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Farmland price determinants in Iowa

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by

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DEDICATION

I would like to dedicate this thesis to my parents. Their guidance and helpfulness shapes me to this day.

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ABSTRACT

Farmland comprises 85% of the assets in production agriculture (12). Surveys show over a 32.5% increase in values from 2010 to 2011 in Iowa (18). An analysis of recent farmland sales data leads to a better understanding of both why prices have been increasing, and possible changes in prices in the future. The factors examined include parcel size, land productivity, and location and type of sellers and buyers. The analysis is both over time and static; it compared characteristics from year to year, and it compared characteristics in the same year.

A data set with land sales from 20 randomly selected Iowa counties for five years was analyzed using a hedonic model to decompose the values various attributes of land contribute to the total sale price per acre. This was used to determine the effects of these factors and to see if these effects change over time. Next, the sales values were compared to land value surveys conducted every year. Using NPV (Net Present Value) formulas, the sales values were examined to determine an implied interest rate, and compared to rent-to-value ratios.

Analysis of descriptive statistics shows approximately 85% of parcels sold are in the lower two-thirds of productivity. The percentage of "Sole Proprietor" buyers and sellers has fallen by over half since 1990. A higher percentage of parcels are being sold in the fourth quarter of the year. Buyers who live in-state are buying higher quality land; sellers from out-of-state are selling higher quality land. Both out-of-state buyers and sellers are buying and selling larger parcels than those in-state.

The analysis reveals that land value survey results from Iowa State University are consistently higher than sale prices by an average of 9.5%. This difference is not statistically significant. Two hedonic models capture corn suitability rating (CSR), lagged cash rent, and some locational variables as statistically significant for every year modeled. Implied interest rates are 3.2% and 6.4% higher than the rent-to-value ratio for 2009 and 2011, respectively.

CHAPTER 1. INTRODUCTION

Land is the most valuable asset in United States agriculture (21). It is used in the production of both livestock and plants. Land is a unique asset because it is immobile and finite in supply. The value of land is influenced directly by the returns in agricultural production, because it is the residual claimant of excess returns. However, estimating the value of land is not easy. Land has numerous variable characteristics, even in very small parcels. Returns compared among parcels in close proximity can have a large variation, and returns are not the only influence of prices for rents and ownership. Because of this, many techniques are used in finding the value of rent and sale price, such as surveys, appraisals, and hedonic modeling (14). Survey values of land in Iowa have more than doubled since 2006, increasing over 32% from 2010-2011 (18). These rapid increases have led to concerns that farmland is on a speculative bubble.

Ownership of land in Iowa is changing. The most recent (2007) Farmland Ownership and Tenure in Iowa survey reported 55% of the land owned in Iowa was owned by people over the age of 65 (8). Also, 73% of land was acquired by purchase, 23% by inheritance, and 4% by other means. The percent of land acquired by purchase has increased since a similar survey in 1997, while the percentage acquired by inheritance has fallen, and other means of acquisition have stayed constant. The increasing age of landowners means that a change in ownership over the next few years is imminent. The changing nature of farmland ownership, the rapid increase in price, and concern about land being overpriced lead to five basic questions:

1. What are the sales trends in:
   - Size (in acres) of parcels sold
   - Quality of the soil in parcels sold
   - Location (state of residence) of buyers and sellers

- Percentages of types of buyers and sellers
- Number of auctions

2. How do sale values compare to survey responses of land values?

3. What are the factors influencing farmland values?

4. What are the expected returns of those purchasing land?

5. What are the implicit costs of borrowing (or opportunity cost) of those purchasing land?

The size of parcels sold is important because of the availability of capital. If a parcel is exceedingly large, it is difficult to find buyers with sufficient capital to make the purchase.

The quality of land sold shows if sellers are selling high, middle, or low quality land, and if that has changed over time. Quality is a major factor in value. Knowing the level of quality allows insight into the possible types of usage of the land, including types of crops that can be grown, as well as management practices necessary to maximize profit and conserve soil and water quality.

Absentee land ownership is a continuing concern to many people. Location of buyers and sellers provides insights into the trends regarding absentee owners. Knowing the changes in types of buyers and sellers can aid policy makers contemplating changes in laws, especially ownership and inheritance, and tax structure and rates.

Auctions seem to be increasing in frequency due to rapidly increasing prices. Auctions are an increasingly common response to the factors influencing land prices (18) . Examining whether the frequency of auctions is increasing or just the result of publicity will help buyers and sellers find the best way to meet in the marketplace.

Comparing sale values to expert opinion survey responses helped determine the extent to which the two methods vary. Opinion surveys are cheaper than purchasing or gathering sales data, but that savings may come at the cost of less reliable results.

The effects of land characteristics on prices can be estimated; this can be used in predicting sales of a described parcel and in determining if these effects have changed over time.

Estimating the cost of borrowing from the sales data can show the cost of borrowing, the expected return on investment, or the discount rate.

1.1 Background Information

Using hedonic modeling to estimate the effects of land characteristics on land prices has a well-developed history.

Drescher et al. (5) used prices of agricultural land in Minnesota in 1996 in a hedonic model. Their variables of interest included urban access, number of interstate miles in a county, percent of tillable acres in parcels sold, size of a parcel, crop equivalent rating (used by University of Minnesota to measure soil productivity), total area of the county, values of crops and livestock sold in a county, share of non-farm employment in manufacturing, recreational amenities, and population growth.

In the model that used sales with a reported agricultural productivity index, all of the above except percent of farmland lost, population growth, and share of employment in manufacturing were significant and had expected signs. This shows the impact of both farm-specific and non-farm specific factors in determining the influences on agricultural land prices.

Miranowski and Hammes (24) used topsoil depth, a measure of potential erosivity (rainfall intensity and amount, soil properties on erodibility, length of slope, and steepness of slope), and pH. Their data comes from the 1978 Iowa Land Value Survey, and from sales observations in the years 1974-1979 reported in a course at Iowa State University. The limitations of the data and results are discussed due to not being a random sample.

Using a Box-Cox transformation, they determine that a linear functional form for estimating implicit prices for agricultural land is appropriate. For the model that removes building value from the price per acre, it was determined that increased topsoil depth and increased pH had a statistically significant positive effect on price per acre, while potential erosivity and the interaction between potential erosivity and topsoil depth had a statistically significant negative effect on price per acre. Locational variables were included in early models but were eliminated due to lack of statistical significance. An explanation hypothesized for these results was the non-randomness of the sample of sales data.

Herriges et al. (16) used a dataset of land rent survey results from the 1988-1990 Iowa State University Cooperative Extenstion Service East Central Iowa Rent Survey. They modeled rent of tillable ground as a function of the fraction of corn base acreage established, expected corn yield, government payments, population density, population growth rate, and county average prices for corn, oats, and soybeans.

Acreage, yield, population density, and population growth rate were found to be significant. The lack of significance of county average prices was explained by the lack of variance in prices for the counties in the study.

Burt (2) builds off of John T. Scott, Jr.'s 1983 work, "Factors Affecting Land Price Decline". He uses sales prices from 1960-1983 as the dependent variable and rent, lagged rent, prices, lagged prices, and a moving average error term as explanatory variables. Rents are found to have the most significant impact in price.

Kuethe et al. (22) take the farmer reported rent from the United States Department of Agriculture/National Agricultural Statistics Service and divide those values by the 10-year Treasury rate. They then compared these results to farmer-reported land values to determine if the two values were similar. If they were not similar, it was assumed that some factor (such as urban influence) was increasing the value of land relative to its agricultural production value.

All of the hedonic models use a linear functional form. The effect of increased productivity, either through a direct measure (crop equivalent rating) or indirect measures (topsoil depth, yield, or rent) is always found to be positive and significant. Population growth and population density are also always statistically significant when included. Regional effects are not always significant, but their exclusion should not be ruled out unless statistical tests are performed. Models with a larger number of explanatory variables (Drescher, Herriges) have higher adjusted R^2 values than models with fewer explanatory variables. Including variables such as population density and interest rates allows for comparison of the estimated effects to their theorized effects.

CHAPTER 2. DESCRIPTION OF DATA

2.1 Years

The dataset is composed of land sales data from 20 randomly chosen Iowa counties from the years 1990, 2005, 2009, 2010, and 2011[1]. This data was purchased from a company specializing in land sales data: Land Sales, Incorporated, in Fort Dodge, Iowa. The data is from open records of sales in each county courthouse. The year 1990 was chosen because it was the earliest year data was available. 2005 was chosen because it was the last year in recent times before values increased. The last three years were chosen to model the present time. 2011 data was used only when applicable; comparisons to other years should be made with caution because not all of the sales were available.

2.2 Counties

The randomly selected counties are: Chickasaw, Clayton, Clinton, Des Moines, Dubuque, Emmet, Floyd, Fremont, Hardin, Humboldt, Lyon, Mills, Page, Pocahontas, Polk, Pottawattamie, Story, Taylor, Woodbury, and Wright. See Figure 2.1. Some areas are missing from the dataset, particularly the southeast, but this study is statewide and not regional.

2.3 Data

Each sale has the following data: Date of Sale, Legal Description, Township, Total Acres, Taxable Acres, Corn Suitability Rating (CSR), Sale Price, Price per Acre, Seller, Buyer, Terms, Assessed Value, and Notes & Comments. CSR is a measure of productivity of soil in Iowa (17). Some counties did not report a CSR value. For observations missing CSR values, a

[1]Only the first three quarters of 2011 were available at the time of this work.

