict which was forecast in 1972 when DeKalb County developed its first comprehensive land use plan and implemented zoning with an inclusive agricultural zone based on a five acre minimum lot size for rural residences. When this plan was unsuccessful in discouraging development of good farmland, the minimum lot size was increased to 40 acres in 1974 (NALS, 1980: 115).

While DeKalb County is not considered to be directly pressured by metropolitan growth, the current comprehensive land use plan addresses growth pressures from the Chicagoland area. The major points of the plan assert the need to preserve prime agricultural land and other natural resources and their uses while accommodating controlled growth. As a result, the zoning of DeKalb County has been established to protect agricultural and other natural resource lands by only allowing development that is coterminous with existing municipalities, and only when full utilities are provided at the time of the development (Comprehensive Plan: Executive Summary, 1995). While the comprehensive land use plan is in place, it is expected that the county will still experience major growth pressure into the 21st century with resulting conflict over the development patterns and the zoning ordinances. Therefore, DeKalb County provides an important case study of conflict among production, speculative or consumptive land uses and the effect of zoning on land values.

Farmland Sales in 1995

As discussed, the value of land can be seen as deriving from its productivity, its location and policies such as zoning which will affect opportunity sets of market participants, and other variables that reflect consumptive and speculative values (see Table 1).

Data

Data for this study were collected from sources readily available to local policy makers or analysts. Our purpose is to suggest an approach to analysis accessible to local officials. Sales price data were selected public records of arms-length transactions maintained by the DeKalb County tax assessors office, as were data on land acreage, the productive value of the land, use characteristics of each parcel, the presence of roads, farm and non-farm buildings, the month of the sale, and whether or not sellers and buyers lived in DeKalb County. Data on the distance to roads, highways and farms were calculated from available maps and zoning characteristics of specific parcels came from official zoning maps.

Dependent Variable: Sales Price Per Acre

The 34 agricultural parcels analyzed for this study were sold in DeKalb County in 1995[3]. Their prices ranged from $45,000 to $1,121,672. The average price per parcel was $292,891. The average price per acre for the farmland parcels analyzed amounted to a little over $6,177, with a range of value from $760 to $31,457 per acre.

Independent Variables: Zoning Policy

Zoning in DeKalb County includes two different levels of agricultural zoning, as well as the usual residential, business and industrial districts. "A-1" agricultural district zoning is designed to "... ensure that land areas within the county which are well suited for production of food and fiber are retained for such production, unimpeded by the establishment of incompatible uses which would hinder farm operations and irretrievably deplete agricultural lands (DeKalb County Zoning Ordinance, 1991:29)." In order to be defined as a farm and thus receive zoning benefits, the real property must be used for commercial agriculture, and be comprised of at least 40 contiguous acres of which 25 have been used for agriculture over the last three years. If the land does not meet the acreage criterion, it may be defined as a farm if it produces a gross annual income of $13,590 on average over a three year period (DeKalb County Zoning Ordinance, 1991:10). Permitted land uses are limited to agriculture and other activities that preserve its natural state[4], although special uses of land and structures are permissible, and include airports, animal shelters, recreational camps, cemeteries, government buildings, fairgrounds, earth extraction activities, and similar activities. Standards allowing these special uses must be less suitable for commercial agriculture than other lands in the district, must minimize the amount of agricultural land converted, and cluster together with other like facilities when possible and appropriate (DeKalb County Zoning Ordinance, 1991:31-33).

"A-2" agricultural districts were established to provide a transition zone for land going from agriculture to other more intensive uses. Use of the land in A-2 districts follows the standards set for A-1 zones, although there is the expectation that the land will be developed when it is appropriate and the necessary public facilities are available. In this agricultural zone, the minimum lot area is decreased from 40 acres to 15 acres in order to allow for better transition (DeKalb County Zoning Ordinance, 1991:34-37).

