THE EFFECTS OF SUGARBEET PRODUCTION ON MONTANA LAND PRICES

by

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ABSTRACT

This study quantifies the effects of sugarbeet production on irrigated land prices in Montana. The theoretical framework uses an hedonic regression model to determine the impact of land characteristics and sugarbeet prices on land prices. It is argued that sugarbeet price has a positive impact on land prices. It is also argued that soil quality, alternative crop prices, location of parcel, population density, and size of parcel affect land prices.

The primary data used in this study were appraisals for individual land parcels gathered from a private agricultural lender. Ordinary Least Squares regressions were estimated to determine the impact on per acre land prices of sugarbeet prices and other characteristics of each parcel. Results are presented for two different model specifications using current and expected prices.

The reported findings of the effects on irrigated land prices of quality adjusted price, parcel location, population density, and size confirm that these variables have a significant influence for the total population of observations studied.

CHAPTER 1

INTRODUCTION

The U.S. sugar industry has operated almost continuously under some form of government involvement for 200 years. Sugar policy began in 1789 as an import duty to generate revenue, there being no domestic sugar production in the United States at the time. The policy today continues to rely on import controls through a series of country-specific import quotas, but now largely provides income supports to domestic sugarbeet and sugarcane producers and processors without burdening U.S. tax payers. As a result of these policies, the domestic price of sugar has consistently been above world prices, and U.S. producers have been protected from the volatility and competition of the world market (Borrell and Duncan, 1992). Protection from imports of low-cost producers in other countries creates economic benefits for U.S. producers selling in the domestic market. These benefits make sugar policy valuable to the U.S. sugar industry, which helps explain the longevity of this policy.

Sugar, in its refined state, can be produced from two markedly different inputs; sugarcane and sugarbeets. Sugarcane is grown in humid climates, while sugarbeets are grown in more temperate climates, making it possible for sugar to be produced in many areas of the world. Most U.S. sugarcane acreage is located in the southern states of Louisiana and Florida. Texas and Hawaii also produce sugarcane. Sugarbeet production is primarily located in Minnesota, North Dakota, Idaho, Michigan, California, Wyoming, Nebraska, and Montana.

Sugarbeet production in Montana is restricted to certain geographic areas by several factors. Soil quality, access to irrigation water, and contractual arrangements with sugarbeet processors are essential for production. Another important consideration is proximity to a processing plant because the high bulk and quick decomposition of sugarbeets generates high transportation and storage costs. These factors considerably limit the distance of production from a processing plant.

Sugarbeet producers in the United States receive sugarbeet prices based upon domestic sugar prices which are consistently above world prices. Sugarbeet production is the most profitable crop alternative in some U.S. regions. Rents from sugar policy may inflate production and processing asset values. For producers, sugarbeet land is the asset that typically capitalizes these rents. The extent of asset capitalization of land values that results from sugar policy needs to be quantified so producers, processors, and domestic policy-makers can understand the impact of sugar policy.

Quantifying the level of asset capitalization provides insights about the effects of U.S. sugar policy and potential impacts from policy changes on sugarbeet production and land values. The specific purpose of this study is to determine the impact of U.S. sugar policy on land prices in sugarbeet production areas of Montana.

This study examines the quantitative effects of sugarbeet prices on irrigated land prices using a raw data set of land prices in Montana. Hedonic regression models are estimated to quantify the impact on land prices using annual sugarbeet prices and land characteristic and price information obtained from appraisal data.

Quantifying the impact of sugarbeet prices and production on land prices provides insights into the role of U.S. sugar policy in affecting agricultural land values. This information is important to the industry and policy makers. The World Trade Organization began trade negotiations of the Uruguay Round Agreement on Agriculture in March 2000 in Geneva. Member countries are considering the reduction of domestic support policies to agriculture producers (Burfisher, Diao, and Somwaru, 2001).

The United States is not the only country with policies that affect the domestic sugar market. Japan and the European Union subsidize domestic sugar production. With policy-induced distortions in the world sugar market, elimination of intervention policies is likely to cause a decline in U.S. sugar prices and may increase world sugar prices (Benirschka, Koo, and Lou, 1996). Trade liberalization is likely to lower domestic prices and have significant consequences for Montana sugarbeet growers. In addition, relatively small reductions in sugarbeet acreage could cause processing plants to close. Thus, small changes in sugar policy could have significant effects on regional markets.

The study is organized as follows: Chapter 2 discusses the history of U.S. sugar policy and sugarbeet production in Montana and provides a review of previous research on the impacts of policy affecting the domestic sugar market. Chapter 3 reviews various land pricing models. Chapter 4 describes the theoretical framework of the hedonic regression model utilized in this study. Chapter 5 describes data sources, data collection procedures and presents descriptive statistics for the data. Chapter 6 follows with the empirical model and analysis of the estimation results. Chapter 7 provides a summary of conclusions from data and analysis presented in previous chapters.

CHAPTER 2

U.S. SUGAR POLICY

History of U.S. Sugar Policy

U.S. sugar policies began in 1789 when a tariff was levied on imported sugar. The purpose of the tariff was to raise money for the U.S. treasury rather than to protect the domestic industry since no sugar was produced in the United States at the time (Schmitz, Allen, and Leu, 1984).

The U.S. sugar industry developed during the nineteenth century. In the early 1890s, when the U.S. Treasury incurred a surplus, tariffs on imported sugar were eliminated and replaced by a direct subsidy to U.S. sugar producers. Tariffs were reestablished in 1894 because sugar was being imported at prices below U.S. sugar production costs. The purpose of this tariff was to protect domestic producers rather than as a means of revenue generation.

In 1934, the Jones-Costigan Act was passed. The Act, which made the Secretary of Agriculture responsible for matching U.S. domestic sugar consumption with domestic production and imports, allocated marketing and production quotas among domestic producers and import quotas for foreign countries. The policy protected the domestic industry, guaranteed a secure domestic supply of sugar, and, it was claimed, allowed enough foreign imports to provide a "reasonable" price to consumers.

Sugar policy has been continued through a series of acts with suspension occurring only twice since 1934. Both instances were a result of high world sugar prices, rendering price supports to U.S. producers unnecessary. In 1982 quotas were reintroduced in response to a dramatic sugar price decline. Between 1977-78 and 1982, tariff protection was insufficient to prevent loan forfeitures to the Commodity Credit Corporation (CCC). With the CCC buying significant quantities of domestic sugar, country-specific import quotas were necessary to maintain the price of sugar above the loan rate. To further prevent accumulation of CCC stocks, the Food Security Act of 1985 required sugar policy to be operated at no cost to the government.

The Food, Agriculture, Conservation, and Trade Act of 1990 modified sugar policy through the introduction of nonrecourse loans to processors, tariff-rate quotas (TRQ), and domestic processor marketing allotments (Uri and Boyd, 1994). Nonrecourse loans guaranteed a minimum support price for producers. If the domestic price of sugar fell below the loan rate, processors could forfeit the loan collateral (i.e. refined sugar) to the CCC. However, to maintain a no cost policy, the domestic price of sugar was kept above the loan rate through the TRQ mechanism. The TRQ allowed only limited quantities of sugar to be imported at a low-tariff rate. All imports above the TRQ were assessed a relatively high second-tier tariff. In cases where the import quota was met and the price of sugar still fell below the loan rate, domestic marketing allotments could be imposed to support prices.

Currently, U.S. sugar policy operates under the 1996 Federal Agriculture Improvement and Reform Act (FAIR). The FAIR Act modified the loan program to include both nonrecourse and recourse loans. If the sugar import TRQ is less than 1.5 million tons (a level determined by the Global Agreement on Tariffs and Trade/Uruguay

Round), CCC loans become recourse loans and must be paid in cash at maturity regardless of the price of sugar. If the TRQ is greater than 1.5 million tons, CCC loans are nonrecourse loans and the CCC may accept sugar in lieu of cash at maturity. Under the FAIR Act, domestic marketing allotments were suspended, but prices continue to be supported through import restrictions.

Montana Sugarbeet Industry

Sugar policies have encouraged sugarbeet production in Montana. Although some land was already in production, legislation during the 1930s helped increase production in Montana to record levels of approximately 86,000 acres by 1940 (USDA). Currently, sugarbeets are grown in several Montana counties and estimated planted acreage was 60,700 acres in 2000 (USDA, 2001). Although acreage has not expanded significantly in the past ten years, sugar production in Montana continues to increase due to higher sugarbeet yields and improved technology in sugar extraction.

Sugarbeet production in Montana is primarily located in the northeast (Dawson, McCone, Richland, Roosevelt, and Sheridan counties) and south central (Big Horn, Carbon, Stillwater, Treasure, and Yellowstone counties) areas of the state. In 2000, the northeast area accounted for 44 percent of the state's planted acreage, while the south central region accounted for 45 percent of the estimated 60,700 acres of planted sugarbeets. The remaining sugarbeet production was in Custer, Prairie, and Rosebud counties (USDA). The Imperial Holly Sugar Company operates a processing facility in Sidney, Montana and contracts sugarbeets with producers in the northeast region. The

Western Sugar Company operates a facility in Billings, Montana and contracts with producers in the south central region of the state.