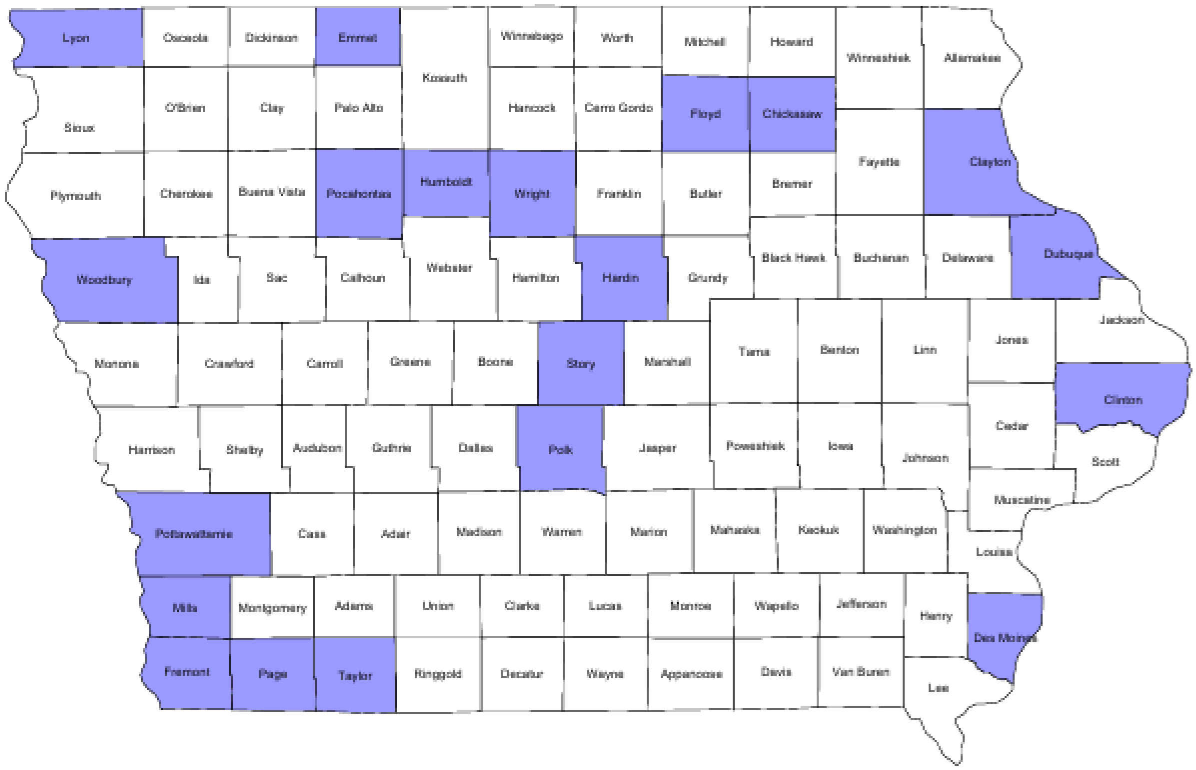

Figure 2.1 Selected Counties

weighted average value is constructed using the Web Soil Survey maintained by the United States Department of Agriculture (26) and the legal description of the parcel from sales data.

Only agricultural land was included in this analysis. Observations were removed that were sold as development, deemed as having "high building value", contained a forest reserve, or were sold to the government or a non-profit organization. In addition, parcels with less than 20 acres or CSR less than 20 were removed. These observations are not likely to be used in production agriculture. Finally, those properties with sales price per acre outside three standard deviations of that year's mean were dropped. These values could be influenced by factors outside the scope of the data reported. Table 2.1 shows the percentage of observations lost due to each restriction.

Table 2.1 Percentage of Observations Dropped Due to Restrictions

Year	Unusual Sales	Size/Quality	Outliers	Total	Observations Remaining
All	4%	4%	<1%	8%	3203
1990	3%	2%	1%	6%	683
2005	9%	4%	1%	14%	728
2009	1%	10%	<1%	11%	607
2010	<1%	2%	<1%	2%	785
2011[a]	4%	1%	1%	6%	400

[a] Not all of the year was available

Tables 2.2 through 2.8 compare variables from year to year. Because of the large time between 1990 and 2005, and the time between 2005 and 2009, it may appear that the differences in the variables is not important. But for the variables that have changed significantly over time, all that can be said is that they changed. That change could have been gradual over the interval, or the change could have been sudden.

2009 was a different year than the others in the analysis. Surveyed land values declined slightly due to a decline in agricultural commodity prices. This explains why sales numbers are low, and why some summary statistics are different than other years.

Table 2.2 shows that the average size of parcel sold has remained fairly consistent. However, preliminary 2011 data has a wider variation (more larger and smaller tracts sold). Except for 2005, 95% of the parcels sold are 242 acres or less. In 2005, 95% of the parcels are under 309 acres.

2.4 Total Acres

Table 2.2 Distribution of Total Acres

Year	Mean	Std. Dev.	Min	Max
All	114	83.2	20	1440
1990	115	80.4	20	1008
2005	123*	97	23	857
2009	110***	74.3	20	677
2010	109	69.4	20	653
2011[a]	108	96.3	23	1440

[a] Not all of the year was available

* Significantly different from the earlier year at a 10% level

*** Significantly different from the earlier year at a 1% level

2.5 CSR

Table 2.3 shows the distribution of sales based on CSR values. The CSR values are truncated at 20 for purposes of analysis, and the maximum value is 100. Overall, CSR of parcels sold has been rather consistent for the years studied. In 2009, parcels sold had a higher average CSR.

Table 2.3 Distribution of CSR

Year	Mean	Std. Dev.	Min	Max
All	64	15	20	99
1990	63	15	24	92
2005	63	16	20	93
2009	67***	15	22	99
2010	65*	15	20	91
2011	65	15	22	94

[a] Not all of the year was available

* Significantly different from the earlier year at a 10% level

*** Significantly different from the earlier year at a 1% level

The sales in each county were individually ranked and divided into thirds based on CSR. It was determined if a parcel was in the high third, middle third, or low third in CSR rating. Table 2.4 shows the percentage of parcels sold in each CSR range. Overall, about half of the parcels sold were sold in the middle CSR range, about 35% were sold in the low CSR range, and 15% were sold in the high CSR range. Most land sold was not in the highest range of CSR.

Table 2.4 Distribution of CSR by Range

Year	Low CSR	Middle CSR	High CSR
All	35.2%	49.2%	15.6%
1990	35.7%	49.8%	14.5%
2005	37.5%	47.4%	15.1%
2009	30.6%	51.2%	18.1%
2010	35.9%	48.4%	15.7%
2011[a]	35.3%	50.0%	14.8%

[a] Not all of the year was available

For both buyers and sellers, "Sole Proprietor" consists of a single person described as the buyer or seller. "Couple" is two people sharing the same last name. "Family" is comprised of descriptions that contain "et al."; it may be a group of unrelated people, or it could be a group of family members. This sorting was done so that sole proprietor and couple trends could be analyzed; "Family" is merely the catch-all for sales not falling into the other descriptions.

The trends in who is selling the land are presented in Table 2.5. This table shows that the percentage of sole proprietor owners selling land has fallen by over half since 1990. Family, couple, and trust owners selling have the largest increases over time. This could be due to the increase in the average age of landowners. The ISU Farmland Ownership in Iowa 2007 publication shows that more than half of farmland in Iowa is owned by people over 65 years of age (8).

2.6 Seller Trends

Table 2.5 Percentage of Land Transactions by Seller

Category	All	1990	2005	2009	2010	2011[a]
Sole Proprietor[b]	24%	43%	20%[***]	17%	19%	20%
Family	12%	7%	13%[***]	16%	12%[**]	16%[*]
Couple	27%	20%	34%[***]	28%[***]	27%	28%
Estate	12%	11%	12%	13%	13%	11%
Trust	11%	2%	11%[***]	13%	15%	13%
Corporation	13%	17%	9%[***]	13%[**]	14%	13%
Govt.	<1%	<1%	<1%	<1%	<1%	0%[*]
NPO[c]	<1%	<1%	<1%	<1%	<1%	0%

[a] Not all of the year was available

[b] Values may not add to 100% due to rounding.

[c] Non-profit organization

[*] Significantly different from the earlier year at a 10% level

[**] Significantly different from the earlier year at a 5% level

[***] Significantly different from the earlier year at a 1% level

Table 2.6 shows the percentage of land sold by type of buyer. Similar to sellers, sole proprietor buyers have decreased by over half since 1990 with couple, trust, and corporation buyers having increased the most.

2.7 Buyer Trends

Table 2.6 Percentage of Land Transactions by Buyer

Buyer Category	All	1990	2005	2009	2010	2011[a]
Sole Proprietor[b]	33%	53%	27%***	29%	28%	27%
Family	5%	3%	5%***	7%	5%	5%
Couple	42%	33%	45%***	45%	43%	46%
Estate	<1%	0%	0%	<1%	<1%	0%
Trust	5%	1%	9%***	5%***	6%	6%
Corporation	15%	10%	14%**	15%	18%	17%

[a] Not all of the year was available

[b] Values may not add to 100% due to rounding.

** Significantly different from the earlier year at a 5% level

*** Significantly different from the earlier year at a 1% level

In Table 2.7, "Elsewhere" is defined as the buyer or seller living outside of the state of Iowa. Table 2.7 shows that 2005 had an increase in land ownership moving outside of Iowa, but after that those selling from outside of Iowa to people in Iowa has increased and stayed relatively steady. In similar fashion, land sold from Iowa ownership to outside of Iowa declined compared to 2005 and has remained relatively constant.

2.8 Location Trends

Table 2.7 Percentage of Land Transactions by Location of Seller and Buyer

Location Description	All	1990	2005	2009	2010	2011[a]
Iowa to Iowa[b]	66%	71%	62%***	64%	67%	70%
Iowa to Elsewhere	9%	8%	14%***	6%***	7%	6%
Elsewhere to Iowa	20%	16%	18%	25%***	20%**	20%
Elsewhere to Elsewhere	5%	4%	7%*	5%	6%	4%*

[a] Not all of the year was available

[b] Values may not add to 100% due to rounding.