Due to the fact that before 1972 lots zoned five acres or less could have a house built on them, and other agriculturally zoned land (A-1) required 40 acres for a single unit, we may expect a positive land value effect for small acreage which has been built on or may be built on, as they provide prime acreage ranchettes that do not involve large scale farming. Of 34 cases in this study, 11 were smaller than 40 acres. Therefore, these parcels smaller than 40 acres are "grandfathered" for houses to be built on them, making them more valuable, an unintentional side-effect of large lot zoning in DeKalb County.

Hypothesis #1:

The presence of large lot zoning will have a negative effect on a parcel's sales price per acre.

Production Variables:
The ability of the land to produce is contingent on not only the soil type and its ability to deal with erosion and flooding, but also the total contiguous acreage available to the farmer, the amount of that land appropriate for cropland, and the accessibility of the parcel. As a result, data collected showed that the 34 parcels sold ranged in size from three to 314 acres, with an average size of 82 acres. Previous studies considering land value have demonstrated a negative linear relationship between size and per acre land value.

Hypothesis #2:
Increases in the size of a parcel will have a negative effect on a parcel's sales price per acre.

The measure of cropland in a parcel was arrived at by dividing total acreage in cropland by the total acreage of that parcel. Values ranged from 21 percent to 100 percent of the land being used for crop production, with an average of 89 percent cropland[5]. It is hypothesized that the greater the percent of cropland, the greater the value of the parcel.

Hypothesis #3:
Increases in the percent of cropland on a parcel will have a positive effect on a parcel's sales price per acre.

The presence of a road on the property, which would positively affect land values due to transport capabilities, was coded as a dummy variable, with a score of "1" for the presence of a road, and a "0" for its absence. Of the 34 parcels considered, 29 had a road on the property. Due to increased accessibility, it is believed that the presence of a road on a parcel should have a positive effect on its value.

Hypothesis #4:
The presence of a road on a parcel will have a positive effect on a parcel's sales price per acre.

Finally, we measured the ability of the land to produce by considering the weighted productivity index, which is based upon a calculation of the soil's potential to produce one of Illinois' four principal grain crops: corn, soybeans, oats and wheat. The calculation is based on long-term estimated crop yields on an identified soil at a specified management level, a base yield for each crop, and the proportion of cropland acreage that is used for each crop in the area of the state where the identified soil occurs. The resulting index is then adjusted in cases where a soil is subject to slope, erosion or flooding. This paper looked at each farm parcel, summed the productivity index and then divided by the total acreage in each parcel for the weighted productivity index. For the 34 parcels sold in 1995, the average value of each parcel's soil ranged from an index value of 81.8 to 123.99 per acre, with an average value of 110.07 for all parcels sold in DeKalb County. Because a land's productive value is based on its soil quality and the potential effects of slope, erosion and flooding on its productivity, it is hypothesized that the greater the weighted productivity index, the greater the value of the land.

Hypothesis #5:

Increases in a soil's productivity index will have a positive effect on a parcel's sales price per acre.

Locational Variables:
DeKalb County has become an attractive place for commuters and businesses to locate due in great part to its accessibility. Distance to limited access highways, state roads and towns were measured in quarter mile increments along public access roads from the middle of the parcel to the locational variable tested. The major limited access highways (I-39, I-88, I-90) which link DeKalb County to Chicago and its suburbs, as well as the other major cities in the region, Rockford, can be reached quite easily, ranging from 0 to 25.25 miles, with an average distance of 10.7 miles from each of the parcels sold. The distance of the parcels from state roads, which is expected to have a positive relationship due to increased accessibility, is 2.8 miles and ranges from 0 to 7.75 miles. Finally, while the remoteness of rural areas is a draw for buyers of land, accessibility to the services of the local towns, such as schools, grocery stores, service stations and video stores, can also be important, with land closer to these towns being more valuable. Distance from the parcel to the closest town ranged from 0 to 7.75 miles, with an average distance of 4.5 miles.