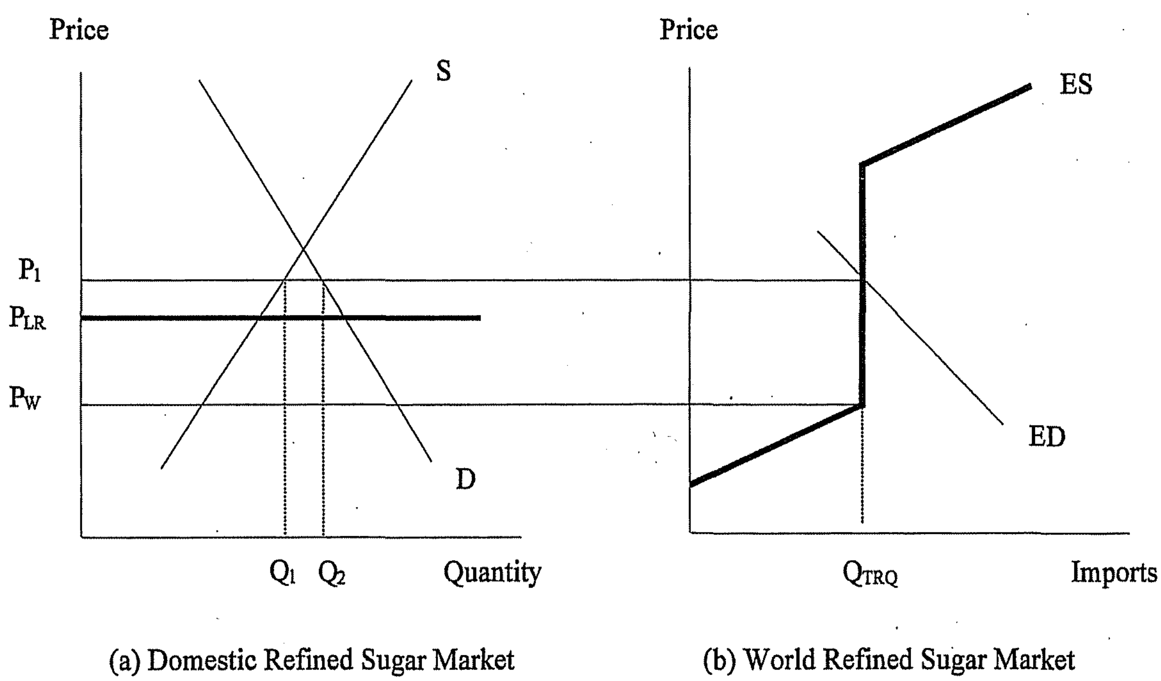
Impacts of U.S. Sugar Policy

U.S. sugar policy has been the subject of several studies that have considered the impact of government policy on social welfare. Leu, Schmitz and Knutson discussed the benefits and costs of the sugar policy on consumers, producers, taxpayers, and exporting countries. They also evaluated the effects of alternative policies such as tariffs and target-price deficiency payments. Analysis of the benefits and costs under a TRQ system show that U.S. sugar policy costs taxpayers very little to administer, while sugar producers capture rents from domestic prices that exceed world sugar prices. Consumers pay a higher price for sugar because they are excluded from the low prices of the world market. A recent report by the United States General Accounting Office estimated the cost of the sugar policy to U.S. sweetener users to be about $1.9 billion in 1998.

Figure 2.1 shows the effects of a TRQ on the U.S. raw sugar market (USGAO, 2000). The imposition of a TRQ causes a kink in the world excess supply of raw sugar (ES). The effects of the TRQ on the domestic sugar price depends on U.S. excess demand (ED). Panel (a) shows the price of refined sugar in the U.S. market as P_1, which is above the world price of P_W and the loan rate P_{LR}. Panel (b) shows a scenario where the TRQ is binding for a specific world ED. The import level is shown as Q_1 to Q_2 in panel (a), which is equal to Q_{TRQ} in panel (b). Imports beyond this level are assessed a higher second-tier tariff. P_{LR} acts as a price floor to producers when Q_{TRQ} is greater than 1.5

million tons. Changes in the world price do not affect P_1 when the TRQ is binding at the given level of excess U.S. raw sugar demand. As a result, the domestic price of raw sugar is relatively stable.

Figure 1. Effects of Tariff-Rate Quota on U.S. Price of Refined Sugar



Countries exporting sugar to the United States under the quota system received quota rents. The U.S. government does not receive revenue from the quotas because they are assigned without charge to exporting countries. Quota recipients are generally based on historical market shares (Krueger, 1990).

The U.S. corn industry also benefits from sugar policy. This is due to the development of high fructose corn syrup (HFCS), which is a substitute for granular sugar, especially in soft drinks. According to Leu, Schmitz, and Knutson, rents from the quota system have been reduced by increased competition from sugar substitutes such as HFCS.

Lopez examines political-economic factors that influence decision making regarding U.S. sugar policies. Lopez reports that target price decisions are significantly linked to consumers' surpluses, corn sweetener producer surpluses, and export quasi-rents of countries with quota rights. Import quota decisions appear to be linked to the level of the federal budget deficit and the price objective set by Congress. Import quotas have been the policy of choice because they are easy to institute and impose no strain on the U.S. treasury. In addition, quotas are more transparent than direct deficiency payments and more compatible with multilateral trade agreements than tariffs (Uri and Boyd, 1994).

Domestic intervention policies dominate the world sugar market and have caused volatile prices resulting from a thin free-trade market. The European Union, Japan, and the United States use government controls to subsidize higher cost domestic production. Without these controls, production would shift to countries with lower costs such as Australia, Brazil and Thailand (Borrell and Duncan, 1992).

Recent trade agreements have increased access to the U.S. sugar market. For example, Mexico has increased sugar exports to the United States under the North American Free Trade Agreement (NAFTA). However, access remains limited due to a side agreement between Mexico and the United States that limits Mexican sugar exports to the difference between domestic consumption and production (Devadoss, Kropf, and Wahl, 1995). However, the side agreement is currently being debated with respect to the inclusion of HFCS in the net surplus calculation. Tariffs on HFCS from the United States and subsidization of sugar for industrial users by the Mexican government has further complicated the trade agreement.

Duty-free exports from Mexico are set to increase at a rate of 10 percent each year until 2007 if Mexico continues to be a net surplus producer. Sugar imports from Mexico could increase by 600,000 tons by 2008. The impact on U.S. sugarbeet price from this increase in Mexican imports is estimated to be $1.25 per ton (Brester, 2001).

CHAPTER 3

LAND PRICES

Several land pricing models have developed through research on determinants of variation in land prices. These models include structural, hedonic, and time-series models. The following section briefly describes the models used in previous research.

Land Pricing Models

Three types of quantitative models have evolved for explaining variation in land prices: structural models, hedonic models, and time-series models. Structural models essentially capitalize the value of rents and other economic factors in determining the demand and supply for agricultural land. Hedonic models are used to evaluate the effects of various relevant land characteristics on land prices. Time-series models use past land prices to model current agricultural land prices.

Structural models explain land prices either by estimating the demand and supply of agricultural land or by using reduced form equations. Castle and Hoch used taxes, expected future land prices, value of buildings on farms, depreciation, capital gains, and inflation as variables for explaining land price changes. Alston considered the relative effects of expected inflation, real growth in net rental income, and taxation on agricultural land prices.

Burt (1986) modeled land prices as a dynamic function of farmland rents. This approach assumed that net farmland returns ultimately include other economic factors and that farmland prices are best explained by considering changes in these returns over time.

Burt considered the supply of farmland to be fixed from year to year with changes occurring gradually over time. Thus, demand for farmland determines price. Given a competitive market and a constant real discount rate, the price of farmland should follow the classical capitalization formula:

$$(1) \qquad P_0 = \sum_{t=1}^{\infty} R_t / (1+r)^t \ ,$$

where P_0 is the price of land at the end of period 0, R_t is net land rent obtained at the end of period t, and r_t is the real discount rate for year t. Burt noted that net rents to farmland are influenced by many factors which are difficult to predict. Examples of these factors are input prices, technological changes, and prices of farm commodities. Burt assumed that buyers and sellers form rent expectations in the market for farmland. As a result, one would expect a dynamic adjustment mechanism of rent expectations in the farmland market. Therefore, Burt estimated the following structural equation:

$$(2) \qquad \ln P_t = \delta + \gamma_0 \ln R_t + \gamma_1 \ln R_{t-1} + \lambda_1 E(\ln P_{t-1}) + \lambda_2 E(\ln P_{t-2}) + \ln u_t \ ,$$

where ln represented natural logarithms, $E\,()$ was the expectation operator, $E(\ln P_t) = \ln P_t - \ln u_t$, $\delta = (1 - \lambda_1 - \lambda_2)$, and $\ln u_t$ was the disturbance term assumed to follow an autoregressive, moving average process of unknown order with expectation zero. The linear homogeneity constraint $\beta_0 + \beta_1 + \beta_1 + \ldots = 1$, implies that

$\gamma_0 + \gamma_1 = 1 - \lambda_1 - \lambda_2$. Burt imposed the homogeneity restriction and estimated equation (2) as a second-order, nonstochastic difference equation (Burt, 1980).

Melichar also examined price expectations. He focused on the role of market participants' expectations about future rents in land valuation by providing an analysis of the capitalization formula when rents are increasing at a constant rate per year. Melichar found that current growth in returns to land predominantly impacts upward pressures on land prices. Therefore, expectations of increasing returns to land will generate real capital gains.

Hedonic models are used to determine the effects of various land characteristics on land prices. Torrell, Libbin, and Miller used the capitalization formula specified in equation (1) in the following hedonic models to quantify differences in non-irrigated and irrigated farmland prices in the U.S. Ogallala Aquifer region:

(3) $$P_{dry} = f(value, time, statime, size, precip, earnings),$$

(4) $$P_{irr} = f(value, time, statime, size, earnings, recharge, nir, depth, water),$$

where P_{dry} and P_{irr} were per acre sale prices of dryland and irrigated land, *value* was appraised value of farmland, *time* was a time trend, *statime* was an interaction of *time* with specific states, *size* was total acres of each farm sold, *precip* was annual inches of precipitation, *earnings* were average returns over variable costs, *recharge* was a location variable, *nir* was irrigation requirements, *depth* was the distance to the aquifer under each farm, and *water* was the depth of the aquifer under each farm.

Sandry et al. used an hedonic model to determine the impacts of agricultural production, average farm size, irrigation, population, and urbanization on Oregon farmland prices. Barnard, et al. followed a similar approach and included direct government payments when considering impacts of government programs on farmland prices.

Time-series modeling is less commonly used for determining agricultural land prices. Pope, et al. modeled current land prices as functions of past land prices only. The model used was an integrated autoregressive moving average of order 2,2. The results indicated that time series models provide better short term forecasts than simultaneous equations econometric models.

CHAPTER 4

THEORETICAL MODEL

This chapter presents a theoretical hedonic model of irrigated land prices in Montana. It outlines the variables included in the hedonic model and provides a comparison with an enterprise budgeting approach.

Enterprise Budget

Enterprise budgeting is one method which can be used to calculate the effects of sugarbeet production on land prices. The budgeting method uses the discounted present value of future returns to land provided by specific crops to determine land price. Calculations using a budgeting approach assume a specific planning horizon determined by expectations of future price and yield of the crops considered. A quantitative example of the budgeting approach calculation for determining the effect of sugarbeet production on land price is provided to serve as a comparison to the hedonic model that is estimated in the study.

Sugarbeets must by grown in rotation with other crops to mitigate disease and soil fertility problems associated with sugarbeet production. Consider the returns to land from a typical three year crop rotation of two years of malt barley and one year of sugarbeets. Common landlord crop share percentages, which represent returns to land, are 20 percent for sugarbeets and 33 percent for barley. Sugarbeets are generally produced on a specific acre once every three years. Thus, for a representative acre, it is assumed that two-thirds of the acre is dedicated to malt barley and one-third to sugarbeets.