* Significantly different from the earlier year at a 10% level

** Significantly different from the earlier year at a 5% level

*** Significantly different from the earlier year at a 1% level

2.9 Time Trends

Table 2.8 shows the percentage of sales by number of parcels and percentage of acres, by quarter. The percentage of sales in the first quarter has declined while the percent of sales in the fourth quarter had increased. It is possible this could be due to perceived, expected, or anticipated changes in laws or taxes, specifically inheritance and capital gains. Because so many sales are now made in the fourth quarter, not having that data available for 2011 makes comparisons with other years difficult, as at least one-fifth (and as much as two-fifths) of total sales for the year could be missing.

Table 2.8 also shows the percentage of parcels sold at auction and the percentage of acres sold at auction. The two do not usually differ by more than 1%. Parcels sold at auctions are not different in size compared to parcels not sold at auction.

Table 2.8 shows that the percentage of parcels sold by auction has slightly increased with time. This is expected when sales prices are increasing, because the market value is not known, and sellers feel that an auction will allow the true value to be found. If a firm sales price is set, it may be too low in the sense that someone else may have paid more than the asking price.

Table 2.8 Percentage of Land Sold by Quarter

Year	1990		2005		2009		2010		2011[a]	
	by Parcels	by Acres	by Parcels	by Acres	by Parcels	by Acres	by Parcels	by Acres	by Parcels	by Acres
Q1	39%	40%	40%	41%	36%	37%	24%	24%	27%	24%
Q2	24%	22%	25%	24%	19%	17%	17%	18%	30%	34%
Q3	14%	14%	14%	14%	14%	14%	16%	15%	14%	13%
Q4	23%	24%	21%	21%	30%	32%	43%	44%	29%	29%

Year	1990, Auction		2005, Auction		2009, Auction		2010, Auction		2011, Auction[a]	
	by Parcels	by Acres	by Parcels	by Acres	by Parcels	by Acres	by Parcels	by Acres	by Parcels	by Acres
Q1	3.8%	4.0%	6.6%	7.4%	5.9%	5.7%	4.3%	4.1%	3.8%	3.9%
Q2	<1%	<1%	6.7%	5.3%	3.4%	2.8%	4.4%	4.9%	7.6%	4.2%
Q3	2.1%	2.4%	3.8%	5.5%	3.5%	4.0%	2.4%	2.8%	5.7%	7.8%
Q4	3.1%	2.7%	7.7%	8.1%	3.8%	3.6%	10.1%	10.7%	5.2%	5.8%
All	2.6%	2.7%	6.5%	6.8%	4.4%	4.3%	6.5%	7.0%	5.5%	5.1%

[a] Not all of the year was available
[b] Values may not add to 100% due to rounding.

An auction provides for direct competition of buyers.

2.10 Means Tests

Recent increases in prices for land, as well as changes in demographics and locations as shown in Tables 2.5 through 2.7, have lead to questions about the differences in land bought and sold by in-state and out-of-state buyers and sellers. For this, means tests on CSR and Total Acres were done comparing locations of buyers and sellers. Means tests use statistical analysis to determine if the mean of one statistic is near the mean of another statistic. This is necessary because even though means may not be the same, the distributions of the parcel size or CSR can allow for a large area of overlap, suggesting that the means are statistically equal.

Out-of-state sellers sold parcels with higher CSR (except for 2011), but only 2010 (95%) and 2009 (90%) are statistically significantly different from CSRs of parcels sold by in state sellers. In-state buyers bought parcels with higher CSR (for all years), but only 2005 (95%) is statistically significantly different from CSRs of parcels bought by out of state buyers. Out-of-state sellers were more likely to be investors, who purchased higher quality land but are selling it. In-state buyers were purchasing higher quality land due to the high returns this land can earn.

Out-of-state sellers sell larger sized parcels (for all years). 1990 and 2010 are statistically significantly different (95%) from sizes of parcels sold by in-state sellers. 2005 and 2009 are statistically significantly different (99%) from sizes of parcels sold by in-state sellers. Out-of-state buyers buy larger sized parcels (for all years). All years except 2011 are statistically significantly different (99%) from sizes of parcels bought by in-state buyers. Sellers and buyers from out-of-state are more likely to be investors, and therefore could have access to larger amounts of capital necessary to make purchases of large parcels.

Table 2.9 Means Testing, CSR

	Sellers		Buyers	
Year	Out-of-State	In-State	Out-of-State	In-State
1990	64	63	61	63
2005	64**	62	60	63
2009	69*	66	66	67**
2010	67	65	65	66
2011[a]	63	65	62	65

[a] Not all of the year was available

* Significantly different at a 10% level

** Significantly different at a 5% level

Table 2.10 Means Testing, Total Acres

	Sellers		Buyers	
Year	Out-of-State	In-State	Out-of-State	In-State
1990	130**	111	152***	110
2005	143***	117	160***	114
2009	123***	105	143***	106
2010	118**	105	140***	104
2011[a]	118	104	116	107

[a] Not all of the year was available

* Significantly different at a 10% level

** Significantly different at a 5% level

*** Significantly different at a 1% level

CHAPTER 3. COMPARISON OF LAND SALE PRICES TO OPINION SURVEY RESULTS

3.1 Introduction

Most land values reported are opinion surveys of professionals, the Federal Reserve, realtors, USDA officials, or others. These values are often used as part of the barometer of the agricultural economy. If farmers are doing well, land values will rise along with prices of inputs to agriculture. A frequent question is "How do opinion survey values compare to actual sale prices?" Theory indicates that if certain rules are followed, accuracy of survey results when compared to the true value can be quite high (3). Issues regarding errors of all types have been studied for years, and considerable literature exists on designing surveys to achieve higher accuracy.

However, the foremost issue is the definition of value. David Ricardo (27) expands on ideas in *An Inquiry into the Nature and Causes of the Wealth of Nations*, a famous work by Adam Smith. Ricardo states that there are two types of value: "value in use" and "value in exchange." Value in use is defined as the utility gained from use of the good. Value in exchange is the amount people will trade or pay for the good. Ricardo says, "Possessing utility, commodities derive their exchangeable value from two sources: from their scarcity, and from the quantity of labor required to obtain them." Land obtains its exchangeable value from its scarcity, because it is not practical to produce land from labor.

The exchangeable value of land is what people will pay for its possession, which is comparable to sale price. What people will pay can depend on many factors, including their utility of wealth and opportunity cost of capital. Exchangeable value ignores the value gained from utility of use. People can gain pleasure from ownership that cannot be captured easily by economic theory, but this pleasure should be accounted for in the total value. For these reasons, surveys of value may not agree with actual sales prices.

A yearly opinion survey is taken of land values in every county in the state of Iowa (18). These values were compared to average sale price values in the selected counties. This determined if county land value estimates from survey respondents is representative of actual sales prices.

3.2 Iowa State University Land Value Survey

Iowa State University (hereafter ISU) conducts a mail survey of those believed to be knowledgable of land market conditions in their area. The survey instrument is shown in Appendix A. The respondents are asked:

- The value of high, medium, and low grade land in the county
- Positive and/or negative factors influencing land values
- The level of sales compared to the previous year
- The percentage of land sold to:
  - Existing farmers
  - Investors
  - New farmers
  - Other

State and crop reporting district averages were calculated from survey responses. These averages were used in an algorithm combining U.S. Census of Agriculture data and geographical location to produce county average values (18).

3.3 Methods

The data described in Chapter 2 was used to calculate an average Price Per Acre for each county and year. Price per acre adjusted for taxable acres (taking total sale price divided by taxable acres instead of dividing by total acres) were available for every parcel except those in 1990, however, using these did not significantly change results. Therefore, price per acre was used so 1990 can be compared to other years. These average prices were compared to the average county values obtained in the ISU survey. For each county, percent difference was calculated as the percentage that the sales average differed from the survey average:

$$\frac{\overline{X}_{sales_{ij}} - \overline{X}_{survey_{ij}}}{\overline{X}_{survey_{ij}}} \tag{3.1}$$

where i represents each year and j represents each county.

Therefore, a negative value indicates that the survey mean was higher than the sales mean; a positive value indicates the sales mean was higher than the survey mean.

3.4 Comparison

As seen in Table 3.1, the survey tends to overstate the value of farmland compared to the sales data. 2010 has the highest variation in differences (highest positive minus lowest negative), while 2005 was the year with least variation in differences. The overall average is fairly consistent and not extremely large. For all the three most recent years shown, Clinton and Polk are the only counties that had survey averages less than sales averages.

The top two rows of Table 3.1 mean that the survey taken by Iowa State University is consistently (80% of the time) higher than actual sales values. The survey values are in a 95% confidence interval of the mean of the sales values, making the difference not statistically significant for any county or year. Because the distribution of the survey values is not known, each county survey value was compared to the 95% confidence interval of the mean price per acre from sales data. 2011 was not included because not all of the year was available.

Table 3.1 Average County Price Per Acre Comparison

Information	All Years Except 2011	1990	2005	2009	2010
Percentage of negative obs.	80%	80%	80%	75%	85%
Percentage of positive obs.	20%	20%	20%	25%	15%
Overall average	-9.5%	-10.0%	-7.8%	-7.3%	-12.2%
Avg if positive	5.3%	3.8%	4.8%	5.2%	9.0%
Max if positive	16.0%	6.6%	9.9%	12.3%	16.0%
Min if positive	0.0%	0.3%	0.0%	0.9%	3.8%
Avg if negative	-13.1%	-13.4%	-10.9%	-11.4%	-15.9%
Max if negative	-0.7%	-3.0%	-1.0%	-0.7%	-1.7%
Min if negative	-30.9%	-30.9%	-22.0%	-23.0%	-26.4%

Table 2.4 shows that over 80% of parcels sold are low-third or middle-third CSR. The value survey numbers used in Table 3.1 were an average of all land. Higher quality land is not equally represented in the sales data; this could be why sales values are lower than survey results.

According to statistical theory, the survey answers should be consistently close to the true value. The ISU survey's differences from sales data are not statistically significant, which supports the theory. Because the survey is sent out in November, respondents should have most of the sales information available, and these observations about the market should be built into their opinions on value. By this time, most of harvest is complete and yields and price information are also known.