Hypothesis #6:
Increases in distance from a limited access highway to a parcel will have a negative effect on a parcel's sales price.

Hypothesis #7:
Increases in distance from a state road to a parcel will have a negative effect on a parcel's sales price.

Hypothesis #8:
Increases in distance from a town to a parcel will have a negative effect on a parcel's sales price.

Other Variables:
Other variables that were anticipated to have an effect were month of sale, presence of a house on the land and location of the buyer and seller of the agricultural parcels. While sales of the land occurred throughout the year, 24 of the 34 occurred during the first and last three months of the year. While the pattern of sales reflects speculation about the future viability of farmland productivity, it was hypothesized that time would have a positive linear effect on sales prices due to inflationary and other macro-economic pressures.

Hypothesis #9:
Time, measured in months, will have a positive effect on a parcel's sales price per acre.

Likewise, the presence of a house on the property was assumed to have a positive effect on the land's value. This higher value includes not only the added capital on the parcel, but also the consumption value of having a house in the country. Of the 34 properties, eight had residences on the parcel.

Hypothesis #10:
The presence of a house on a parcel will have a positive effect on a parcel's sales price per acre.

Location of the buyer's residence was seen as having a potential effect on the land's value, with in-county buyers potentially representing a more production-based group, and out-of-county buyers representing a more speculative, development-based group. Six of the 34 parcels were sold to out-of-county buyers.

Hypothesis #11:
Buyer location outside DeKalb County will have a positive effect on a parcel's sales price per acre.

Similarly, location of the seller was seen as affecting sales prices. Sellers living in DeKalb County would likely see the land for its production value, and have a lower price reservation than out of county sellers who are likely to see the land in terms of its speculative value. Of the total 34 parcels, 22 were sold by persons from outside DeKalb County.

Hypothesis #12:
Sellers from outside DeKalb County will have a positive effect on a parcel's sales price per acre.

Analysis and Results
The model of land values was tested in two stages. The first stage analyzed relationships among the variables through the use of bivariate correlation (see Table 2). This approach allowed for relationships between all the variables to be analyzed for the magnitude of relationships, as well as to check for potential collinearity amongst the independent variables. In the second stage of the analysis Ordinary Least Squares regression techniques were used to test explanatory relationships between the determinants of farmland value and the per acre price of a farmland parcel while controlling for the other independent variables. For this study, we will first consider the results of the full OLS model, and then discuss the effect of each variable in relation to the posited hypotheses, both in terms of bivariate relationships and explanatory power of each alone in the OLS regression model.

The results of the full OLS regression, testing the determinants of sales price per acre of each parcel are displayed in Table 3. Results of the F-ratio, 5.61478, show the model to be highly significant, with the coefficient of determination (the R-Square) explaining over 76 percent of the variance in the dependent variable. The adjusted coefficient of determination (the Adjusted R-Square), which corrects for added variables and number of observations, shows that the model explains nearly 63 percent of the variance. The intercept for the multivariate model was $21,395, suggesting a base rate for the price per acre for the farmland parcels from which all variables discussed below must be related.

Zoning Policy
Hypothesis #1:
The presence of large lot zoning will have a negative effect on a parcel's sales price per acre.

The effect of agricultural zoning on the value of the farmland was quite strong in this case study, both in terms of the bivariate relationship and its effect in the regression model. Its correlation with the parcel's sales price per acre was -.65, which was highly significant. In the regression model, it was the strongest variable, and functioned in the predicted direction. By being zoned at 40 acres or more, the effect was to reduce the sales value per acre by

$11,064. Therefore, in both bivariate and multivariate approaches, hypothesis #1 was supported.

Production Variables

Hypothesis #2:
Increases in the size of a parcel will have a negative effect on a parcel's sales price per acre.