If sugarbeets were not produced, an alternative crop would therefore be grown on one-third of the acre. Increasing production of malt barley is unlikely because the crop is generally grown throughout the Yellowstone River Valley under contract. Feed barley is likely to be the next most profitable crop that would replace sugarbeets in typical rotations. Local price effects of increased feed barley production would probably be small because the price of feed barley is determined by national markets.

A 20-year planning horizon is assumed because that is the length of typical farmland mortgages. Three scenarios are considered to reflect various expectations of potential irrigated land purchases based on current trade agreements.

Scenario A is based on the expectation that sugarbeet production will continue throughout the life of the mortgage. Under this scenario, a land purchaser expects current U.S. sugar policy and sugarbeet production in the Yellowstone River Valley to continue for at least the next 20 years. Under this scenario, the traditional rotation would be maintained.

Scenario B uses the expectation that trade liberalization under NAFTA will impact the domestic price of sugar. A person using this planning horizon would expect sugarbeet prices to decline until 2008 due to increased imports from Mexico. In 2009, sugarbeet production would be eliminated as a result of complete free trade with Mexico and, by implication, with other countries. Therefore, in 2009, production on the one-third acre would switch from sugarbeets to feed barley.

Scenario C is based on an expectation that sugarbeet production will continue for only one more year because 2002 is the last year of a current three-year production contract with Montana processors. Feed barley production is then substituted for sugarbeet production. Scenario C assumes that the sugar policy would be eliminated under federal legislation that will replace the FAIR Act when it expires in 2002 and production in the region would no longer be large enough to meet capacity requirements of processing plants. A comparison of Scenario A with the other two scenarios provides measurements of the impact of sugarbeet production on land prices under different expectations of market participants.

Price and yield information used in the budgeting approach is based on state-level historical data. Sugarbeet and malt barley price data were obtained for the period 1981-2000. Yield data for sugarbeets and irrigated barley were collected over the same period. Feed barley price data was available for the years 1991-2000.[1] Table 1 presents regression results of the historical data using a linear trend model. Graphical analysis indicated that irrigated barley and sugarbeet yields both display significant linear trends. Therefore, the yields are predicted 20 years into the future using linear trend regression estimates. The linear trend models for malt barley, sugarbeet, and feed barley price did not have a significant linear trend. Thus, the average price of each crop was determined using the historical data. These average prices are used in the regressions and remain constant throughout the 20 year period.

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[1] The data gathered for this example were collected from Montana Agricultural Statistics Yearbooks and malt barley contracts for Yellowstone County.

Table 1. Regression Results of Linear Trend Model

Dependent Variable	Constant	Coefficient of Independent Variable*	Standard Error of Coefficient	P Value
Irrigated Barley Yield	66.111	0.529	0.207	0.02
Sugarbeet Yield	19.292	0.215	0.053	0.01
Malt Barley Price	3.518	-0.008	0.006	0.20
Sugarbeet Price	38.760	0.195	0.145	0.20
Feed Barley Price	2.159	-0.040	0.045	0.40

* The independent variable is year.

Returns to land from malt barley are presented in Table 2. Although price is constant, yields increase based on the estimated linear trend. The calculation assumes a one-third crop share to determine returns to land and multiplies the return by the percentage of a given acre used to produce malt barley.

Table 2. Calculations of Returns to Land from Malt Barley, (2002-2021)

Year	t	Yield*	Price**	Gross Returns***	Crop Share	% of Acre	Returns to Land
2002	1	77.23	3.44	265.38	0.33	0.67	58.97
2003	2	77.76	3.44	267.20	0.33	0.67	59.38
2004	3	78.29	3.44	269.02	0.33	0.67	59.78
2005	4	78.82	3.44	270.84	0.33	0.67	60.19
2006	5	79.35	3.44	272.66	0.33	0.67	60.59
2007	6	79.88	3.44	274.48	0.33	0.67	60.99
2008	7	80.41	3.44	276.30	0.33	0.67	61.40
2009	8	80.94	3.44	278.12	0.33	0.67	61.80
2010	9	81.47	3.44	279.94	0.33	0.67	62.21
2011	10	81.99	3.44	281.75	0.33	0.67	62.61
2012	11	82.52	3.44	283.57	0.33	0.67	63.02
2013	12	83.05	3.44	285.39	0.33	0.67	63.42
2014	13	83.58	3.44	287.21	0.33	0.67	63.83
2015	14	84.11	3.44	289.03	0.33	0.67	64.23
2016	15	84.64	3.44	290.85	0.33	0.67	64.63
2017	16	85.17	3.44	292.67	0.33	0.67	65.04
2018	17	85.70	3.44	294.49	0.33	0.67	65.44
2019	18	86.23	3.44	296.31	0.33	0.67	65.85
2020	19	86.76	3.44	298.13	0.33	0.67	66.25
2021	20	87.29	3.44	299.95	0.33	0.67	66.66

* Yield reported in bushels per acre. ** Price reported in dollars per bushel. *** Gross Returns reported in dollars per acre.

Table 3 shows the returns to land from sugarbeet production under Scenario A. Gross returns are multiplied by the crop share and the percentage of a given acre dedicated to sugarbeet production to determine returns to land assuming sugarbeet production continues until 2021. The price of sugarbeets under this scenario is not constant. Prices are adjusted downward to reflect a decrease in the U.S. price of sugar from additional annual increases in Mexican exports to the United States until 2008. After 2008, prices are held constant as in Scenario A.

Table 3. Calculation of Returns to Land Under Scenario A: Sugarbeet Production, (2002-2021)

Year	t	Yield*	Price**	Gross Returns***	Crop Share	% of Acre	Returns to Land
2002	1	23.81	40.71	969.11	0.20	0.33	64.61
2003	2	24.02	40.53	973.54	0.20	0.33	64.90
2004	3	24.24	40.35	977.89	0.20	0.33	65.19
2005	4	24.45	40.17	982.16	0.20	0.33	65.48
2006	5	24.67	39.99	986.36	0.20	0.33	65.76
2007	6	24.88	39.81	990.48	0.20	0.33	66.03
2008	7	25.10	39.63	994.52	0.20	0.33	66.30
2009	8	25.31	39.46	998.74	0.20	0.33	66.58
2010	9	25.53	39.46	1007.22	0.20	0.33	67.15
2011	10	25.74	39.46	1015.71	0.20	0.33	67.71
2012	11	25.96	39.46	1024.19	0.20	0.33	68.28
2013	12	26.17	39.46	1032.67	0.20	0.33	68.85
2014	13	26.39	39.46	1041.16	0.20	0.33	69.41
2015	14	26.60	39.46	1049.64	0.20	0.33	69.98
2016	15	26.82	39.46	1058.13	0.20	0.33	70.54
2017	16	27.03	39.46	1066.61	0.20	0.33	71.11
2018	17	27.25	39.46	1075.10	0.20	0.33	71.67
2019	18	27.46	39.46	1083.58	0.20	0.33	72.24
2020	19	27.68	39.46	1092.07	0.20	0.33	72.80
2021	20	27.89	39.46	1100.55	0.20	0.33	73.37

* Yield reported in tons per acre. ** Price reported in dollars per ton. *** Gross Returns reported in dollars per acre.

Table 4 presents returns to land from sugarbeet production and, beginning in 2009, feed barley production under Scenario B. Table 5 presents returns to land calculations assuming sugarbeets are produced in 2002 and then feed barley is produced on that land from 2003 to 2021.

Table 4. Calculation of Returns to Land Under Scenario B: Sugarbeet Production, (2002-2008), and Feed Barley Production, (2009-2021)

Year	t	Yield*	Price**	Gross Returns***	Crop Share	% of Acre	Returns to Land
2002	1	23.81	40.71	969.11	0.20	0.33	64.61
2003	2	24.02	40.53	973.54	0.20	0.33	64.90
2004	3	24.24	40.35	977.89	0.20	0.33	65.19
2005	4	24.45	40.17	982.16	0.20	0.33	65.48
2006	5	24.67	39.99	986.36	0.20	0.33	65.76
2007	6	24.88	39.81	990.48	0.20	0.33	66.03
2008	7	25.10	39.63	994.52	0.20	0.33	66.30
2009	8	80.94	1.94	156.77	0.33	0.33	17.42
2010	9	81.47	1.94	157.80	0.33	0.33	17.53
2011	10	81.99	1.94	158.82	0.33	0.33	17.65
2012	11	82.52	1.94	159.85	0.33	0.33	17.76
2013	12	83.05	1.94	160.88	0.33	0.33	17.88
2014	13	83.58	1.94	161.90	0.33	0.33	17.99
2015	14	84.11	1.94	162.93	0.33	0.33	18.10
2016	15	84.64	1.94	163.95	0.33	0.33	18.22
2017	16	85.17	1.94	164.98	0.33	0.33	18.33
2018	17	85.70	1.94	166.00	0.33	0.33	18.44
2019	18	86.23	1.94	167.03	0.33	0.33	18.56
2020	19	86.76	1.94	168.05	0.33	0.33	18.67
2021	20	87.29	1.94	169.08	0.33	0.33	18.79

* Yield reported in tons per acre for sugarbeets and bushels per acre for feed barley. ** Price reported in dollars per ton for sugarbeets and dollars per bushel for feed barley. *** Gross Returns reported in dollars per acre.

Table 5. Calculation of Returns to Land Under Scenario C: Sugarbeet Production, (2002), and Feed Barley Production, (2003-2021)

Year	t	Yield*	Price**	Gross Returns***	Crop Share	% of Acre	Returns to Land
2002	1	23.81	40.71	969.11	0.20	0.33	64.61
2003	2	77.76	1.94	150.62	0.33	0.33	16.74
2004	3	78.29	1.94	151.64	0.33	0.33	16.85
2005	4	78.82	1.94	152.67	0.33	0.33	16.96
2006	5	79.35	1.94	153.70	0.33	0.33	17.08
2007	6	79.88	1.94	154.72	0.33	0.33	17.19
2008	7	80.41	1.94	155.75	0.33	0.33	17.31
2009	8	80.94	1.94	156.77	0.33	0.33	17.42
2010	9	81.47	1.94	157.80	0.33	0.33	17.53
2011	10	81.99	1.94	158.82	0.33	0.33	17.65
2012	11	82.52	1.94	159.85	0.33	0.33	17.76
2013	12	83.05	1.94	160.88	0.33	0.33	17.88
2014	13	83.58	1.94	161.90	0.33	0.33	17.99
2015	14	84.11	1.94	162.93	0.33	0.33	18.10
2016	15	84.64	1.94	163.95	0.33	0.33	18.22
2017	16	85.17	1.94	164.98	0.33	0.33	18.33
2018	17	85.70	1.94	166.00	0.33	0.33	18.44
2019	18	86.23	1.94	167.03	0.33	0.33	18.56
2020	19	86.76	1.94	168.05	0.33	0.33	18.67
2021	20	87.29	1.94	169.08	0.33	0.33	18.79

* Yield reported in tons per acre for sugarbeets and bushels per acre for feed barley. ** Price reported in dollars per ton for sugarbeets and dollars per bushel for feed barley. *** Gross Returns reported in dollars per acre.