CHAPTER 4. HEDONIC MODEL OF PRICES

4.1 Hedonic Model of Prices

4.1.1 Hedonic Modeling

Freeman provides a detailed analysis of hedonic theory (11). Hedonic theory states that the price of a differentiated good in a market will be a function of the attributes of that good if there is variation in the attributes, separate goods can be combined to equal the attributes of a single good, and the market is in equilibrium. The relevant portions from that analysis will be covered here.

In equilibrium, the price of a parcel of land should be the present value of the stream of "rents" produced by that parcel of land. Because land productivity (and other attributes) vary across sites, rents will not be equal, and the prices of land will vary. In order to determine the values buyers place on these characteristics, a hedonic model is used. This model attempts to estimate the implicit prices of "characteristics that differentiate closely related products in a product class" (11). After estimating the price of land as a function of its characteristics, the change in price due to a marginal change in the characteristic is estimated by the partial derivative of the function with respect to that characteristic. In this way, it can be determined what characteristics buyers value most about land, and how these factors are influencing land values.

Many functional forms for hedonic models exist; two will be used in this analysis. A log-linear model will be used because it is commonly used for goodness-of-fit. A log-log model will be used to give elasticities of price per acre with respect to explanatory variables.

To allow for variable effects of variables by year, each model is estimated separately for every year. Because of the large interval of years as described in Section 2.1, a time series model cannot be estimated.

4.1.2 Variables

- CSR: Corn Suitability Rating for the parcel sold
- Total Acres: Size of the parcel
- Total AcresSQ: Size of the parcel squared
- Risk: A measure of risk, the University of Michigan Consumer Sentiment Index, by quarter (29)
- RentLag: The average cash rent for row crop ground for each county, for the previous year (20)
- Percent Land Rented: The percent of cropland that is rented, by county (30)
- Seller Location: Binary variable indicting whether seller is in Iowa (1) or outside of Iowa (0)
- Buyer Location: Binary variable indicting whether buyer is in Iowa (1) or outside of Iowa (0)
- Interest Rate: Farm Real Estate Loan Rate, obtained from the Federal Reserve Bank of Chicago, quarterly
- Measurement of proximity to large city and urbanization (Rural-urban Continuum Codes, 2003) (10)
- USDA County Amenity Index(1999) (9)

- DFamily: Binary variable indicating whether sale was to a family member (1) or to a non-family member (0)

- μ_{ij}: Error term

Natural log of price per acre is used as the dependent variable. Price per acre adjusted for taxable acres (taking total sale price divided by taxable acres instead of dividing by total acres) are available for every parcel except those in 1990, however, using price per acre does not significantly change results. Therefore, price per acre is used so 1990 can be compared to other years.

CSR measures productivity of the soil. Higher productivity should lead to an increase in price, because of the ability to grow high revenue crops (corn and soybeans) as opposed to lower revenue crops (pasture and alfalfa).

A large parcel size is desirable for ease of agricultural production with modern large equipment, however too large of a size may reduce price per acre due to higher transactions costs, less capital availability, less need for a large parcel size due to equipment and time constraints, or other factors. The squared term for parcel size should capture this effect mathematically, by allowing for a quadratic (declining) effect of parcel size on price. Total Acres is divided by 100 to make the coefficient larger while still being easily interpreted. This value is squared for the quadratic effect, again allowing for a larger coefficient that is still easily interpreted.

A measurement of risk allows for capturing the expectations of people in the general economy. The University of Michigan Consumer Sentiment Index is a nationwide survey that is used by business, finance, and federal agencies. It asks about personal financial situations, overall economic conditions, and buying attitudes (28). If expectations about the economy are high, people will be more willing to invest in productive capital such as land.

Lagged rents capture past returns to corn and soybeans. It also captures county specific productivity, and productivity changes over time. Missing values were calculated using interpolation or extrapolation.

Percent land rented shows the availability of land, as well as the influence of investors in land as opposed to owner-operators.

Seller and buyer location are included to estimate the difference location has on prices. If farmland is seen as an investment by those outside agriculture then people from out of state will purchase farm land and increase the price.

Interest rate captures the effect higher costs of borrowing has on land prices. If costs to borrow are high, parcels will sell for a lower price because the cost of borrowing will be figured into the sales price. The interest rate is also related to the opportunity cost of capital: the returns that could be made in other investments.

Proximity to large city and urbanization accounts for land values affected by increased demand for development and desire for proximity to cities. Proximity to cities may be desirable for marketing agricultural production, shopping, entertainment, education, and off-farm employment.

Amenity index accounts for amenities in specific counties (of the factors included in the index, topography and water area vary the most in Iowa) that may influence buyers to purchase land in that county. Those who value outdoor recreation will pay a higher price to be closer to areas that offer recreation.

DFamily measures the effect that selling to a family member has on price. It is assumed that sales to a family member will be below market value.

For simplicity, the error term is assumed to be randomly distributed with a mean of zero.

4.1.3 Model 1: Log-Linear

$$\begin{aligned} Ln(price/acre)_j = {} & \beta_{0j} + \beta_{1j}CSR + \beta_{2j}TotalAcres/100 + \beta_{3j}(TotalAcres/100)SQ + \beta_{4j}Risk \\ & + \beta_{5j}RentLag1 + \beta_{6j}\%LandRented + \beta_{7j}SellerLocation + \beta_{8j}BuyerLocation \\ & + \beta_{9j}InterestRate + \beta_{10j}Beale2003 + \beta_{11j}Amenity + \beta_{12j}DFamily + \mu_{ij} \end{aligned}$$

Where subscript j denotes the specific year, either 2010, 2009, 2005, or 1990. 2011 was not included because fourth quarter data was not included. Trends show that an increasing amount of sales are being made in the fourth quarter, and it was felt that modeling only the first three quarters of 2011 would not be representative of the entire year.

This model has two main advantages: goodness of fit and easy interpretation of dummy variables (13). This specification assumes that the effects were additive. The coefficient on a dummy variable is the percentage change in the explanatory variable, *ceteris paribus*. The coefficients on other variables are the effect on ln(price/acre) given a marginal change in the explanatory variable:

$$\frac{\partial ln(price/acre)}{\partial q_i} = \beta_i$$

where q_i is a specific characteristic (explanatory variable), i.

4.1.4 Model 1 (Log-Linear) Results

Table 4.1 shows the coefficients and standard errors for each variable. Only CSR, RentLag1, and Beale2003 are significant for every year. CSR is not the variable with the most effect (positive or negative) on price per acre, but this is because CSR has a high range of values (20 to 100), while most of the variables having a larger effect have a smaller range. Preliminary work with standardization of coefficients shows that CSR has the largest effect on the natural log of price per acre.

The coefficient on size of the parcel (TotAcres) was negative for every year except 2010. This shows that larger parcels have a lower price per acre, possibly due to the difficulty in obtaining sufficient capital to purchase a large parcel, or because of increased closing costs or other costs that are a percentage of final sale price.

The coefficient on Risk was negative until 2010, which indicated that higher perceived risk in the economy meant lower prices for land. In 2010, the coefficient was positive and significant, which showed that the uncertainty in most areas of the economy has lead to an increase in the use of agricultural land as an investment. Investment could be by existing farmers, new farmers, or absentee owners.

Beale codes range in value from 1 to 9. They are structured so that a higher number means less urban influence, which explains why coefficients are all negative. This shows that land prices in Iowa are influenced by proximity to urban areas and population centers; parcels closer to urban areas will have higher prices, and parcels farther from urban areas will have lower prices.

In the entire United States, amenity index values range from -6.4 to 11.17. Each factor is calculated for all counties, and standardized so that it has a mean of zero and a standard deviation of one. All the factors are summed to create the index. All counties in the sales data have a value less than zero. The Amenity index gives counties with more natural amenities a higher number. This gives a negative sign on the coefficients; parcels sold in counties with less natural amenities have a lower price. People are willing to pay more for land in areas with higher amenities.

The coefficient on DFamily (indicating a sale made to a family member) was not always statistically significant, but for all years except 1990 it had the expected (negative) sign. This means that sales made to a family member had a lower sale price than those that were sold at "arm's length".

Table 4.1 Model 1 Results

Variable	1990	2005	2009	2010
CSR	0.014***	0.011***	0.011***	0.013***
	(0.001)	(0.001)	(0.001)	(0.001)
TotAcres100	-0.092***	-0.030	-0.057	-0.014
	(0.031)	(0.022)	(0.034)	(0.037)
TotAcres100SQ	0.009	0.005	0.006	0.008
	(0.005)	(0.004)	(0.008)	(0.009)
Risk	-0.002	-0.010	-0.004**	0.016**
	(0.003)	(0.011)	(0.002)	(0.007)
RentLag1	0.009***	0.010***	0.004***	0.003***
	(0.001)	(0.001)	(0.001)	(0.001)
%LandRented	0.376**	0.359***	0.265	0.499***
	(0.163)	(0.107)	(0.139)	(0.127)
SellStateD	0.010	-0.033	-0.015	0.045
	(0.032)	(0.021)	(0.024)	(0.024)
BuyStateD	0.077	-0.034	0.003	0.039
	(0.040)	(0.023)	(0.035)	(0.031)
RELoanRate	-0.159	-0.012	-0.921	-0.634***
	(0.589)	(0.193)	(1.004)	(0.097)
Beale2003	-0.018***	-0.018***	-0.025***	-0.030***
	(0.007)	(0.005)	(0.005)	(0.005)
Amenity	0.000	-0.025**	-0.070***	-0.038***
	(0.016)	(0.010)	(0.012)	(0.013)
DFamily	0.120	-0.048	-0.092	-0.049
	(0.338)	(0.049)	(0.047)	(0.044)
Constant	7.002	6.778***	12.709**	9.186***
	(6.253)	(2.267)	(6.208)	(0.466)
Adjusted R^2	0.4903	0.5686	0.4568	0.5373

Standard errors in parenthesis
** Statistically significant at a 5% level
*** Statistically significant at a 1% level

4.1.5 Model 2: Log-log

A log-log form of the model takes the following form:

$$\begin{aligned} Ln(price/acre)_j = \gamma_{0j} + \gamma_{1j} ln(CSR) + \gamma_{2j} ln(TotalAcres) + \gamma_{3j} ln(Risk) + \gamma_{4j} LNRentLag1 \\ + \gamma_{5j} LN\%LandRented + \gamma_{6j}(SellerLocation) + \gamma_{7j}(BuyerLocation) \\ + \gamma_{8j} ln(InterestRate) + \gamma_{9j} ln(Beale2003) + \gamma_{10j} ln(Amenity) \\ + \gamma_{11j}(DFamily) + \varepsilon_{ij} \end{aligned}$$

Where subscript j denotes the specific year, either 2010, 2009, 2005, or 1990. It was assumed that the effects are additive.

