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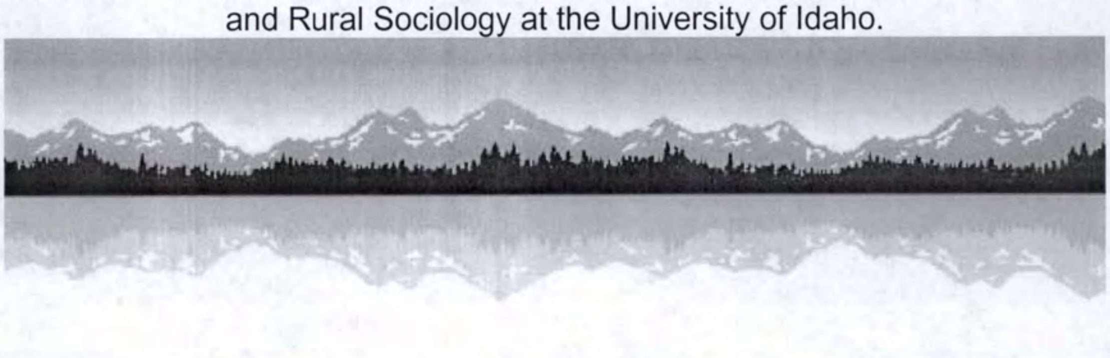

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Abstract

Public and private decision makers in Southwest Idaho are concerned about such issues as land values, land development, land use planning, open space preservation, and economic base lost as the growth of the Boise metro area results in conversion of high quality agricultural land to residential and commercial development. To effectively address such concerns, they need information about what farmlands experience the greatest demand for (conversion pressure from) development, and why.

This paper reports results of regression analysis of farmland values in the Boise metro area (Ada and Canyon Counties). Variables that were found to be significant determinants of farmland parcel values were numbers of acres in each USDA, NRCS soil capability class (measures of productivity) and distance from large towns and cities (greater than 10,000 population). The distance variable indicates that Boise metro area farmland values decline by $88.47 per acre for every mile in distance from the nearest town with more than 10,000 population.

Introduction

From 1990 to 2000 the Boise, Idaho metropolitan area, consisting of Ada and Canyon Counties (Figure 1), was the seventh fastest growing metropolitan area in the nation and the fastest growing such city in the Pacific Northwest. During the 1990's, the Boise metro area population increased by 46.1 percent or 136,494 residents (from 295,851 to 432,345) (U.S. Census Bureau, April 2001). The growth continues. The 2003 estimated population of the Boise metro area was 476,659 (U.S. Census Bureau, February 2005).

The rapid and substantial development that accompanies such growth is of particular concern to many residents and policy makers in the Boise area because of Ada and Canyon Counties' highly diversified crop production on approximately 227,000 acres of the best irrigated cropland in Idaho. Only two counties in Idaho have higher cropland receipts per acre than do Ada County and Canyon County. These are Boise County, which has only about 1,900 acres of cropland, most of which is in nursery production;

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and Clark County, where almost all of the 31,000 acres of cropland is in high value potato production (U.S. Department of Agriculture, June 2004).

Figure 1. Boise, Idaho Metropolitan Area (Ada and Canyon Counties)

Land owners and decision makers in Southwest Idaho are concerned about such issues as land values, land development, land use planning, open space preservation, and economic base lost as the growth of the Boise metro area results in conversion of high quality agricultural land to residential and commercial development. To effectively address such concerns, they need information about what farmlands experience the greatest demand for (conversion pressure from) development, and why. Since development pressure on farmland is an economic force that exerts upward pressure on land prices, a reasonable method for evaluating such pressure is to estimate land values with methods that decompose that value into quantifiable components, including development pressure or an appropriate proxy for development pressure.