Enterprise budgeting estimates are based on the returns to land presented in Tables 2 to 5. Total returns to a single acre are calculated each year by adding the returns from malt barley to returns generated under Scenarios A, B, and C regarding sugarbeet production. These nominal income streams are discounted to obtain the present value using a nominal mortgage rate of 8.2 percent.[2] The present value of the income stream

[2] Long term fixed nominal rate for farmland loans used by Farm Credit Services of Bozeman, MT. The nominal interest rate is used for discounting because the future returns are expressed in nominal revenue terms that reflect nominal prices and yield trends.

from each year is summed to determine the total present value of the net returns to land.

Table 6 presents the present value calculation for Scenario A. The discounted present value of revenues from a single acre of land for which two-thirds is planted in malt barley and one-third is planted to sugarbeets is $1,248.20. Tables 7 and 8 shows the present value calculations under Scenario B and C, respectively. The discounted present value for a single acre of land for which one-third is planted to sugarbeets through 2008 and feed barley for the remaining years is $1,016.83. The discounted present value is $810.64 for a rotation where one-third of the acre is planted to sugarbeets for one year and planted to feed barley for the remaining years.

Table 6. Budgeting Approach for Land Valuation: Scenario A

Year	t	Returns to Land-MB	Returns to Land- SB	Total Returns	Discount Factor	Present Value of Returns
2002	1	58.97	64.61	123.58	0.92	114.21
2003	2	59.38	64.90	124.28	0.85	106.16
2004	3	59.78	65.19	124.97	0.79	98.66
2005	4	60.19	65.48	125.66	0.73	91.69
2006	5	60.59	65.76	126.35	0.67	85.20
2007	6	60.99	66.03	127.03	0.62	79.16
2008	7	61.40	66.30	127.70	0.58	73.55
2009	8	61.80	66.58	128.39	0.53	68.34
2010	9	62.21	67.15	129.36	0.49	63.64
2011	10	62.61	67.71	130.33	0.45	59.26
2012	11	63.02	68.28	131.30	0.42	55.18
2013	12	63.42	68.85	132.27	0.39	51.37
2014	13	63.83	69.41	133.24	0.36	47.83
2015	14	64.23	69.98	134.21	0.33	44.52
2016	15	64.63	70.54	135.18	0.31	41.45
2017	16	65.04	71.11	136.15	0.28	38.58
2018	17	65.44	71.67	137.12	0.26	35.91
2019	18	65.85	72.24	138.09	0.24	33.42
2020	19	66.25	72.80	139.06	0.22	31.11
2021	20	66.66	73.37	140.03	0.21	28.95
				Total of Present Value of Returns:		**1248.20**

Table 7. Budgeting Approach for Land Valuation: Scenario B

Year	t	Returns to Land-MB	Returns to Land-SB/FB	Total Returns	Discount Factor	Present Value of Returns
2002	1	58.97	64.61	123.58	0.92	114.21
2003	2	59.38	64.90	124.28	0.85	106.16
2004	3	59.78	65.19	124.97	0.79	98.66
2005	4	60.19	65.48	125.66	0.73	91.69
2006	5	60.59	65.76	126.35	0.67	85.20
2007	6	60.99	66.03	127.03	0.62	79.16
2008	7	61.40	66.30	127.70	0.58	73.55
2009	8	61.80	17.42	79.22	0.53	42.17
2010	9	62.21	17.53	79.74	0.49	39.23
2011	10	62.61	17.65	80.26	0.45	36.49
2012	11	63.02	17.76	80.78	0.42	33.95
2013	12	63.42	17.88	81.30	0.39	31.57
2014	13	63.83	17.99	81.81	0.36	29.37
2015	14	64.23	18.10	82.33	0.33	27.31
2016	15	64.63	18.22	82.85	0.31	25.40
2017	16	65.04	18.33	83.37	0.28	23.62
2018	17	65.44	18.44	83.89	0.26	21.97
2019	18	65.85	18.56	84.41	0.24	20.43
2020	19	66.25	18.67	84.92	0.22	19.00
2021	20	66.66	18.79	85.44	0.21	17.67
				Total of Present Value of Returns:		**1016.83**

Table 8. Budgeting Approach for Land Valuation: Scenario C

Year	t	Returns to Land-MB	Returns to Land-SB/FB	Total Returns	Discount Factor	Present Value of Returns
2002	1	58.97	64.61	123.58	0.92	114.21
2003	2	59.38	16.74	76.11	0.85	65.01
2004	3	59.78	16.85	76.63	0.79	60.50
2005	4	60.19	16.96	77.15	0.73	56.29
2006	5	60.59	17.08	77.67	0.67	52.37
2007	6	60.99	17.19	78.19	0.62	48.73
2008	7	61.40	17.31	78.70	0.58	45.33
2009	8	61.80	17.42	79.22	0.53	42.17
2010	9	62.21	17.53	79.74	0.49	39.23
2011	10	62.61	17.65	80.26	0.45	36.49
2012	11	63.02	17.76	80.78	0.42	33.95
2013	12	63.42	17.88	81.30	0.39	31.57
2014	13	63.83	17.99	81.81	0.36	29.37
2015	14	64.23	18.10	82.33	0.33	27.31
2016	15	64.63	18.22	82.85	0.31	25.40
2017	16	65.04	18.33	83.37	0.28	23.62
2018	17	65.44	18.44	83.89	0.26	21.97
2019	18	65.85	18.56	84.41	0.24	20.43
2020	19	66.25	18.67	84.92	0.22	19.00
2021	20	66.66	18.79	85.44	0.21	17.67
				Total of Present Value of Returns:		**810.64**

Table 9 presents a summary of the total present value of returns to land under each scenario. The differences between the total present values indicates the impact of sugarbeet production under the different scenarios.

Table 9. Summary of Land Valuation Scenarios

	Scenario	Sum of Present Value of Future Returns to Land ($/acre)
A	Sugarbeet production, (2002-2021)	$1,248.20
B	Sugarbeet production, (2002-2008) Feed barley production, (2009-2021)	$1,016.83
C	Sugarbeet production, (2002) Feed barley production, (2003-2021)	$810.64

The difference between the total present value of net returns under Scenario A versus Scenario B provides the quantitative effect of sugarbeet production on land prices if sugarbeet production is viable until 2008. The difference equals $231.37 per acre in current dollars. The effect on land prices if sugarbeet production is no longer viable beyond 2002 (Scenario C) is equal to the difference between the total present values under Scenarios A and C. This value is equal to $437.56 per acre in nominal terms.

The effect under Scenario B is less than the effect under Scenario C because sugarbeets, a high revenue crop, are expected to be produced for the next seven years. Scenario C, a more conservative expectation, indicates the effect on land prices if sugarbeets could only be produced one more year.

Hedonic Model

Results of a budgeting approach will vary depending on the expectations of participants in the market for irrigated farmland. Therefore, the hedonic model used in this study will consider actual land market data that reflects the expectations of farmland buyers during the period observed.

The method used in this study for determining the impact of sugarbeet production on land prices is an hedonic regression model. This model considers the influence of land characteristics and crop prices on the price of farmland. The model uses actual market data and incorporates the concerns of land purchasers regarding inherent risks associated with the continued production of sugarbeets.

The hedonic model regresses per acre sale prices of irrigated Montana farmland against variables describing land characteristics and returns from crop production. The model is specified as follows:

(5) $P_L =$ *f(sugarbeet price, soil quality, alternative crop prices, location of parcel, population density, size),*

where P_L is the per acre price of irrigated land, *sugarbeet price* is an annual price of sugarbeets received by Montana producers, *soil quality* represents an index of soil productivity, *location of parcel* is the county in which the parcel is located, *population density* represents population density of county in which the parcel is located, and *size* is a measure of acreage of land parcels.

Sugarbeet price is the expected annual price received by Montana producers. This variable measures the returns to land from sugarbeet prices. Although not all of the observations in the sample produced sugarbeets at the time of the land sale, this variable is potentially relevant for all the parcels observed. If the price of sugarbeets rises to a sufficiently high level, it may become profitable for producers to enter the market. Since land is the likely asset to capitalize rents from high crop prices, the coefficient of this variable is expected to be positive.

Soil quality is an indicator of the productivity of land and the quality of crop produced. Soil quality is an important determinant of farmers' production decisions. High quality land can produce high yields and also enable producers to capture price premiums for high quality crops. Low quality land produces lower yields and lower quality crops. In the case of sugarbeets, crop quality is an important determinant of crop price.[3]

Soil quality ratings for each parcel of land are based on historical yield and productivity relative to historical yields for the region studied. Highly productive land will be more profitable, resulting in higher land prices. The coefficient of this variable is expected to have a positive relationship with land price. Therefore, land with a higher soil quality rating will result in higher land prices.

The profitability of a parcel of land determines its price. Thus, in addition to sugarbeet price, the prices of alternative crops are included in the theoretical model. Alfalfa and dry edible bean annual prices are used as proxies of profitability from these alternative crops. Alfalfa, a perennial crop, is sometimes grown in rotation with sugarbeets in Montana's sugarbeet production areas. Dry edible beans are an annual crop that is sometimes grown in a three year rotation with sugarbeets and barley. Higher prices of alternative crops are expected to increase land prices.

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[3] Prices received by producers is partially determined by the sucrose content of the beets. High levels of sucrose extraction are associated with a high quality crop.

The location variable describes a parcel's proximity to sugarbeet production facilities. The variable is equal to one if the parcel is located in a county where sugarbeet production currently occurs. The variable equals 0 otherwise. This variable captures an expected positive effect on land prices when a parcel is located close enough to a processing facility for sugarbeets to be a viable crop in terms of transportation costs. Since location is a limiting factor for some sugarbeet producers, the variable is included in the model to explicitly account for the impacts of location on land price.

Population density is measured as the number of people per square mile in each county. There are several alternative uses for land near urban areas including commercial,

industrial, and residential development. This variable accounts for the potential influence of urban areas on farmland prices. Land prices are expected to be positively related to population density.