Each γ term is the elasticity of its explanatory variable (except dummy variables) (13), which means that a 1% change in the explanatory variable causes a γ_i% change in price per acre:

$$\frac{\partial ln(price/acre)}{\partial ln(q_i)} = \gamma_i = \epsilon_i$$

where ϵ_i is the elasticity of characteristic (explanatory variable) i.

4.1.6 Model 2 (Log-Log) Results

Amenity was transformed to Amenity5 by adding 5 to every value. The natural log of Amenity5 was taken and used in the regression. This transformation was necessary because Amenity values for counties in Iowa are negative, and natural logs of a negative number cannot be taken. The natural log of Total Acres squared was not included due to collinearity with the natural log of Total Acres.

Table 4.2 shows the coefficients and standard errors for each variable. Only LNCSR, LNRentLag1, LNBeale2003, and LNAmenity5 are significant for every year. CSR is now one of the variables with the highest effects, because the coefficients are now elasticities.

The size of the parcel (LNTotAcres) was negative for every year except 2010. This shows that larger parcels have a lower price per acre, due to the difficulty in obtaining sufficient capital to purchase a large parcel, or because of increased closing costs or other costs that are a percentage of final sale price.

The coefficient on Risk was negative until 2010, which means that higher perceived risk in the economy meant lower prices for land. In 2010, the coefficient is positive and significant, which means that the uncertainty in most areas of the economy has lead to an increase in the use of agricultural land as an investment.

Beale codes are structured so that a higher number means less urban influence, which explains why coefficients are all negative. This shows that land prices in Iowa are influenced by proximity to urban areas and population centers; parcels closer to urban areas will have higher prices, and parcels farther from urban areas will have lower prices.

The Amenity index gives counties with more natural amenities a higher number. This gives an expected negative sign on the coefficients; parcels sold in counties with less natural amenities have a lower price.

The coefficient on DFamily (indicating a sale made to a family member) was not always statistically significant, but for all years except 1990 it had the expected (negative) sign. This means that sales made to a family member had a lower sale price than those that were sold at "arm's length".

Table 4.2 Model 2 Results

Variable	1990	2005	2009	2010
LNCSR	0.775***	0.534***	0.615***	0.738***
	(0.058)	(0.035)	(0.047)	(0.048)
LNTotAcres100	-0.072***	-0.021	-0.041**	0.016
	(0.023)	(0.014)	(0.018)	(0.018)
LNRisk	-0.137	-0.791	-0.234	0.894
	(0.279)	(0.982)	(0.133)	(0.504)
LNRentLag1	1.009***	1.460***	0.588***	0.626***
	(0.124)	(0.108)	(0.130)	(0.155)
LN%LandRented	0.021	0.133***	0.049	0.135**
	(0.075)	(0.049)	(0.063)	(0.058)
SellStateD	0.008	-0.035	-0.004	0.045
	(0.032)	(0.021)	(0.024)	(0.024)
BuyStateD	0.056	-0.041	-0.001	0.029
	(0.040)	(0.023)	(0.035)	(0.031)
LNRELoanRate	-1.936	0.092	-6.478	-3.490***
	(7.077)	(1.394)	(6.115)	(0.552)
LNBeale2003	-0.127***	-0.087***	-0.157***	-0.179***
	(0.031)	(0.022)	(0.025)	(0.024)
LNAmenity5	-0.063**	-0.091***	-0.190***	-0.149***
	(0.029)	(0.021)	(0.023)	(0.024)
DFamily	0.206	-0.042	-0.099**	-0.037
	(0.337)	(0.049)	(0.047)	(0.044)
Constant	4.651	2.294	15.864	4.819***
	(15.870)	(7.083)	(11.258)	(1.862)
Adjusted R^2	0.4932	0.5726	0.4661	0.5480

Standard errors in parenthesis

** Statistically significant at a 5% level

*** Statistically significant at a 1% level

4.2 Conclusions

CSR is the most common measure of productivity in Iowa; that it was always a positive influence of land prices is expected. A higher productivity of soil allows for larger returns in row crop production, and parcels with higher productivity should be higher in price than a similar parcel with lower productivity. CSR was most influential in 1990 and 2010. The increase from 2005 to 2009 to 2010 showed that buyers were willing to pay more for more productive ground, due to the increased revenue from row crop production.

In 2010, no measure of parcel size was significant. This means that the issues mentioned in Subsection 4.1.2 (higher transactions costs, less capital availability, etc.) did not affect land prices in 2010.

For both models in all years, the lag of rent was always significant. Productivity and profitability are reflected in rents; when either or both of these increase, the value of land increases.

The real estate loan rate, when significant, was a negative influence on price. This is expected from economic theory; higher borrowing costs lead to lower offered prices. However, this effect was smaller in 2010 and 2009. This signals that the availability of capital was not as influencing of a factor; buyers were able to find cheaper sources of capital.

Location (measured by proximity to population centers) positively influencing land prices is also expected, because of positive influences to production agriculture (markets, availability of inputs) as well as personal influences (educational, recreational, and job opportunities).

For all years, the log-log model has slightly better fit than the log-linear model, though this difference is small. Both models provide similar R^2 values to other hedonic models of farmland price (5) and (16). All coefficients that are significant have the same sign in both models.

Use of either model depends on the variables of interest. If the effect of a specific, known change of a variable is desired to be known, then Model 1 should be used. If the effect of a percentage change in a variable is desired to be known, then Model 2 should be used.

CHAPTER 5. DERIVING IMPLIED INTEREST RATES FROM SALE PRICES

In a simple case, the net present value of a stream of incomes can be represented by (21):

$$NPV = \frac{P_1}{(1+i)^1} + \frac{P_2}{(1+i)^2} + \ldots + \frac{P_n}{(1+i)^n} \tag{5.1}$$

Where NPV is the net present value of the stream of returns, P_n is the return received in period n (net of inflation), i is the interest rate (also net of inflation) (1), and n is the number of periods. If it is assumed that P_n and i are the same for every period, and the number of periods approaches infinity, Equation 5.1 simplifies succinctly to (1):

$$NPV = \frac{P}{i} \tag{5.2}$$

Solving Equation 5.2 for i gives Equation 5.3:

$$i^* = \frac{P}{NPV} \tag{5.3}$$

Solving this equation for i^* gives an estimation of the discount rate used by those purchasing land in their decision to do so. A large value indicates a higher discounting of more distant returns, a higher cost of capital, or necessity of high returns.

Estimated returns were calculated in a multi-step process. For all years, the previous year's data was used, because those selling land in the first three-quarters of the year do not know the yields or prices for that year. County average yields for corn and soybeans were used for all years (25). County average prices were used for 1990; regional average prices were used in 2005 and 2009, because county average prices ceased to be reported after 2005. State average prices were used for 2010 and 2011, because regional prices were not available. Costs were calculated as the state average cost of production for each crop minus land cost (19). Then, for each county and year, an estimated return per acre was calculated. Price minus cost for each crop gave net profit for each crop, and this value was multiplied by the yield for that specific crop to find net profit per acre. Then, a weighted average return was calculated using weights for corn and soybean acres based on crop rotation patterns. For each year (i) and county (j), the acres of corn (in rotation with soybeans (C_{ij}^r) and continuous corn (C_{ij}^c)) and soybeans planted was summed ($C_{ij}+S_{ij} = T_{ij}$). The acreage of soybeans divided by the total acres was assumed to be the percentage of soybeans that was in a crop rotation with corn ($\%S_{ij} = S_{ij}/T_{ij}$). Therefore, that same percentage was currently in corn (in a rotation with soybeans) ($\%S_{ij} = \%C_{ij}^r$). The percentage of corn in continuous rotation was then 100% minus the percentage of soybeans in rotation minus the percentage of corn in rotation ($\%C_{ij}^c = 100\% - \%C_{ij}^r - \%S_{ij}$). The sum of percentages of corn in rotation and continuous corn by county and year ($\%C_{ij}^r + \%C_{ij}^c$) was multiplied by the return to corn by county and year, and added to the percentage of soybean in rotation ($\%S_{ij}$) multiplied by the return to soybeans. This method assumed revenue per acre was the same for every parcel in a specific county in a specific year, but allowed for regional and yearly variation in crop rotation practices. Each transaction then has an estimate of returns, so i^* is estimated for every sale in the set. It is then averaged for each year, removing certain observations as described in Chapter 2.

It was felt that the real estate interest rates from the Chicago Federal Reserve do not truly reflect the capitalization rates for land owners. Similarly to Henderson and Briggeman (15), a rent to value rate was computed. In this case, 92% of the average rental rate per acre (calculated by ISU) for each year was divided by that county's land value survey value. The owner will not net 100% of the rent; taxes and management fees must be paid. Taxes are assumed to be 1% of the rent and management fees 7% of the rent. For the year 1990, the rental rate from the USDA was used, because ISU did not do a statewide survey before 1994. Adjusted price per acre (adjusted for taxable acres) did not change the results significantly, therefore, price per acre was used so that 1990 could be included in the analysis (adjusted price per acre was not available in the sales data in 1990). The rent-to-value ratio and the implied interest rate are summarized in Table 5.1.