Research Objectives

The overall objective of the research reported in this paper was to identify and evaluate factors that affect farmland values in Ada and Canyon Counties in Idaho, with the intent that such information will help land use policy makers better understand how to develop and direct such policy. Also, study results will hopefully provide other interested individuals with better knowledge and understanding about land values. Specific objectives of this research were to identify land attributes that affect farmland values and to interpret information about these attributes to provide information to policy makers about how land values are affected by relative levels of development pressure and other factors.

Land Value Models

A commonly taught traditional economic model for evaluating land and other long term assets is the discounted cash flow model. In theory, the "proper" value of a tract of land, based on the discounted cash flow model, is the present value of cash flow of the parcel's future income stream (Elad, et al.). However, applications of the discounted cash flow model to explain values of land assets that are likely to have future changes in use, which may occur at unpredictable times, can be quite problematic. Also, the discounted cash flow model is of no use for estimating values of land parcels that have no income streams but still reflect value (wetlands, woodlands).

A more useful type of model for explaining land values in such situations is based on the assumption that the value of a differentiated good (such as land) can be identified by a unique set of attribute levels, and the value of the good is the aggregation of the values of its individual attributes. For farmland, some individual attributes may be related to productivity. Others may be related to esthetics, access to recreation, proximity to cities, etc. Modeling farmland value in this way is consistent with the concept of decomposition of value into quantifiable components, including development pressure. Models of this sort lend themselves well to estimation using straight forward regression techniques, and have been used by numerous agricultural land value researchers including Torrel and Bailey, McLeod, Vasquez, et al., Elad et al. and others to explain values of different types of land assets with different types of economically valued attributes.

Data and Analysis

The authors used data from Farm Credit Services on 151 sales of irrigated cropland in Ada and Canyon Counties. These data included, for each parcel, sale price (total dollars per parcel); acres; year of sale; and township, range and section . Sale price data were modified to form the variable, adjusted sale price, determined by the sale price minus the value of any improvements on the land. Another adjustment was made by adjusting acres downward by road and waste acreage, assuming road and waste acres had no agricultural value. Adjusted sale price, as defined above, was designated as the dependent variable in this study.

With the help of geographical information system specialists at both the University of Idaho and the Natural Resources Conservation Service (NRCS) in Boise, more data were gathered. These included distances to cities greater than 10,000 population, presence of water bodies on or adjoining tracts, average slopes and elevations of sections containing data parcels, and estimated capabilities of soils present in tracts.

Soil capability classes are values developed by the U.S. Department of Agriculture to indicate the presence of soil limitations. The capability classes range from 1-8, with one defined as land with slight limitations and eight as land unsuitable for farming (Table 1).

Soil capabilities were estimated using NRCS data. Since locations of parcels were known only down to the section level, the soil in each capability class (defined by NRCS) in each parcel was estimated through the use of an algorithm. The algorithm took the percent of acres in each soil classification in each section containing a transacted parcel and applied those percentages to the number of acres in the parcel to estimate the parcel's acres in each soil classification.

All of the independent variables analyzed, and their expected signs are specified in Table 2. For most of the variables, expected signs are readily explainable by economic theory, as follows:

- Parcels located further from cities were expected to be worth less for development than parcels that are nearer to cities.
- Lower numbered soil capability classes are more productive, thus more valuable for agriculture than are higher numbered classes.
- Since land prices tend to increase over time, and since the base year for analysis was 1997, it was expected that transactions before 1997 would be for less dollars than parcels transacted after 1997.

However, for three of the dependent variables considered (elevation, slope and rivers-lakes) economic theory does not clearly suggest expected signs:

- Elevation tends to shorten growing seasons (negative sign relative to agricultural value), but makes for desirable views (positive sign relative to development value).
- Slope tends to make a parcel more difficult and costly to farm (negative sign relative to agricultural value), but it is usually considered to be esthetically interesting (positive sign relative to development value).
- Rivers and lakes on or adjoining a parcel add esthetic value (positive sign relative to development value), but "break up" land, making it more difficult to farm (negative sign relative to agricultural value).