Size is expected to negatively influence land prices. Previous studies by Sandry, et al. and Pope et al. suggest a negative correlation between average farm size and market value. This negative effect may be due in part to greater numbers of bidders for smaller tracts of land (Sandry et al, 1982). This variable may also account for influence of urban areas as populations begin to encroach on surrounding rural areas.

The model considers several factors influencing land sale prices. If the model can account for all the relevant variables, then the effect of sugarbeet price on land prices can be isolated. These estimates will help identify the impacts of sugar policy and its potential changes on irrigated land prices in Montana.

CHAPTER 5

DATA

This chapter describes data sources, data collection procedures, and presents descriptive statistics. Montana is a non-disclosure state in that land transactions data are not public record. However, information regarding land transactions is collected by agricultural lenders for use as comparables for appraisal work. The primary source of data used in this study is a major private sector agricultural lender who finances a substantial portion of the Montana agricultural land debt. Information regarding the parties involved is withheld for confidentiality reasons. Other data sources include Montana Agricultural Statistics Yearbooks, Natural Resources Conservation Service soil surveys, and the 1990 U.S. Census.

The data set from the primary source includes 619 observations on land sales from 17 counties. Observations were collected for the years 1986 to 1999. There is a possibility of duplicate transactions for a single parcel of land. However, it is not possible to determine duplicates in the data set because legal descriptions included in the data are not highly specific and some tracts are small enough for more than one sale to have occurred in the same area, but with different parties involved. Nonetheless, given the relative infrequency of land sales, it is unlikely that a substantial number of duplicate observations exist. The data are considered to be a cross section of observations for each year observed and the model accounts for the data being gathered over a fourteen year period of time.

Land sale data includes information on parcel size, date of sale, county location, and per acre sale price. Data used in the regressions are presented in Appendix A, with certain variables excluded to protect the privacy of the parties involved. This data set is a complete population of observations from the lender and includes land sales beyond those financed by this particular lender, but represent only a sample of all Montana land sales.

The data set includes 602 land transactions across 15 counties that have sufficiently complete information to be included in model estimates. Observations with a deflated price per acre of more than one standard deviation below the mean and two standard deviations above the mean were considered outliers and were deleted from the data set. This resulted in 33 observations being excluded from the data set before the model was estimated. Table 10 presents summary statistics of the edited data set. All prices are presented in real dollars.

Table 10. Summary Statistics of the Edited Data Set

	Total Sample Size n = 569			
Variable	**Mean**	**Standard Deviation**	**Minimum Value**	**Maximum Value**
Real Price Per Acre	$697.50	$367.51	$171.39	$1,912.05
Price of Sugarbeets ($/Ton)	$36.71	$9.89	$22.64	$62.38
Price of Alfalfa ($/Ton)	$59.39	$14.39	$39.62	$88.70
Price of Dry Edible Beans ($/Cwt)	$18.01	$8.05	$9.57	$37.95
Sugarbeet Production Counties	0.57	0.50	0	1
Size of Parcel (Acres)	282.61	398.27	6	4,591
Population Density (PPL/Sq Mi)	12.64	15.22	0.8	43.0
Soil Quality Index	0.65	0.23	0.04	1

The dependent variable in the model is the price of land. This variable is measured using per acre real sales prices for each parcel. Sales prices are deflated using the Consumer Price Index (1982-1984=1).

Price data were collected from the Montana Agricultural Statistics Yearbooks 1975-1999 for sugarbeets, alfalfa, and dry edible beans. Annual prices for each crop are measured as prices received by Montana producers and are also deflated using the Consumer Price Index (1982-1984=1).

County location information is also included in the data set. A dummy variable is assigned a value of 1 if the parcel is located in a county where sugarbeet production currently occurs.[4] The variable equals 0 otherwise. Of the 569 observations in the data set, 324 parcels were located in counties where sugarbeet production occurs.

The acreage of each parcel sold is included in the appraisal data. This is used as a measure of the size of the parcel sold.

Information regarding population density was gathered from the 1990 U.S. Census. Population density is only available at the county level for Montana. Therefore, each parcel is assigned a population density value based on its county location. Table 11 lists the counties in the data set and their respective population densities. Yellowstone County has the highest population density of any county in Montana and Prairie County has one of the lowest population densities of any Montana county.

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[4] Current production of sugarbeets in each county in 1999.

Table 11. Population Densities of Montana Counties with Sugarbeet Production

County	Population Per Square Mile
Big Horn*	2.3
Blaine	1.6
Broadwater	2.8
Carbon*	3.9
Cascade	28.8
Custer*	3.1
Dawson*	4.0
Prairie*	0.8
Richland*	5.1
Rosebud*	2.1
Stillwater*	3.6
Sweet Grass	1.7
Teton	2.8
Treasure*	0.9
Yellowstone*	43.0

*Counties in which sugarbeet production occurs.

Soil quality data were obtained from Natural Resources Conservation Service county soil survey maps. A dominant soil type for each parcel was determined using legal descriptions and soil survey maps. Due to variation in soil type nomenclature of the observed counties, a measure of soil quality across counties could not be based on soil types. Therefore, a crop equivalency index was created to allow comparison of all the parcels in the data set. The crop used for this index is barley, as it is produced in all counties in the sample. The index is created by dividing the reported barley yield potential of each parcel's dominant soil type into the twenty-year average historical barley yield of all the counties in the data set.

The range of the index variable is 0.04 to 1.0 for parcels in the data set. Observations with a high soil quality rating are relatively productive tracts of land. Lower values for the index indicate the soil quality is low and the land is relatively less productive.

Data were collected from seventeen counties. However, only fifteen counties are included in the analysis due to incomplete information for some observations. The counties included in the analysis are listed in Table 11. Asterisks identify the ten sugarbeet producing counties among the fifteen counties included in the analysis. Data on non-sugarbeet producing counties were collected in areas where irrigated land is suitable for growing sugarbeets. These observations provide a wider sample for comparing similar soil quality and population influences, while allowing the impact of sugarbeet production to be isolated by the model. Figure 2 displays the general locations for all observations in the data set.

The data described in this chapter are used to estimate the empirical model. The following chapter presents the model specification and a discussion of the empirical results.

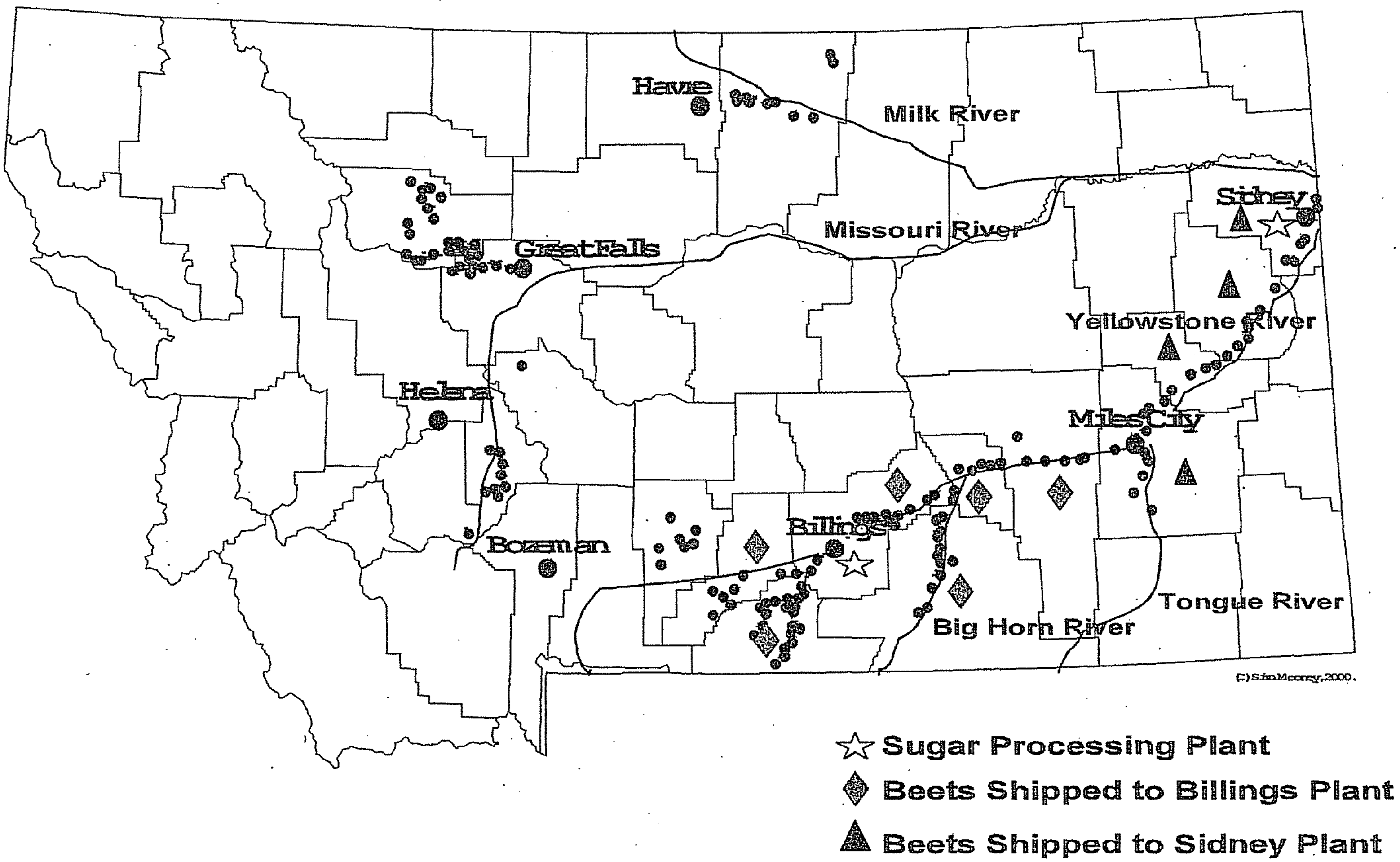

Figure 2 Map of Data Observations

CHAPTER 6

ESTIMATION AND ANALYSIS

This chapter discusses econometric issues, presents empirical results, and evaluates policy implications. The model estimates land price as a function of land characteristics and returns from primary crops such as sugarbeets, alfalfa, and dry edible beans.

The first section of this chapter provides descriptions of each variable used in the model. The second section addresses econometric issues. The third section presents the regression results. Regression results are presented in table form to facilitate subsequent discussions. The next five sections explain the use of a trend variable versus a dummy variable for each sale year, differences between two proxies for sugarbeet price, impacts of returns from alternative crops, inclusion of a quality adjusted price variable, and the significance of an interaction term combining quality adjusted price and parcel location.