In Table 5.1, i^* is the average implied discount rate used by those purchasing land in that year. The rent-to-value ratio for each county and year is represented by i. In general, rent-to-value has been decreasing. This means rents have not increased at the same rate as value per acre. The implied discount rate for the same time has been increasing, and is higher for every county for 2009 and 2011.

Table 5.1 shows that implied interest rates vary significantly between counties. The counties with higher values tend to be in the southwest region. This could mean that land in those regions is undervalued compared to other areas of the state. However, that land can be more variable in productivity than land in other regions; the higher quality ground cannot be managed and utilized separately from the lower quality ground due to abrupt, sudden variations in the same parcel.

Table 5.1 Implied Interest Rate by County

Year	2005		2009		2010		2011[a]	
	i^*	i	i^*	i	i^*	i	i^*	i
Chickasaw	3.1%	4.3%	7.7%	4.0%	2.6%	3.9%	14.0%	3.2%
Clayton	4.3%	5.3%	9.5%	4.3%	2.9%	4.0%	13.1%	3.5%
Clinton	2.9%	5.4%	7.4%	4.7%	2.8%	4.5%	9.7%	3.5%
Des Moines	4.3%	4.6%	8.1%	4.6%	3.4%	4.0%	7.8%	3.2%
Dubuque	2.9%	4.7%	6.4%	4.4%	2.5%	4.3%	9.8%	3.5%
Emmet	2.4%	3.7%	8.4%	3.2%	3.3%	2.9%	7.8%	2.4%
Floyd	3.1%	4.1%	7.3%	3.8%	2.7%	3.1%	10.5%	3.0%
Fremont	3.8%	4.8%	8.4%	4.4%	5.3%	3.5%	13.0%	3.1%
Hardin	2.9%	4.3%	6.1%	4.0%	2.5%	3.3%	8.6%	3.0%
Humboldt	2.4%	3.8%	6.6%	3.8%	2.4%	3.1%	7.0%	2.7%
Lyon	2.2%	4.5%	5.6%	3.5%	2.1%	3.3%	6.7%	2.6%
Mills	2.9%	4.4%	7.0%	3.9%	3.9%	3.5%	8.2%	3.1%
Page	4.9%	5.3%	8.6%	5.0%	5.1%	4.2%	15.5%	4.0%
Pocahontas	2.3%	3.6%	7.0%	3.6%	2.4%	2.8%	6.3%	2.7%
Polk	2.7%	4.5%	5.5%	4.1%	2.4%	3.3%	6.5%	2.6%
Pottawattamie	3.4%	4.4%	7.0%	3.8%	2.7%	3.3%	7.6%	2.9%
Story	2.5%	3.9%	5.7%	3.6%	2.3%	3.1%	6.7%	2.8%
Taylor	6.4%	6.9%	11.9%	6.9%	5.8%	6.7%	15.6%	5.1%
Woodbury	2.8%	5.1%	7.9%	4.9%	3.1%	4.3%	10.3%	3.6%
Wright	2.4%	3.9%	6.6%	3.8%	2.4%	3.2%	6.6%	2.8%
Average	3.2%	4.6%	7.4%	4.2%	3.1%	3.7%	9.6%	3.2%

i^* is the average imputed interest rate

i is the rent-to-value ratio for each county

[a] Only first three-quarters of the year were available

The difference in i^* and i could be seen as the risk premium for those using the land for production compared to those using the land for its rental value. The increase in i^* in 2009 and 2011 could mean that those purchasing land in those years feel that the returns seen recently will not continue. 2008 and 2010 were high return years in corn and soybeans. In agriculture, believed to be a competitive market, excess returns will not last for long periods of time, due to entry of new firms, expansion of existing firms, and increases in prices of inputs. Also, rent reported by survey may be artificially low due to 31% of cash rent being rented to relatives (7). Rent charged to relatives may not be adjusted as often to reflect market conditions. Which of these factors are contributing to the difference in i^* and i, and how much they are contributing, are areas for future research.

A more general net present value model assumes a constant growth rate (g) for P_i (4):

$$NPV = \frac{(1+g)}{(1+i)} * P_0 + \frac{(1+g)^2}{(1+i)^2} * P_0 + \ldots + \frac{(1+g)^n}{(1+i)^n} * P_0 \tag{5.4}$$

In this case, the NPV is the price of land per acre, and P_0 is the net profit per acre in period zero. If it is assumed that i is greater than g, g is constant, and the number of periods goes to infinity, the infinite sum can be written

$$NPV = \frac{(1+g)}{(i-g)} * P_0. \tag{5.5}$$

(4)

For future research, expected growth rates could be calculated using crop returns at P_0 and sale prices as NPV.

CHAPTER 6. DISCUSSION AND CONCLUSIONS

6.1 Discussion

The changing nature of farmland ownership, the rapid increase in price, and concern about land being overpriced had lead to many questions about sales of land in Iowa. Using a dataset composed of sales, as opposed to survey responses, allowed for an analysis of trends in parcel size and quality, trends in location of buyers and sellers, trends in types of buyers and sellers, and trends in the number of auctions. Survey values were compared to sales data, and a hedonic model of price per acre from sales data was constructed to estimate the effects that different characteristics and microeconomic variables have on farmland prices. Finally, using Net Present Value formulas, implicit interest rates of those purchasing land were calculated.

Average size of parcels sold has remained relatively constant. In 2005 the average parcel sold was larger, and the standard deviation was higher. Average CSR has increased slightly since 1990. About 85% of land sold was in the low or middle third of its county's CSR range. Owners are holding on to higher quality land, even in times of rapid price increases.

The percentage of sellers classified as sole proprietors has decreased, while the percentage of sellers classified as families, couples, and trusts has increased. The percentage of buyers classified as sole proprietors has decreased, while the percentage of buyers classified as couples, trusts, and corporations have increased. The age of landowners has been slowly increasing; more couples, trusts, and corporations are buying land. The combinations of locations of buyers and sellers have no clear pattern or trend.

The two most recent full years of data show that less land is being sold in the first quarter of the year, and more land is being sold in the fourth quarter of the year. If land is sold later in the year, that year's crop returns are closer to being realized, and can be used in purchasing land. Also, this land can be turned over to the new ownership and farmed starting the next year. The number of parcels sold by auction has been slowly increasing, due to price volatility.

Using means tests, it was determined that out-of-state sellers sell parcels with higher CSR (except for 2011), in-state buyers buy parcels with higher CSR, out-of-state sellers sell larger sized parcels, and out-of-state buyers buy larger sized parcels. Out-of-state sellers are more likely to be investors that had capital to purchase higher quality land, and they are now selling due to high land prices. In-state buyers are buying more productive land that is returning more profit due to higher commodity prices. Out-of-state sellers and buyers are selling and buying larger parcels, due to the higher amounts of capital they are likely to have as investors.

The sales data have one major problem: it is not composed of a large number of consecutive years. If all of 2011 was available, a hedonic model for that year could be estimated, and trends in sales details in Chapter 2 could be expanded. Also, if the years from 2005 to 2011 were all available, it would be easier to see if trends in sales details have been gradual or sudden. Finally, if some periodic years between 1990 and 2005 were available, patterns in the trends could be observed. Another problem is that the southeast region of the state is not represented; adding more randomly selected counties might capture some this region, then its effects could be calculated.

6.2 Conclusions

6.2.1 Comparison of Sales Data to Survey Results

For all years except 2011, means of price per acre are calculated for each county. These means are compared to survey results conducted by Iowa State University (18). Survey results are consistently (80% of the time) higher than sales prices, by an average of 9.5%. The ISU survey asks for "value", which has many components. Value can have components that are not easily seen, such as pride of ownership, opportunity of expansion, and ability to pass on to future generations. The two types of value, "value in use" and "value in exchange," are not the same and differ from person to person. Value in use captures the utility from the components mentioned above, but value in exchange is the amount a person would be willing to trade or pay for the land. These two definitions of value lead to differing opinions.

6.2.2 Hedonic Model

Two hedonic models are estimated. The first is estimated using a log transformation to the dependent variable, price per acre. The second performs the log transformation to the dependent variable and the independent variables that are not binary. This allows the coefficients on the explanatory variables to be interpreted as elasticities. Both models have a higher predicting power (adjusted R^2) than an earlier model (14), due to a higher number of explanatory variables that influence land prices. They have a similar adjusted R^2 to (5) and (16).

In the first model, only CSR, the previous year's average cash rent, and a variable measuring urban influence are statistically significant for every year. Sales made to family members are determined to have a lower price than those made at "arm's-length", but the effect is only statistically significant for one year (2009).

In the second model, the transformed variables of CSR, the previous year's average cash rent, urban influence, and natural amenities are statistically significant in every year. This shows that land prices in Iowa are influenced by the productivity of land, returns to corn and soybeans, as well as the proximity to cities and natural amenities.

6.2.3 Implied Interest Rate

Using a simple net present value formula, the implicit interest rate is estimated for every parcel. Averaged per county, in 2009 and 2011, this value is much higher than real estate loan interest rates or implied capitalization rates given by the rent-to-value ratio. This difference could be seen as the risk premium for those using the land for production compared to those using the land for its rental value. The sharp increase in 2009 and 2011 could mean that those purchasing land in those years feel that the returns seen recently will not continue.

6.3 Future Research

In order to better capture trends, especially in seller and buyer types and locations, more years and/or counties could be added to the sales data. More years would allow for a time series analysis of land characteristics on prices.

Government payments are not included in the estimated returns. These can reduce losses in years of poor yield, low prices, or both. If government payments can be estimated separately their effects on land prices could be estimated.

A breakdown of land value survey results into low, middle, and high grade land could be compared to the sales values for low, middle, and high CSR parcels in Chapter 2 to obtain more insights into the difference in land value survey results and sales prices.

Expected growth rates could be calculated using Equation 5.5, as discussed at the end of Chapter 5.