The bivariate analysis of this variable showed a moderately strong relationship in the predicted direction (-.42) that was highly significant. However, in the multivariate application, this variable was not significant, with the coefficient acting in the opposite direction from that hypothesized, adding $8.50 for each acre added to parcel size. This may be in part due to shared variance between it and the zoning variable. Both used size as a measure, with zoning using less than 40 acres and 40 acres or more as a standard[6]. In addition, the small size of the study's population may have an influence on the estimates, limiting our ability to not reject the null hypothesis.

Hypothesis #3:
Increases in the percent of cropland on a parcel will have a positive effect on a parcel's sale price per acre.

The percent of cropland in a parcel had a negligible influence on a parcel's sales price, both in bivariate and multivariate settings, being non-significant in both cases. In part, this may be due to the lack of variance in the variable, and the abundance of prime farmland in DeKalb County.

Hypothesis #4:
The presence of a road on a parcel will have a positive effect on a parcel's sale price per acre.

Oddly enough, the presence of a road on a parcel had a negative effect on the price of a parcel, although the level of significance of .10 for a one-tailed direction test was not reached in either the bivariate or multivariate conditions. This suggests that this variable was not important in determining the value of the land.

Hypothesis #5:
Increase in soil productivity index will have a positive effect on a parcel's sale price per acre.

In the bivariate case, the weighted productivity index was significant and quite strong (-.56). However, the variable operated in a counterintuitive direction, having a negative effect on a parcel's sale price per acre. In the multivariate model, when controlling for the other independent variables, the variable operated in the expected direction yet was non-significant.

Locational Variables

Hypothesis #6:
Increases in distance from a limited access highway to a parcel will have a negative effect on a parcel's sales price.

The bivariate relationship between a parcel's price per acre and distance from a limited access highway was statistically significant and operated in the expected direction, with a -.41 correlational relationship. Likewise, multivariate analysis showed the same negative relationship at a .05 level of significance. As shown by the regression coefficient, for every mile from a highway (I-37, I-88, I-90), the per acre value of a parcel decreased by $390.

Hypothesis #7:
Increases in distance from a state road to a parcel will have a negative effect on a parcel's sales price.

Distance from a state road was shown to be non-significant in the bivariate conditions, although the relationship of the variables was in the predicted direction. The multivariate equation, controlling for other variables, suggested that the impact of distance from a state road was significant at the .10 level for a one-tailed test. The regression coefficient for this variable suggested that the per acre value of a parcel was adjusted downward by $577 per mile from a state road.

Hypothesis #8:
Increases in distance from a town to a parcel will have a negative effect on a parcel's sales price.

The bivariate relationship between the value per acre of a parcel and the distance from a town showed the opposite relationship of that shown by the distance from a parcel to a state road. In other words, the bivariate relationship was highly significant and correlated in the hypothesized direction at a moderate level (-.41). In the multivariate condition, the relationship was non-significant, although the regression coefficient performed in the expected direction.

Other Variables
Hypothesis #9:
Time, measured in months, will have a positive effect on a parcel's sales price per acre.

The control variable for time was shown to have a non-significant effect in both bivariate and multivariate conditions. However, the placement of this variable in the multivariate regression treatment was important in order to control for the effect of time on the price of parcels, which was minimal.

Hypothesis #10:
The presence of a house on a parcel will have a positive effect on a parcel's sales price per acre.

The effect of having a house on a parcel was significant at both the bivariate and multivariate levels. At the bivariate level, there was a moderate positive relationship between the price per acre of a parcel and the presence of a house (.41). In the multivariate model, the presence of a house was significant at the .10 level for a one-tailed test, and can be seen as adding $2,996 to the value of a parcel per acre.

Hypothesis #11:
Buyers from outside DeKalb County will have a positive effect on a parcel's sales price per acre.

The relationship between a buyer coming from outside of DeKalb County and the price of a parcel per acre was non-significant in the both the bivariate and multivariate treatments. Both the bivariate correlation and multivariate regression coefficients had an effect that was in the direction contrary to that posited by the hypothesis, although the effect was close to zero.