The last two sections present the final model specification and analysis of the results in the context of the theoretical model.

Description of Variables

Table 12 presents definitions of each variable and Table 13 lists the summary statistics of the variables used in the model.

Table 12. Variable Descriptions

Variable Name	Description
Def Land Price	Per acre price of land parcels. Data is deflated using Consumer Price Index (1982-1984=1).
Exp Price	Expected annual price per ton of sugarbeets received by Montana producers. Predicted using AR(2) OLS model.
Price	Current crop price per ton of sugarbeets received by Montana producers in year of land sale.
Soil Quality	Index of soil quality based on soil survey data.
*EPQ**	Quality-adjusted annual price per ton of sugarbeets using the interacted variables *Exp Price* and *Soil Quality*.
*PQ**	Quality-adjusted annual price per ton of sugarbeets using the interacted variables *Price* and *Soil Quality*.
Location Dummy	Dummy variable. Equal to one if parcel is located in a county where sugarbeet production occurs.
*Location EPQ**	Interaction term of *Location Dummy* and *EPQ**.
*Location PQ**	Interaction term of *Location Dummy* and *PQ**.
Alfalfa	Expected annual price per ton of alfalfa received by Montana producers. Predicted using AR(1) ARIMA model.
Dry Bean	Expected annual price per hundredweight of dry edible beans received by Montana producers. Predicted using AR(1) OLS model.
Popden	Population density of the county in which the parcel is located, measured in people per square mile.
Size	Size of the parcel sold, measured in acres.
$Size^2$	Size of parcel squared.
Saleyear	Trend variable for each sale year.
Year 1-13	Dummy variable for each sale year.

Table 13. Summary Statistics of Variables in Model

	Total Sample Size n = 569			
Variable	**Mean**	**Standard Deviation**	**Minimum Value**	**Maximum Value**
Def Land Price	$697.50	$367.51	$171.39	$1,912.05
Exp Price	$29.01	$2.47	$23.85	$36.46
Price	$28.90	$3.28	$22.64	$38.21
Soil Quality	0.65	0.23	0.04	1
*EPQ**	$29.10	$7.18	$10.63	$49.38
*PQ**	$28.99	$7.55	$10.37	$51.75
Location Dummy	0.57	0.50	0	1
*Location EPQ**	$17.63	$16.17	$0	$49.38
*Location PQ**	$17.53	$16.22	$0	$51.75
Alfalfa	$50.66	$3.67	$45.43	$72.59
Dry Bean	$14.71	$1.85	$12.91	$20.33
Popden	12.64	15.22	0.8	43.0
Size	282.61	398.27	6	4,591
Size^2	238,217.4	1,133,070	36	21,100,000
Saleyear	1994	2.69	1986	1999

The dependent variable, *Def Land Price*, is the deflated per acre sale price of each land parcel in the sample.

Explanatory variables in the model include sugarbeet price (*Price*, *Exp Price*), soil quality index (*Soil Quality*), a dummy variable for location of the parcel in a sugarbeet producing county (*Location Dummy*), alternative crop prices (*Alfalfa*, *Dry Bean*), population density of surrounding areas (*Popden*), and the size of the parcel (*Size*, *Size*^{2}).

Two different measures of sugarbeet prices are considered: the current year crop price and a price expectation using previous annual prices to predict current price. *Price* is the annual average price per ton of sugarbeets received by producers in the year previous to the land sale date.[5] A one year lag is needed to obtain a current crop price because sugarbeet prices are not determined until the year following harvest. Therefore, *Price* represents the crop price at the time of the land sale. The variable *Exp Price* is an expected price per ton developed using a second-order autoregressive model estimated by ordinary least squares. This specification was identified using estimated autocorrelation and partial autocorrelation functions generated by the real sugarbeet price series. Appendix B presents graphs of the autocorrelation and partial autocorrelation functions and the regression results of the models used to estimate expected crop prices. The use of the variables *Price* and *Exp Price* in the empirical model are discussed in a separate section.

Soil Quality describes the quality of soil on each parcel using the quality index described in Chapter 5. *Location Dummy* is a dummy variable equal to one if a parcel is located in a county where sugarbeets are currently produced and equal to zero otherwise. *Location Dummy* accounts for the proximity of a sugarbeet processing facility to each parcel.

Alfalfa and dry edible bean annual prices are also considered in the model. The variables *Alfalfa* and *Dry Bean* represent expected annual price per ton of alfalfa and price per hundredweight of dry beans generated using first order autoregressive models.

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[5] Marketing year average prices received by farmers.

The expectation models were identified using estimated autocorrelation and partial autocorrelation functions generated by the series of real prices of alfalfa and dry edible beans.

Popden measures population density of the county in which each parcel is located. *Size* indicates the acreage of each parcel sold. *Size*^{2} is the square of size and is used to account for potential nonlinear effects of size on land prices.

Estimation Issues

The ordinary least squares regression results and test statistic for each regression are shown in Tables 14 and 15. The data, collected over thirteen years, form a non-random cross-section sample of land sales. Thus, two versions of the Cook and Weisberg (1983) test for heteroskedasticity were conducted. The null hypothesis of constant error variance was rejected for each regression. Thus, all regressions presented are adjusted for heteroskedasticity using the Huber (1967) and White (1980,1982) robust estimates of variance.

Annual crop prices were tested for stationarity using the Dickey-Fuller test for unit roots. The sugarbeet and alfalfa price test statistics implied non-stationarity. The Dickey-Fuller test statistic of real sugarbeet price was $Z = -2.196$ and the test statistic of real alfalfa price was $Z = -1.957$. Stationarity was implied for dry edible bean prices with a test statistic of $Z = -2.754$. Although differencing the data could be used to correct for non-stationarity, the model would no longer provide information on long-term relationships among variables. However, the Dickey-Fuller test was also applied to the residuals of the price expectation model to determine if the regression was cointegrated. The test showed the residuals to be stationary with test statistics of $Z = -4.417$ for sugarbeet price and $Z = -4.953$ for alfalfa price. Thus, the regression results obtained from using the data in levels are not spurious and resulting test statistics are valid (Gujarati, 1995).

Regression Estimates

The regression models presented in Table 14 use current crop price for sugarbeets, while the results presented in Table 15 use expected sugarbeet price. Regression 1 in each table includes the variables suggested by the theoretical model. Subsequent regressions were used to test alternative model specifications suggested by theory.

Table 14. Estimation Results Using the Current Real Crop Price of Sugarbeets

Variable	Regression 1	Regression 2	Regression 3	Regression 4	Regression 5
Constant	-39,280.24** (17,275.10)	-34,542.91** (15,088.15)	596.651*** (66.155)	464.052*** (96.417)	683.087*** (66.874)
Price	2.472 (8.081)	-0.200 (6.050)			
Soil Quality	189.660*** (57.756)	190.291*** (57.639)			
*PQ**			6.739*** (1.931)	11.421*** (3.283)	4.064* (2.190)
*Location PQ**				-6.812** (3.637)	4.324*** (1.002)
Location Dummy	117.404*** (28.104)	116.371*** (27.993)	141.615*** (28.130)	333.687*** (103.289)	
Popden	2.586*** (0.954)	2.561*** (0.950)	2.246** (0.954)	2.493*** (0.978)	2.056** (0.956)
Size	-0.620*** (0.067)	-0.617*** (0.067)	-0.612*** (0.067)	-0.597*** (0.068)	-0.624*** (0.067)

Table 14. (continued)

Variable	Regression 1	Regression 2	Regression 3	Regression 4	Regression 5
Size²	*0.00012**** *(0.00003)*	*0.00012**** *(0.00003)*	*0.00012**** *(0.00003)*	*0.00012**** *(0.00003)*	*0.00012**** *(0.00003)*
Dry Bean	2.306 (9.149)				
Saleyear	20.046** (8.605)	17.633** (7.495)			
Year 1			-68.663 (47.503)	-55.655 (43.517)	-69.435 (51.878)
Year 2			-301.730*** (74.412)	-295.450*** (70.934)	-301.786*** (76.459)
Year 3			-348.700*** (63.440)	-350.414*** (61.634)	-346.293*** (65.678)
Year 4			-390.783*** (59.450)	-380.108*** (56.428)	-389.660*** (61.943)
Year 5			-239.054*** (53.271)	-242.416*** (53.593)	-234.297*** (53.535)
Year 6			-88.707* (52.101)	-90.913* (51.863)	-85.120 (52.386)
Year 7			-16.927 (58.545)	-18.498 (58.692)	-17.929 (58.767)
Year 8			-52.637 (50.845)	-52.461 (50.655)	-52.059 (51.024)
Year 10			-23.818 (53.581)	-25.693 (53.498)	-20.176 (53.681)
Year 11			-8.261 (58.584)	-11.104 (58.179)	-6.511 (59.194)
Year 12			-34.202 (53.705)	-33.332 (53.167)	-31.508 (54.125)
Year13			1.300 (68.247)	-4.403 (67.888)	11.983 (68.906)
R^2	0.2620	0.2613	0.2840	0.2878	0.2770
RMSE	315.32	314.92	312.83	312.28	314.36
Cook-Weisberg Test Statistic	$X^2 = 29.69$	$X^2 = 29.17$	$X^2 = 36.36$	$X^2 = 35.45$	$X^2 = 37.22$

Standard Errors in parentheses. Year 9 dropped from each regression due to dependency between dummy variables. Significance of coefficients: ***(1%), **(5%), *(10%). Total sample size of each regression is 569 observations.