Because some of the counties in the dataset are adjacent to each other, a comparison of sale values of parcels in close proximity to each other but in different counties could provide details into the values of county specific assets (such as natural resources), or the effects of county specific taxes or policies.

Functions for bid and offer curves for land characteristics could be derived from the hedonic model (11), along with profit functions for those purchasing land and using it in production agriculture.

Overall, the most useful additions to this work will be sales data from 2006-2008 and the fourth quarter of 2011, to determine trends in CSR, parcel size, and sellers and buyers in recent years, and to estimate a hedonic model for 2011.

APPENDIX A. ADDITIONAL MATERIAL

Land Value Survey

IOWA STATE UNIVERSITY
University Extension

Department of Economics
478 Heady Hall
Ames, IA 50011-1070
Phone: 515-294-6160
Fax: 515-294-3838
E-mail: mduffy@iastate.edu

November 1, 2011

Dear Friend:

Each year since 1942, Iowa State University has conducted an annual farmland value survey. Questionnaires are sent to over 1,000 licensed real estate brokers, farm managers, and others knowledgeable about the land market. A complete analysis of land values and factors influencing the land market is compiled from the survey data. Participation in this survey is voluntary and all responses are treated confidentially. A copy of the survey report is sent to all participants. I hope you will support the land value survey by filling in the answers to the questions below and returning the questionnaire in the enclosed envelope as soon as possible but no later than November 30. If you have any questions concerning the survey, please contact me at (515) 294-6160. Thank you for your help.

Sincerely,

Michael Duffy
Extension Economist

Farmland Values as of November 1, 2011*

Primary County: ________________________________

1. Values for average-size farms are:

High grade land $______________/acre

Medium grade land $______________/acre

Low grade land $______________/acre

2. Number of sales you have made in the last 12 months compared to the same period in 2010 was:

More _____ Less _____ Same _____ *(check one)*

3. What were the most important factors operating in the land market in your territory since November 2010?

Positive	**Negative**
a. ________________________________	a. ________________________________
b. ________________________________	b. ________________________________
c. ________________________________	c. ________________________________

4. In your territory during the past 12 months what percentage of farmland sales were to:

_______% Investors _______% New Farmers

_______% Existing Farmers _______% Other

***IF YOU HAVE INFORMATION FOR OTHER COUNTIES, PLEASE LIST ON REVERSE SIDE.**

Background Sources

1. Huang, Haixiao; Miller, Gay Y.; Sherrick, Bruce J. and Gómez, Miguel I. "Factors Influencing Illinois Farmland Values." *American Journal of Agricultural Economics*, May 2006, *88* (2), pp. 458-470.

2. Iowa State University Extension. "Iowa Land Value Survey Results 2010." Extension and Outreach. Available at: http://www.extension.iastate.edu/landvalue/

3. Kmenta, Jan. *Elements of Econometrics.* 2nd ed. Ann Arbor, MI: The University of Michigan Press, 2000.

4. Peterson, Willis. "Land Quality and Prices." *American Journal of Agricultural Economics*, November 1986, *68* (4), pp. 812-819.

5. Scott, John T., Jr. "Factors Affecting Land Price Decline." *American Journal of Agricultural Economics*, November 1983, *65* (4), pp. 796-800.

APPENDIX B. STATISTICAL RESULTS

Supplemental Statistics

Table B.1 Model 1 (Log-Linear), 2010 Correlation Matrix

	LNPPA	CSR	TotAcres100	TotAcres100SQ	Risk	RentLag1	%LandRented	SellStateD	BuyStateD	RELoanRate	Beale2003	Amenity	DFamily
LNPPA	1.0000												
CSR	0.6550	1.0000											
TotAcres100	-0.0312	-0.0560	1.0000										
TotAcres100SQ	-0.0176	-0.0376	0.9153	1.0000									
Risk	-0.1077	-0.0353	0.0332	0.0367	1.0000								
RentLag1	0.4093	0.3625	-0.0780	-0.0562	-0.0260	1.0000							
%LandRented	0.4976	0.5493	-0.0230	-0.0151	-0.0658	0.3571	1.0000						
SellStateD	-0.0099	-0.0810	-0.0809	-0.0767	-0.0015	-0.0433	-0.1511	1.0000					
BuyStateD	0.0649	0.0142	-0.1787	-0.1730	-0.0073	0.0122	-0.0225	0.1682	1.0000				
RELoanRate	-0.2377	-0.0906	-0.0118	0.0138	0.6894	-0.0441	-0.0616	0.0492	-0.0165	1.0000			
Beale2003	-0.2000	-0.0544	0.0162	0.0323	-0.0004	-0.1748	-0.0446	-0.1265	-0.1421	0.0095	1.0000		
Amenity	-0.4253	-0.4863	0.0952	0.0691	0.0116	-0.4335	-0.5754	0.0617	0.0150	0.0953	-0.2968	1.0000	
DFamily	-0.0509	-0.0158	0.0202	0.0179	-0.0129	-0.0762	0.0258	0.0712	0.0325	0.0280	0.0416	0.0210	1.0000

Table B.2 Model 1 (Log-Linear), 2009 Correlation Matrix

	LNPPA	CSR	TotAcres100	TotAcres100SQ	Risk	RentLag1	%LandRented	SellStateD	BuyStateD	RELoanRate	Beale2003	Amenity	DFamily
LNPPA	1.0000												
CSR	0.5709	1.0000											
TotAcres100	-0.0891	0.0286	1.0000										
TotAcres100SQ	-0.0631	0.0242	0.9023	1.0000									
Risk	-0.0736	-0.0608	-0.0201	-0.0281	1.0000								
RentLag1	0.2472	-0.0001	-0.0639	-0.0463	-0.0481	1.0000							
%LandRented	0.3534	0.4523	-0.0260	-0.0239	0.0463	-0.2364	1.0000						
SellStateD	-0.0120	-0.0729	-0.1137	-0.0912	-0.0177	0.1817	-0.1176	1.0000					
BuyStateD	0.0733	0.0200	-0.1619	-0.1535	-0.1115	0.1379	0.0106	0.1301	1.0000				
RELoanRate	-0.0724	-0.0959	-0.0749	-0.0583	-0.1369	0.0038	-0.1043	-0.0169	0.0326	1.0000			
Beale2003	-0.1976	-0.0236	0.0210	0.0145	0.0653	-0.4030	0.0300	-0.0506	-0.1038	-0.0440	1.0000		
Amenity	-0.4057	-0.3687	0.0877	0.0539	-0.0933	-0.0351	-0.5388	0.0068	-0.0144	0.0770	-0.2270	1.0000	
DFamily	-0.0185	0.0193	-0.0418	-0.0361	-0.0646	0.0117	0.0690	0.0539	0.0021	-0.0259	-0.0375	-0.0506	1.0000

Table B.3 Model 1 (Log-Linear), 2005 Correlation Matrix

	LNPPA	CSR	TotAcres100	TotAcres100SQ	Risk	RentLag1	%LandRented	SellStateD	BuyStateD	RELoanRate	Beale2003	Amenity	DFamily
LNPPA	1.0000												
CSR	0.6119	1.0000											
TotAcres100	-0.1130	-0.0883	1.0000										
TotAcres100SQ	-0.0657	-0.0655	0.8996	1.0000									
Risk	-0.0993	-0.0213	0.0277	-0.0003	1.0000								
RentLag1	0.4538	0.1090	-0.1216	-0.0915	0.0833	1.0000							
%LandRented	0.4305	0.5400	-0.0990	-0.0605	-0.0304	-0.0122	1.0000						
SellStateD	-0.0120	-0.0498	-0.1112	-0.0928	0.0239	0.1532	-0.0799	1.0000					
BuyStateD	0.0831	0.0794	-0.1946	-0.1563	0.0522	0.1950	0.0109	0.0910	1.0000				
RELoanRate	0.1002	0.0245	-0.0247	0.0066	-0.9818	-0.0807	0.0418	-0.0275	-0.0373	1.0000			
Beale2003	-0.2888	-0.0692	0.0476	0.0294	-0.0289	-0.4163	-0.1421	-0.0762	-0.0875	0.0381	1.0000		
Amenity	-0.3762	-0.4595	0.0843	0.0505	-0.0178	-0.1298	-0.5311	0.0220	-0.1050	0.0050	-0.2259	1.0000	
DFamily	-0.0178	-0.0092	-0.0277	-0.0321	0.0057	0.0265	-0.0338	0.0049	0.0619	0.0001	-0.1307	0.0851	1.0000

Table B.4 Model 1 (Log-Linear), 1990 Correlation Matrix

	LNPPA	CSR	TotAcres100	TotAcres100SQ	Risk	RentLag1	%LandRented	SellStateD	BuyStateD	RELoanRate	Beale2003	Amenity	DFamily
LNPPA	1.0000												
CSR	0.6322	1.0000											
TotAcres100	-0.1919	-0.1127	1.0000										
TotAcres100SQ	-0.1329	-0.0764	0.8531	1.0000									
Risk	-0.1032	-0.0437	-0.0126	0.0129	1.0000								
RentLag1	0.5373	0.4988	-0.1531	-0.1373	-0.0640	1.0000							
%LandRented	0.4550	0.4709	-0.1424	-0.1072	0.0234	0.5152	1.0000						
SellStateD	0.0160	-0.0380	-0.0942	-0.0428	-0.0074	0.0489	-0.0538	1.0000					
BuyStateD	0.1354	0.0404	-0.1766	-0.1913	0.0072	0.1685	0.0752	0.1198	1.0000				
RELoanRate	-0.1109	-0.0647	-0.0098	0.0143	0.9326	-0.0688	0.0138	0.0024	0.0277	1.0000			
Beale2003	-0.1711	-0.0535	0.0740	0.0658	0.0377	-0.1172	-0.2154	-0.0097	-0.0862	0.0282	1.0000		
Amenity	-0.3717	-0.4772	0.1393	0.1058	0.0486	-0.4962	-0.5409	0.0383	-0.0666	0.0578	-0.2962	1.0000	
DFamily	0.0303	0.0433	-0.0158	-0.0098	0.0279	0.0044	0.0454	0.0195	0.0146	0.0192	0.0546	-0.0151	1.0000