Hypothesis #12:
Sellers from outside DeKalb County will have a positive effect on a parcel's sales price per acre.

Finally, the relationship between the price per acre of a farmland parcel and the seller's location was shown to be weak and non-significant in the bivariate condition. In the multivariate regression model, the relationship operated in a manner contrary to the hypothesis, with sellers from outside DeKalb County having a negative effect on the sales price, although it was significant at the .10 level in a one-tailed test (however, one-tailed tests are premised on a theoretical directional basis). The sales price paid per acre in the multivariate form decreased by $2,225 per parcel when the buyer came from outside the county.

Discussion
Through the use of bivariate and multivariate analytic methods we were able to test several hypotheses as to the relationship of theorized determinants of farmland value. Bivariate correlational analysis showed that six variables were significantly correlated with price per acre of a farmland parcel. Of these six variables, five (large lot zoning, total acreage, distance from a highway and distance from a town and the presence of a house on the parcel) were correlated in the hypothesized direction, with one, the weighted productivity index, acting in a counter-intuitive fashion with greater soil values negatively correlated with the land price.

The regression analysis, by controlling for the effects of all the variables in the equation, allowed for alternative hypotheses to be simultaneously tested, and theories to be compared. The large lot zoning hypothesis was the most significant variable in the equation and operated in the hypothesized direction, suggesting that governmental policies (zoning) do indeed have a major effect on the value of farmland, at least in DeKalb County with its population pressures. Distance variables, especially distance from limited access highways and state roads, performed in the expected direction and were significant. Although distance from a town was close to statistical significance, it at least operated in the expected direction, further suggesting the influence of distance.

As expected, the presence of a house on a parcel was statistically significant, and added value to the farmland parcel. However, the preliminary hypothesis that a seller from outside DeKalb County would seek to derive more monetary value from the parcel sale, based on our belief that "outsiders" would be more likely to be speculators, was not upheld. Instead, there was a weakly significant relationship in the opposite direction, suggesting that out-of-county sellers would market their land for over $2,100 less per acre than would in-county residents.

The lack of influence by production variables on the price of farmland was perhaps the most interesting finding of this study. The soil's value (the weighted productivity index), which dropped the value of farmland in the bivariate condition while changing to the expected direction in the multivariate analysis, did not approach significance. Likewise, the size of a

parcel (total acreage), its proportion of cropland, and the presence of a road on the parcel, were non-significant. The lack of a significant impact of the production variables on the price of farmland in DeKalb County suggests that individuals buying the parcels do not consider production potential as much as speculative value. This becomes more apparent when considering the impact of distance variables and lots that circumvent large lot zoning, allowing for "country estates" that do not have to be used for production purposes. Conclusions as to the lack of importance of production variables must be tempered by an understanding that farmland in DeKalb County is uniformly good, and thus uniformly desirable.

Conclusions

While conclusions suggested by this study are necessarily bounded by study location and the limited population size available to be tested, important lessons may be drawn and tested elsewhere. As intended, this study was a practical application of statistical tools that may be used by local government planners and other land use professionals to better understand the local land market. This information may help policy makers design more reasonable and effective land use policy based on a cross section of cases that considers a variety of factors affecting land values and grounded in empirical reality that steps away from anecdotal evidence that appeals more to emotion than substance.

This paper expands the literature on determinants of farmland value, supporting contentions that public policies and location are important factors driving prices, whereas the productive value of the land is often ignored by those who would buy land adjacent to areas under development pressure. However, to expand the pool of knowledge pertaining to farmland value, some further steps are suggested. Consideration of case sites that have different characteristics, such as counties in different states where different public policies and ecological and population pressures may structure the market for farmland differently, would expand our understanding. Studies considering detailed characteristics of both buyers and sellers of farmland would provide greater insight into psychological processes driving the sales dynamic, and the influence of institutional structures such as zoning. Finally, expansion of the sample size, perhaps to consider a regional land market, would allow for stronger inferences to be made and would allow use of more advanced statistical methods, such as path analysis, that would allow for a better specification of the model's form.