Table 15. Estimation Results Using the Expected Annual Price of Sugarbeets

Variable	Regression 1	Regression 2	Regression 3	Regression 4	Regression 5
Constant	14,705.92 (22,084.37)	-3,850.655 (19,395.34)	590.243*** (66.198)	441.249*** (100.452)	677.224*** (66.862)
Exp Price	-32.739*** (12.504)	-19.404** (9.783)			
Soil Quality	204.992*** (57.036)	198.572*** (57.261)			
*EPQ**			6.900*** (1.920)	12.139*** (3.414)	4.197** (2.172)
*Location EPQ**				-7.590** (3.916)	4.325*** (0.999)
Location Dummy	120.554*** (28.104)	118.738*** (27.938)	141.188*** (28.120)	356.036*** (111.372)	
Popden	2.469*** (0.955)	2.529*** (0.945)	2.235** (0.955)	2.481*** (0.980)	2.063** (0.957)
Size	-0.614*** (0.066)	-0.612*** (0.066)	-0.612*** (0.067)	-0.596*** (0.069)	-0.625*** (0.067)
Size^2	0.00012*** (0.00003)	0.00012*** (0.00003)	0.00012*** (0.00003)	0.00012*** (0.00003)	0.00013*** (0.00003)
Alfalfa	0.771 (3.806)				
Dry Bean	12.809 (8.866)				
Saleyear	-6.707 (10.944)	2.520 (9.596)			
Year 1			-65.741 (47.398)	-52.193 (43.067)	-66.161 (51.785)
Year 2			-287.809*** (73.364)	-283.734*** (69.860)	-285.728*** (75.153)
Year 3			-335.131*** (61.328)	-338.151*** (59.556)	-331.497*** (63.226)
Year 4			-389.820*** (59.497)	-377.949*** (56.150)	-388.968*** (62.024)
Year 5			-237.238*** (53.070)	-240.995*** (53.438)	-232.477*** (53.335)
Year 6			-98.580* (52.139)	-101.933** (51.981)	-94.993* (52.396)

Table 15. (continued)

Variable	Regression 1	Regression 2	Regression 3	Regression 4	Regression 5
Year 7			-1.628 (57.907)	0.824 (57.574)	-4.287 (58.166)
Year 8			-49.459 (50.752)	-48.856 (50.511)	-49.004 (50.942)
Year 10			-25.959 (53.532)	-28.154 (53.450)	-22.465 (53.633)
Year 11			9.35 (58.002)	8.382 (57.282)	10.608 (58.641)
Year 12			-45.270 (53.346)	-44.585 (52.762)	-43.034 (53.711)
Year13			-3.561 (68.032)	-8.947 (67.705)	5.998 (68.605)
R^2	0.2683	0.2656	0.2847	0.2889	0.2779
RMSE	313.97	313.99	312.69	312.04	314.16
Cook-Weisberg Test Statistic	$X^2 = 33.35$	$X^2 = 31.49$	$X^2 = 36.67$	$X^2 = 35.32$	$X^2 = 37.60$

Standard Errors in parentheses. Year 9 dropped from each regression due to dependency between dummy variables. Significance of coefficients: ***(1%), **(5%), *(10%). Total sample size of each regression is 569 observations.

Specification Issues

Several empirical and theoretical issues were addressed to determine the final model specification. The following five sections explain these issues.

Trend Variables

Variables representing sale years are included to account for unspecified factors which influence land prices. *Year 1-Year 13* are dummy variables assigned to each sale year. For example, *Year 12* equals one if the parcel observed was sold in 1998 and zero otherwise. However, the price variables for sugarbeets, alfalfa, and dry edible beans are perfectly correlated with the *Year 1-13* dummy variables. Thus, some specifications use a linear trend variable, *Saleyear*, instead of the *Year 1-13* dummy variables.

Price Variables

The theoretical basis for the empirical models suggests that sugarbeet price expectations are likely to be important determinants of land prices. However, an alternative price (current crop price) is also used. The results shown in Tables 14 and 15 differ only by the selection of one of the two sugarbeet prices. The model reported in Table 14 uses *Price* which represents current year crop prices, while Table 15 reports the results obtained using the variable *Exp Price* which is the expected sugarbeet price obtained from the second-order autoregressive model described above. Domestic sugar prices are relatively stable as a result of U.S. sugar policy. Therefore, the differences between the models using current sugarbeet price and expected sugarbeet price are expected to be small. The empirical results confirm this intuition as the coefficients of all the variables including current price (*Price*, *PQ**, and *Location PQ**) are very similar to the coefficients of the variables using the expected price (*Exp Price*, *EPQ**, and *Location EPQ**). Thus, current price appears to provide a reasonable proxy for expected future price. However, the empirical results presented in the remainder of this chapter will focus on specifications which include expected sugarbeet prices because of theoretical considerations.

Alternative Crops

Expected prices for alfalfa (*Alfalfa*) and dry edible beans (*Dry Bean*) are used as the prices of crop alternatives. Both prices are expected to have a positive relationship with land price. However, neither variable was significantly different from zero in Regression 1. Therefore, both of the alternative crop price variables were omitted in subsequent models.

Quality Adjusted Price

A quality adjusted sugarbeet price variable is used to account for differences in prices received by farmers based on crop quality. Sugarbeets with higher sugar content receive higher prices. The use of state-level average sugarbeet prices masks these quality impacts. The soil quality index variable (*Soil Quality*) provides a proxy for crop quality, and is used to adjust sugarbeet prices by parcel.

The variable *EPQ** is the product of expected price of sugarbeets (*Exp Price*) and the soil quality index variable (*Soil Quality*). Soil quality is centered on one before it is multiplied by the price variable. This is done by adding to each observation the difference between the mean soil quality and one.

Results in Table 15, Regression 3, indicate the quality adjusted price has some explanatory power. Therefore, the variable *Exp Price* variable is replaced with *EPQ** to capture the significant effect of a quality adjusted price of sugarbeets on land price.

Location of Parcel

The last issue investigated, before a final empirical model was determined, addressed parcel location. The dummy variable *Location Dummy* measures the effect of a parcel's location on land price. The variable is significant in Regressions 1-3 and indicates that proximity to a processing plant has some effect on land price. As a result, the product of the location dummy and expected sugarbeet price (*Location EPQ**) was included in Regression 4. This variable measures the effect of quality adjusted expected sugarbeet price on land price for parcels located in sugarbeet producing counties. *Location EPQ** was highly correlated with the *Location Dummy* variable. Therefore, Regression 5 excludes the *Location Dummy* variable. Regression 5, in Table 15, is the final model specification after adjustment for the issues just discussed.

Empirical Results

Regressions 3 and 5 are both model specifications with relatively high R squared values and low root mean squared errors. The following discussions regarding quality adjusted price, population density, and size use the empirical results of Regression 5. The coefficient of *Location Dummy* in Regression 3 is also used to determine the effect on land prices if sugarbeet production is no longer viable.

Regression 5 (Table 15) includes the explanatory variables *EPQ**, *Location EPQ**, *Popden*, *Size*, $Size^2$, and annual dummy variables (*Year 1-13*). Table 16 presents the estimated elasticities for each coefficient (except annual dummy variables) in Regression 5. All elasticities are estimated using sample means.

Table 16. Elasticities of Variables in Regression 5

Variable	Elasticity[1]
*EPQ**	0.175
*Location EPQ**	0.109
(*EPQ** + *Location EPQ**)[2]	0.284
Popden	0.037
Size	0.253
Size^2	0.043

[1] Absolute value of elasticity value. [2] This elasticity is the joint effect of *EPQ** and *Location EPQ** on real per acre land price.

The results indicate the expected price of sugarbeets, when adjusted for the quality of land, positively impacts the price of irrigated land. The coefficient of the variable *EPQ** is 4.197 and is significant at the $\alpha = 0.05$ level. Holding all other variables constant, a $1 per ton increase in the quality-adjusted price causes a $4.20 increase in the real per acre price of land even for parcels that are not in sugarbeet producing counties. The elasticity of real land price with respect to real expected sugarbeet price is 0.175.[6] That is, a 1 percent increase in the quality adjusted price of sugarbeets will increase the real price per acre of land by 0.175 percent.

The other price variable included in Regression 5 is the parcel location dummy variable interacted with quality-adjusted price. *Location EPQ** has a positive impact of

[6] The elasticity is calculated by dividing the mean expected sugarbeet price by the mean deflated price per acre, then multiplying by the coefficient of real expected sugarbeet price.

$4.33 on land price if sugarbeet price is increased by $1 per ton for parcels located in a sugarbeet producing county. The variable has an estimated elasticity of 0.109.

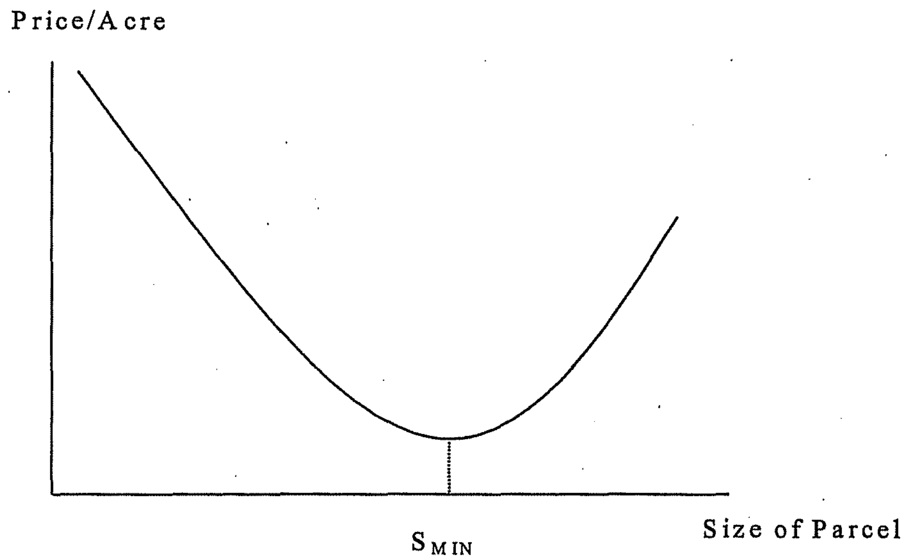
The overall impact of expected sugarbeet prices on land prices is a joint effect for parcels located in sugarbeet producing counties. Land prices are positively impacted by increases in sugarbeet prices, while parcels in counties where sugarbeets are a viable crop alternative experience additional positive impacts. The joint effect is measured by adding the coefficients of *EPQ** and *LocationEPQ**. Thus, a $1 per ton increase in expected sugarbeet price increases the price of land in sugarbeet producing counties by $8.52 per acre. The joint elasticity of the two price variables is 0.284.

The additional effect of *LocationEPQ** measures the effect of proximity to sugarbeet processing facilities. Parcel location is important not only because of transportation costs, but also because sugarbeets decompose once they are harvested. The location of sugarbeet processing plants is the most restrictive constraint on the geographical expansion of sugarbeet production. The effect measured by *EPQ** is not specific to land near a processing facility. However, all land in the sample is irrigated and could produce sugarbeets under certain conditions. This land becomes more valuable as the price of sugarbeets increases simply by being arable, irrigated land in a region with existing sugar processing plants. Overall, sugarbeet prices have a positive impact on irrigated land prices in the region.