Table B.5 Model 2 (Log-Log), 2010 Correlation Matrix

	LNPPA	LNCSR	LNTotAcres100	LNRisk	LNRentLag1	LN%LandRented	SellStateD	BuyStateD	LNRELoanRate	LNBeale2003	LNAmenity5	DFamily
LNPPA	1.0000											
LNCSR	0.6454	1.0000										
LNTotAcres100	-0.0210	-0.0418	1.0000									
LNRisk	-0.1045	-0.0318	0.0355	1.0000								
LNRentLag1	0.4134	0.3535	-0.0880	-0.0254	1.0000							
LN%LandRented	0.4796	0.5364	-0.0171	-0.0642	0.3081	1.0000						
SellStateD	-0.0099	-0.0898	-0.0734	-0.0024	-0.0447	-0.1439	1.0000					
BuyStateD	0.0649	0.0164	-0.1478	-0.0071	0.0127	-0.0200	0.1682	1.0000				
LNRELoanRate	-0.2383	-0.0843	-0.0359	0.6764	-0.0453	-0.0586	0.0494	-0.0165	1.0000			
LNBeale2003	-0.1818	-0.0344	0.0000	0.0005	-0.1132	-0.0664	-0.1053	-0.1313	0.0070	1.0000		
LNAmenity5	-0.4185	-0.4051	0.0734	-0.0025	-0.3923	-0.5047	0.0602	0.0078	0.0857	-0.3662	1.0000	
DFamily	-0.0509	-0.0125	0.0039	-0.0137	-0.0783	0.0308	0.0712	0.0325	0.0283	0.0479	0.0235	1.0000

Table B.6 Model 2 (Log-Log), 2009 Correlation Matrix

	LNPPA	LNCSR	LNTotAcres100	LNRisk	LNRentLag1	LN%LandRented	SellStateD	BuyStateD	LNRELoanRate	LNBeale2003	LNAmenity5	DFamily
LNPPA	1.0000											
LNCSR	0.5507	1.0000										
LNTotAcres100	-0.0779	0.0592	1.0000									
LNRisk	-0.0754	-0.0643	-0.0245	1.0000								
LNRentLag1	0.2499	-0.0111	-0.0622	-0.0436	1.0000							
LN%LandRented	0.3333	0.4465	-0.0230	0.0347	-0.2379	1.0000						
SellStateD	-0.0120	-0.0851	-0.1385	-0.0179	0.1799	-0.1317	1.0000					
BuyStateD	0.0733	0.0278	-0.1385	-0.1118	0.1377	0.0084	0.1310	1.0000				
LNRELoanRate	-0.0723	-0.0926	-0.0629	-0.1299	-0.0078	-0.1074	-0.0169	0.0327	1.0000			
LNBeale2003	-0.1839	-0.0096	0.0268	0.0622	-0.3187	-0.0078	-0.0399	-0.0889	-0.0504	1.0000		
LNAmenity5	-0.4038	-0.2864	0.0798	-0.0522	-0.0840	-0.4499	0.0339	-0.0197	0.0587	-0.2988	1.0000	
DFamily	-0.0185	0.0299	-0.0481	-0.0646	0.0136	0.0754	0.0539	0.0021	-0.0258	-0.0233	-0.0479	1.0000

Table B.7 Model 2 (Log-Log), 2005 Correlation Matrix

	LNPPA	LNCSR	LNTotAcres100	LNRisk	LNRentLag1	LN%LandRented	SellStateD	BuyStateD	LNRELoanRate	LNBeale2003	LNAmenity5	DFamily
LNPPA	1.0000											
LNCSR	0.5796	1.0000										
LNTotAcres100	-0.1406	-0.0631	1.0000									
LNRisk	-0.0991	-0.0349	0.0387	1.0000								
LNRentLag1	0.4746	0.0736	-0.1416	0.0831	1.0000							
LN%LandRented	0.4048	0.5136	-0.1048	-0.0370	-0.0279	1.0000						
SellStateD	-0.0120	-0.0593	-0.1028	0.0256	0.1560	-0.0877	1.0000					
BuyStateD	0.0831	0.0725	-0.1958	0.0528	0.2015	0.0041	0.0910	1.0000				
LNRELoanRate	0.1004	0.0364	-0.0436	-0.9835	-0.0800	0.0454	-0.0266	-0.0369	1.0000			
LNBeale2003	-0.2508	-0.0532	0.0529	-0.0336	-0.3616	-0.1460	-0.0697	-0.0653	0.0404	1.0000		
LNAmenity5	-0.3731	-0.3655	0.0896	-0.0319	-0.1544	-0.4761	0.0295	-0.0825	0.0202	-0.2965	1.0000	
DFamily	-0.0178	-0.0057	-0.0116	0.0058	0.0201	-0.0254	0.0049	0.0619	0.0001	-0.1332	0.0890	1.0000

Table B.8 Model 2 (Log-Log), 1990 Correlation Matrix

	LNPPA	LNCSR	LNTotAcres100	LNRisk	LNRentLag1	LN%LandRented	SellStateD	BuyStateD	LNRELoanRate	LNBeale2003	LNAmenity5	DFamily
LNPPA	1.0000											
LNCSR	0.6141	1.0000										
LNTotAcres100	-0.1889	-0.0901	1.0000									
LNRisk	-0.1042	-0.0413	-0.0185	1.0000								
LNRentLag1	0.5505	0.4609	-0.1317	-0.0715	1.0000							
LN%LandRented	0.4270	0.4593	-0.1367	0.0223	0.4814	1.0000						
SellStateD	0.0160	-0.0374	-0.1105	-0.0067	0.0469	-0.0578	1.0000					
BuyStateD	0.1354	0.0437	-0.1230	0.0091	0.1811	0.0691	0.1198	1.0000				
LNRELoanRate	-0.1109	-0.0595	-0.0179	0.9441	-0.0747	0.0126	0.0024	0.0277	1.0000			
LNBeale2003	-0.1418	-0.0142	0.0693	0.0229	-0.0619	-0.2077	-0.0103	-0.0667	0.0138	1.0000		
LNAmenity5	-0.3300	-0.3765	0.1102	0.0422	-0.4069	-0.4723	0.0371	-0.0621	0.0496	-0.3751	1.0000	
DFamily	0.0303	0.0393	-0.0111	0.0274	0.0067	0.0386	0.0195	0.0146	0.0192	0.0440	-0.0028	1.0000

Table B.9 Model 1 Results, Coefficients and p-values

Variable	1990	2005	2009	2010
CSR	0.014	0.011	0.011	0.013
	(0.000)	(0.000)	(0.000)	(0.000)
TotAcres100	-0.092	-0.030	-0.057	-0.014
	(0.003)	(0.168)	(0.096)	(0.694)
TotAcres10 Q	0.009	0.005	0.006	0.008
	(0.073)	(0.195)	(0.469)	(0.382)
Risk	-0.002	-0.010	-0.004	0.016
	(0.494)	(0.339)	(0.050)	(0.028)
RentLag1	0.009	0.010	0.004	0.003
	(0.000)	(0.000)	(0.000)	(0.000)
%LandRented	0.376	0.359	0.265	0.499
	(0.022)	(0.001)	(0.056)	(0.000)
SellStateD	0.010	-0.033	-0.015	0.045
	(0.768)	(0.120)	(0.545)	(0.062)
BuyStateD	0.077	-0.034	0.003	0.039
	(0.057)	(0.140)	(0.926)	(0.204)
RELoanRate	-0.159	-0.012	-0.921	-0.634
	(0.788)	(0.951)	(0.359)	(0.000)
Beale2003	-0.018	-0.018	-0.025	-0.030
	(0.008)	(0.000)	(0.000)	(0.000)
Amenity	0.000	-0.025	-0.070	-0.038
	(0.995)	(0.015)	(0.000)	(0.003)
DFamily	0.120	-0.048	-0.092	-0.049
	(0.722)	(0.325)	(0.051)	(0.273)
Constant	7.002	6.778	12.709	9.186
	(0.263)	(0.003)	(0.041)	(0.000)
Adjusted R^2	0.4903	0.5686	0.4568	0.5373

p-values in parenthesis

Table B.10 Model 2 Results, Coefficients and p-values

Variable	1990	2005	2009	2010
LNCSR	0.775	0.534	0.615	0.738
	(0.000)	(0.000)	(0.000)	(0.000)
LNTotAcr 100	-0.072	-0.021	-0.041	0.016
	(0.002)	(0.151)	(0.022)	(0.358)
LNRisk	-0.137	-0.791	-0.234	0.894
	(0.623)	(0.421)	(0.078)	(0.076)
LNRentLag1	1.009	1.460	0.588	0.626
	(0.000)	(0.000)	(0.000)	(0.000)
LN%LandRented	0.021	0.133	0.049	0.135
	(0.777)	(0.007)	(0.435)	(0.021)
SellStateD	0.008	-0.035	-0.004	0.045
	(0.814)	(0.099)	(0.879)	(0.061)
BuyStateD	0.056	-0.041	-0.001	0.029
	(0.157)	(0.075)	(0.970)	(0.340)
LNRELoanRate	-1.936	0.092	-6.478	-3.490
	(0.784)	(0.948)	(0.290)	(0.000)
LNBeale2003	-0.127	-0.087	-0.157	-0.179
	(0.000)	(0.000)	(0.000)	(0.000)
LNAmenity5	-0.063	-0.091	-0.190	-0.149
	(0.027)	(0.000)	(0.000)	(0.000)
DFamily	0.206	-0.042	-0.099	-0.037
	(0.540)	(0.385)	(0.033)	(0.396)
Constant	4.651	2.294	15.864	4.819
	(0.770)	(0.746)	(0.159)	(0.010)
Adjusted R^2	0.4932	0.5726	0.4661	0.5480

p-values in parenthesis

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