Conclusions drawn from this study of DeKalb County, which is unique with its extremely productive soil and other production factors, are also emblematic of the situation facing many rural areas near expanding urban centers. Recent studies by the American Farmland Trust (1994, 1997) show that much of the U.S.'s finest agricultural land is located adjacent to rapidly growing urban areas. Because of the lure of bucolic lifestyles in rural areas, speculative values will overwhelm production values in determining the price of that land.

Perhaps most importantly, this study shows that public policies do make a difference. Large lot zoning reduces the value of land significantly, especially when compared with small acreage lots with "country estate" consumptive value that were "grandfathered" in and avoided this zoning policy. Likewise, distance from highways and state roads, whose placement is a public policy decision, has a strong effect on the price of the land when speculators consider the direction and expanse of growth. Policy makers and land use professionals must therefore be aware of the importance of farmland policies that are direct and obvious as well as those that alter the market conditions in more indirect ways.

Footnotes

[1] Speculative value may be seen as a combination of production and consumptive values forecast into the future. Back.

[2] This was in spite of losses in the student population of DeKalb, a college town which houses Northern Illinois University. Back.

[3] Thirty-four of the universe of 39 cases were utilized in this study. Five cases were removed from this study due to their being outliers which positively skewed the dependent variables' distribution. This was presumably due to their being within range of development options of towns (all five were within three miles of towns), and hence rezoning opportunities. Back.

[4] Permitted land uses include agriculture, conservation area for fauna and flora, farm dwelling units, farm, farm buildings, farm drainage and irrigation systems, forest preserve, game breeding and hunting preserve, game refuge, grazing and forage, historic sites and structures, nursery, privagte stable, roadside stands, tree and sod farms, public utility transmission and distribution lines within existing right of ways, and uses customarily accessory to farm operations (DeKalb County Zoning Ordinance, 1991:30-31). Back.

[5] Cropland is defined as including "all land from which crops are harvested or hay is cut; all land in orchards, vineyards, and nursery and ornamental stock; land in rotational pasture and grazing land that could have been used for crops without additional improvements; land used for cover crops, legumes, and soil improvement grasses; land on which crops failed; land in cultimvated summer fallow; and idle cropland." (Chicoine and Scott, 1983:7) Permanent pasture refers to land that is not normally tilled except for renovation, while other farmland includes land in ponds; woodland pasture; woodland, including woodlots, timber tracts, cutover, and deforested land; and farm building lots other than homesites. Wasteland refers to land that cannot be classified as cropland, permanent pasture, or other farmland, and cannot be cultivated or pasgtured (Chicoine and Scott, 1983:7). Back.

[6] However, in testing for collinearity, while there was a strong correlation between the two variables, the magnitude (.57) was not high enough to suggest correlation. Further diagnostic use, including measures of tolerance, variance inflation factors and eigenvalues and condition indexes (Norusis, 1992:341-344) showed that while collinearity did exist in the equation (as can be expected from a small sample size), it was not high enough to justify dropping of variables. lAs an added precaution, the independent variables were each regressed on each of the others to compare the R-square with of the original equation (Kennedy, 1996:181). Because none of the independent variable equaqtion's had an R-square higher than the tested model, the equation was left as is. Back.