An ordinary least squares (OLS) regression model was utilized to determine the influence of the independent variables on the dependent variable. The first run included all of the variables listed in Table 2. In subsequent runs the elevation, slope and rivers-lakes variables were dropped from the model because they were not significant and their theoretical rationales for inclusion are ambiguous (as mentioned above). Also, year of sale variables, except for the year 2001, were dropped from the model because they were not significant. Their lack of significance suggests that progressive land value inflation is not detectable from the data analyzed.

The OLS assumptions were checked and no multicolinearity was found, however using a Glejser test, heteroskedasticity was found to be a problem. The problem was addressed with weighted least squares (WLS) techniques.

Table 1: Soil Capability Class Definitions Provided by the USDA Natural Resource Conservation Service (NRCS)*

CLASS	DEFINITION
CLASS I	Soils have slight limitations that restrict their use.
CLASS II	Soils have moderate limitations that reduce the choice of plants or Require moderate conservation practices.
CLASS III	Soils have severe limitations that restrict the choice of plants or require very careful management, or both.
CLASS IV	Soils have very severe limitations that restrict the choice of plants or require very careful management, or both.
CLASS V	Soils have little or no hazard of erosion but have other limitations, impractical to remove, that limit their use mainly to pasture, range, forestland, or wildlife food and cover.
CLASS VI	Soils have severe limitations that make them generally unsuited to cultivation and that limit their use mainly to pasture, range, forestland, or wildlife food and cover.
CLASS VII	Soils have very severe limitations that make them unsuited to cultivation and that restrict their use mainly to grazing, forestland, or wildlife.
CLASS VIII	Soils and miscellaneous areas have limitations that preclude their use for commercial plant production and limit their use to recreation, wildlife, or water supply or for esthetic purposes.

* U.S. Department of Agriculture, April 2005.

Table 2: List of Variables and their Expected Signs

Variable Name	Variable Description	Expected Sign
Dependent Variable		
Adjusted Sale Price	Total dollars per parcel	-------
Independent Variables		
Continuous Variables		
More10000	Meter distance to a city greater than 10,000	(-)
Elevation	Section average elevation (meters)	(?)
Slope	Section average slope (degrees)	(?)
I-1	Acres of irrigated soil capability 1	(+)
I-2	Acres of irrigated soil capability 2	(+)
I-3	Acres of irrigated soil capability 3	(+)
LowPro	Acres of irrigated soil capability 4, 5, 6, 7	(+)
Discrete Variables		
Y1994	Parcel was sold in the year 1994[1]	(-)
Y1995	Parcel was sold in the year 1995[1]	(-)
Y1996	Parcel was sold in the year 1996[1]	(-)
Y1998	Parcel was sold in the year 1998[1]	(+)
Y1999	Parcel was sold in the year 1999[1]	(+)
Y2000	Parcel was sold in the year 2000[1]	(+)
Y2001	Parcel was sold in the year 2001[1]	(+)
Y2002	Parcel was sold in the year 2002[1]	(+)
Rivers-lakes	River or lake located in or borders section	(?)

[1]Base year is 1997

Results

Results of the WLS model are shown in Table 3. The regression variables explain 62.18 percent of the price variation of farmland parcels in Ada and Canyon Counties. The independent variables in the model all have the expected signs. The only development pressure variable that is significant is the distance to city greater than10,000 variable.

Results would be more satisfying (and more in line with economic theory) if coefficients for land capability class variables grew consistently smaller as productivity classes moved from lower numbered classes (more productive) to higher numbered classes (less productive). The theoretically inconsistent values of these coefficients could be results of inherent inaccuracies in the algorithm used to determine acres assigned to a particular soil capability class. Nevertheless, it is notable that the model yielded a larger coefficient for productivity class "1" (most productive) than for all less productive classes.

Table 3: Weighted Least Squares (WLS) Model Results

Variables	Parameter Estimate	T-Value
Int	123191	4.81***
Y2001t	66398	1.95*
More10,000t	-5.45	-3.46***
I1t	2418.68	3.01***
I2t	1956.47	5.10***
I3t	1974.85	6.54***
LowProt	2346.79	3.49***
Computed R-Squared	0.6218	
F-Value	64.11	

* (0.1) Significance Level ** (0.05) Significance Level ***(0.01) Significance Level

Using the model estimated above, it is possible to estimate the expected average price of a parcel of farmland located in the Boise metro area. This can be done by using the coefficients from Table 3 and the average values of the variables (based on the data in the study) to which the coefficients apply. This process is indicated below:

Average Adjprice = 123191 – 5.454(13876.43) + 2418.682(9.13) + 1956.437(28.15) + 1974.847(44.70) + 2346.795(17.23)

Average Adjprice = $253,376.16
Average Acres per parcel = 99.21
Average Adjprice per Acre = $2,553.94

Conclusions and Implications

The von Thunen Factor

Johann von Thunen's theory of concentric circles used to describe land use suggested that access to a city center matters when deciding to purchase land. The closer the land is to the center of the city the higher the price. This is because locating at or near the city center minimizes transaction costs. Von Thunen used a bid rent function to illustrate the amount each sector is willing to pay relative to the distance from the city center (Leahy). He argued that manufacturers locate in or very near the central city, then as distance from the central city increases land is used for housing. At greater distances, it is used for agriculture. As these uses bid for land, land prices decline as distance from a city increases. Von Thunen's theory may be a bit simplistic in today's complicated economies, but the concept still applies.

Research results presented above indicate that, for farmland in the Boise metro area, the value of an average parcel (99.21 acres) decreases \$5.45 (or 5.5 cents per acre) for every meter of distance from a city of greater than 10,000 population. The distribution of the data on which these results are based suggests that this relationship is meaningful in the study area from about three to 17 miles distance from a city of greater than 10,000 population. The expected price per acre for the hypothetical parcel described in the equations above is about \$2,554 per acre. This parcel would be located about 8.5 miles from the nearest town with a population greater than 10,000 (Boise, Caldwell, Nampa, Meridian, Garden City, or Eagle). However, if the same parcel were located 16 miles from the nearest town with population greater than 10,000, its expected value would be only about \$1,899 per acre. If it were located only 3 miles from such a city, its expected value would be about \$3,041 per acre. Research results strongly suggest that development demand for Ada and Canyon Counties' farmland has a substantial effect on land prices. As von Thunen suggested, that effect lessens as distance from cities increases.

The Agriculture Factor

The coefficients for the number of acres in a parcel of each of the categories of irrigated land capability (productivity) considered in the study are estimates of the marginal values per acre of agricultural land in each capability class, but in the opinions of the authors, not necessarily in long term agricultural use. For land that is expected to develop in the foreseeable future these coefficients may more nearly represent the values of different levels of expected agricultural productivity in the intermediate term, as the land is held for future development.

Application of Results

The information presented in this paper may be interesting, and hopefully useful to many types of people in southwestern Idaho (buyers and sellers of land, appraisers, land use policy makers, and others with interests in how rural lands around Boise will be used). The effect of distance from large towns (greater than 10,000) on values of farmland parcels in Ada and Canyon Counties is quantified. This information may be useful to the sorts of people indicated above as they evaluate land values, investment opportunities and development pressure in the Boise metro area. The distance coefficient presented here can be used directly to evaluate the effects of distance from large towns on farmland values. It may be even more useful to look for situations where the distance coefficient does not seem to reasonably explain land values in the Boise area, then to "figure out why not."

Results of this research suggest the potential for some additional investigation. It is mentioned above that there is potential ambiguity in interpretation of the coefficients for the number of acres in a parcel of each of the categories of irrigated land capability (productivity) considered in the study. Do these coefficients represent the value of land if it is left in agricultural production? Or do they represent the value of holding land in agriculture while awaiting foreseeable future development? More information, and possible clarification of this issue would mean better information for people who care about agricultural land in the Boise metro area.

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