TABLES

Table 1
Variable Description

Variable	Mean	Std. Dev.	Data Description	Direction
Sales Price/Acre	6177.014	7092.406	Interval	Dependent
Ag-Zone	.676	.475	Dichotomous	Negative
Total Acreage	82.179	73.658	Interval	Negative
% Cropland	.892	.152	Interval	Positive

Road	.853	.359	Dichotomous	Positive
Productivity Index	110.074	11.419	Interval	Positive
Highway	10.704	5.480	Interval	Negative
State Road	2.785	2.376	Interval	Negative
Town	4.483	2.443	Interval	Negative
Month	6.029	3.973	Interval	Positive
House	.235	.431	Dichotomous	Positive
Buyer	.176	.387	Dichotomous	Positive
Seller	.353	.485	Dichotomous	Positive

Table 2: Correlation Matrix

	Sales Price	Ag Zone	Total Acres	% Cropland	Road	Productivity	Highway	State Rd	Town	Month	Ho
Ag Zone	-0.6549	1									
	0										
Total Acres	-0.4235	0.5718	1								
	-0.013	0	0								
% Cropland	-0.1108	0.0565	0.2703	0							
	-0.533	0.751	0.122	0							
Road	-0.1723	-0.1096	-0.0659	-0.0857	1						
	-0.33	0.537	0.711	0.63	0						
Productivity	-0.5579	0.5651	0.4565	0.3704	0.0301	1					
	-0.001	0	0.007	0.031	0.866	0					
Highway	-0.4079	-0.0263	0.081	-0.1508	0.1618	0.1622	1				
	-0.017	0.883	0.649	0.395	0.361	0.359	0				
State Rd	-0.1948	-0.218	0.1362	0.2937	0.1481	0.1522	0.2788	1			
	-0.27	0.216	0.442	0.092	0.403	0.39	0.11	0			
Town	-0.4165	0.0605	0.0024	0.0393	0.023	0.2909	0.4815	0.4317	1		
	-0.014	0.734	0.989	0.825	0.897	0.095	0.004	0.011	0		

Month	-0.1668	0.1497	-0.0718	-0.1106	-0.4424	0.3336	0.3268	0.0701	0.2346	1	
	-0.346	0.398	0.686	0.533	0.009	0.054	0.059	0.694	0.182	0	
House	0.4113	-0.3575	-0.1675	-0.1756	0.0345	-0.5184	-0.0595	0.0584	-0.133	-0.4116	1
	-0.016	0.038	0.344	0.32	0.846	0.002	0.738	0.743	0.453	0.016	0
Buyer	-0.0267	-0.1746	-0.1639	0.1681	-0.0256	0.1951	0.1183	0.2238	-0.0369	0.371	-0.2
	0.881	0.323	0.354	0.342	0.886	0.269	0.505	0.203	0.836	0.031	0.1
Seller	-0.1472	-0.0155	0.1632	0.0869	-0.0409	0.0417	0.0398	0.0334	-0.0285	-0.1471	0.0
	0.406	0.931	0.356	0.625	0.818	0.815	0.823	0.851	0.873	0.407	0.8

Printing Help for Table 2: A separate Table 2 file is available by clicking here. Set your printer to "landscape" or horizontal, and print Table 2 by itself. You may also purchase a print copy of this working paper from CAE.

Table 3
OLS Regression Results: Sales Price Per Acre

Variable	Coefficient	Std Error	Standardized Beta	Sig. of t
Ag-Zone	-11,064.62	2545.10	-.74	.0003
Total Acreage	8.39	15.79	.08	.6008
% Cropland	-2215.81	6557.13	.05	.7388
Road	-3028.45	3045.94	-.15	.3314
Productivity Index	29.74	114.35	.05	.7974
Highway	-390.09	188.04	-.30	.0505
State Road	-576.71	446.53	-.19	.2106
Town	-436.49	434.48	-.15	.3265
Month	130.40	343.47	.07	.708
House	2995.75	2297.45	.18	.2064
Buyer	-594.17	2531.09	-.03	.8167
Seller	-2224.70	1687.74	-.15	.2017
Intercept	21395.56	10402.95		.0524
	R^2=.7624	Adjusted R^2=.6266		
	F-ratio=5.6148	Significance		

		of F=.0003		

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Top of Document.