Popden is significant at the $\alpha = 0.05$ level. The coefficient for *Popden* indicates that a $2.06 increase in land price occurs if a county's population density increases by one person per square mile. For purposes of comparison, Yellowstone and Treasure Counties are geographically adjacent. Yellowstone County has a population density of 43.0, while Treasure County has a population density of 0.9 people per square mile. Using the marginal effect of $2.06, the expected price difference in land price between the two counties, holding all other factors constant, is approximately $86.73 in real dollars. This difference accounts for the larger number of alternative land uses such as commercial, industrial, and residential in a more populated area such as Yellowstone County.

Other effects on land prices presented in Regression 5 include parcel size. These effects are captured by the *Size* and $Size^2$ variables. These variables are significant at the $\alpha = 0.01$ level. *Size* has the expected negative sign and $Size^2$ is positive. Given the coefficient estimates and the sample data, the results indicate that price per acre decreases as the size of a parcel increases, but this effect declines at a decreasing rate. Figure 3 shows the impact of size on deflated price per acre. S_{MIN} is the minimum point on the curve. For parcels less than S_{MIN}, the theoretical effect of size on land price presented in Chapter 4 applies. Using the coefficients estimated by the model, S_{MIN} equals 4,994 acres. The largest parcel in the data set is 4,591 acres, so the results indicate the expected negative effect of size on per acre land price.

Figure 3. Effects of Size of Parcel on Price Per Acre



Small tracts appeal to a larger number of buyers, while large tracts are difficult and costly to divide into smaller tract for alternative uses. As a result, per acre land prices for small tracts may be higher than sale prices on large tracts because of a larger number of bidders or because of capital constraints.

Annual dummy variables are included in Regressions 3-5. Correlation between the dummy variables and crop prices was reduced after expected sugarbeet price was interacted with soil quality. Therefore, dummy variables were used in place of the trend variable. Most of the variables *Year 1-13* in Regression 5 are not significant.

Policy Implications

Previously discussed was the role of U.S. sugar policy in maintaining domestic sugar prices above world prices. The empirical results indicate that sugarbeet production positively impacts land prices in Montana. Therefore, changes in U.S. sugar policy that reduce domestic sugarbeet prices are likely to reduce land prices.

Benirschka, Koo, and Lou claimed that the multilateral elimination of intervention policies is likely to cause a decline in U.S. sugar prices and may increase world sugar prices. Sugar production in the United States was 7.6 million tons for the 2000-2001 crop year. This represents about 6 percent of total world production. Thus, unilateral trade liberalization by the United States is not expected to change the world sugar price significantly. Under this type of policy change, domestic producers may face sugar prices similar to the current world price.

If U.S. producers face the world price of sugar, land prices are expected to decline. Canadian sugarbeet production operates without domestic support. Therefore, prices received by Canadian sugarbeet producers may be reasonable proxies for the prices U.S. producers would expect to receive under unilateral trade policy liberalization. The average real price of sugarbeets in Canada during the period 1997-1999 was $24.01 (Canadian) per metric ton. Converting this average price to U.S. dollars using an exchange rate of 0.63 yields an average real price of $13.87 per short ton.[7] During the same period, U.S. producers received an average real price of $24.04 per short ton. The price difference of $10.17 per ton would reduce real land prices by $42.68 per acre

[7] This is the current exchange rate listed by Bank of Canada for October, 2001.

throughout Montana. For irrigated farmland in sugarbeet producing counties, an additional negative impact of $43.99 per acre on real land price is expected. Jointly, the impact is a decline of $86.67 per acre for land located within sugarbeet producing counties. Inflating these values to current dollars, the effect on land prices is $73.49 for land in Montana and $75.75 for land in sugarbeet producing counties. The joint effect, inflated to current dollars, of quality adjusted price on land price in sugarbeet producing counties is expected to be $149.25 per acre.

A low domestic price has the additional implication of causing higher cost producers to exit the industry. Although lower-cost producers may want to continue production, processing facilities may close if they are unable to operate plants at efficient utilization levels. The potential impacts of the total loss of sugarbeet production are measured by the *Location Dummy* variable in Regressions 3. This variable captures the difference between land close to processing facilities and land in non-sugarbeet producing counties, holding all other factors constant. If sugarbeets are no longer produced, the estimated coefficient for the location dummy variable indicates a decrease of approximately $141 per acre in real land prices in those counties. Inflating this value to current dollars yields an impact on land price due to location of approximately $243 per acre.

CHAPTER 7

CONCLUSION

The production of sugarbeets by Montana farmers has allowed land owners to capture economic rents from policy-supported domestic sugar prices. Land prices are likely to include the capitalization of these rents because the expectations of profitability by participants in the land markets will be reflected in bid prices.

The purpose of this study has been to measure the effects of sugarbeet production on land prices. Quantifying these effects provides policy makers with tools necessary for anticipating impacts on domestic sugar prices from changes in trade agreements. The analysis also provides producers, sugar processors, and agricultural lenders the information needed to make production and financial decisions that account for future changes in U.S. sugar policy.

An hedonic land price model was estimated in this study. This allowed estimation of individual land characteristics and the impact of sugarbeet price on land prices. The model was estimated using data supplied by a regional agricultural lender and data obtained from the U.S. Census, the Natural Resources Conservation Service, and the U.S. Department of Agriculture.

The results indicated quality-adjusted expected prices of sugarbeets positively influence land price. Population density, parcel size, and the location of parcels in sugarbeet producing counties also impact land prices in the manner described by the theoretical model. The prices of alternative crops did not have significant explanatory power in the model.

Implications

Several implications follow from the regression results. First, expected sugarbeet prices that have been adjusted for quality are important for explaining the impact of crop price on land price. Models not accounting for quality differences between producers may not be capturing the full effect of sugarbeet price on land prices. Second, there will be a significant reduction in land prices for irrigated parcels located in sugarbeet producing counties if sugarbeet production is no longer viable. This is an important result when capacity issues of processing plants are considered. If plants are closed due to less sugarbeet acreage, low cost producers will be impacted adversely. Furthermore, land price is also affected in counties which contain irrigated land but do not produce sugarbeets.

Policy makers may want to consider the results of this study before adjusting international trade agreements for agricultural products. In addition to the direct impacts on producers, some sugar processing facilities may not survive a decrease in the domestic price of sugar. Adjustments to domestic sugar policies will impact land prices.

Producers and agricultural credit lenders have concerns regarding the impacts on land prices from a decline in the domestic price of sugar. In addition to loans for agricultural land, producers may have also mortgaged land to purchase stock in processing plants. The financial impact of a decrease in land price has implications for both borrowers and lenders.

An alternative method for assessing the impacts of sugarbeet revenues on land prices was also considered. A comparison of the alternative enterprise budgeting approach results to the hedonic model results shows the regression estimates to be consistent with a planning horizon where purchasers of farmland expect to produce sugarbeets through 2008 and then plan on switching to an alternative crop such as feed barley. This expectation may be based on the phase out of trade restrictions on imports from Mexico under NAFTA.

The enterprise budgeting approach indicates a decline in nominal land price of \$231 per acre, whereas estimates from the hedonic model indicate the impact on land price from sugarbeet production to be \$243 per acre in current dollars. Such declines in irrigated land prices suggest that those purchasing land expect sugarbeet production to be viable in the immediate future. Purchasers with planning horizons based on long-term sugarbeet production may be too optimistic in the face of changes in trade agreements that could diminish the current impacts of U.S. sugar policy on land prices.

Future Research

Future research of land prices should focus on quality adjusted price variables. Previous work has not addressed this issue and this study indicates these prices to have some explanatory power in a land price model. Future research issues include a more precise measure of quality adjusted prices received by producers. A better proxy for crop quality may increase the explanatory power of quality adjusted prices on land prices. Another consideration for future research will be exploring alternative specifications of the quality adjusted price model. This study constrained the impact of quality adjusted price on land price to a linear form. This effect may not be linear and other forms of the model need consideration.

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APPENDICES

APPENDIX A

ORIGINAL DATA SET

Table 17. Original Data Set

Index	Sale Year	County	Price Per Acre	Population Density
	Total Sample Size n=619			
1	1986	Big Horn	$896	2.3
2	1986	Carbon	$931	3.9
3	1988	(missing)	$625	(missing)
4	1988	Big Horn	$705	2.3
5	1988	Big Horn	$559	2.3
6	1988	Big Horn	$613	2.3
7	1988	Big Horn	$651	2.3
8	1988	Big Horn	$228	2.3
9	1988	Broadwater	$732	2.8
10	1988	Broadwater	$144	2.8
11	1988	Broadwater	$840	2.8
12	1988	Carbon	$480	3.9
13	1988	Carbon	$1,125	3.9
14	1988	Carbon	$543	3.9
15	1988	Carbon	$358	3.9
16	1988	Treasure	$1,167	0.9
17	1988	Treasure	$327	0.9
18	1988	Treasure	$247	0.9
19	1988	Treasure	$935	0.9
20	1988	Yellowstone	$360	43.0
21	1989	(missing)	$505	(missing)
22	1989	Big Horn	$750	2.3
23	1989	Big Horn	$450	2.3
24	1989	Big Horn	$573	2.3
25	1989	Broadwater	$839	2.8
26	1989	Broadwater	$573	2.8
27	1989	Carbon	$874	3.9
28	1989	Carbon	$750	3.9
29	1989	Yellowstone	$642	43.0
30	1989	Yellowstone	$938	43.0
31	1990	(missing)	$5,011	(missing)
32	1990	Big Horn	$163	2.3

Index	Sale Year	County	Price Per Acre	Population Density
33	1990	Big Horn	$558	2.3
34	1990	Big Horn	$665	2.3
35	1990	Big Horn	$621	2.3
36	1990	Big Horn	$631	2.3
37	1990	Carbon	$535	3.9
38	1990	Treasure	$596	0.9
39	1990	Treasure	$541	0.9
40	1990	Yellowstone	$246	43.0
41	1990	Yellowstone	$915	43.0
42	1990	Yellowstone	$938	43.0
43	1991	(missing)	$468	(missing)
44	1991	Broadwater	$365	2.8
45	1991	Broadwater	$544	2.8
46	1991	Broadwater	$604	2.8
47	1991	Broadwater	$772	2.8
48	1991	Carbon	$936	3.9
49	1991	Carbon	$1,183	3.9
50	1991	Custer	$957	3.1
51	1991	Custer	$720	3.1
52	1991	Custer	$1,070	3.1
53	1991	Custer	$906	3.1
54	1991	Dawson	$427	4.0
55	1991	Dawson	$425	4.0
56	1991	Prairie	$558	0.8
57	1991	Prairie	$481	0.8
58	1991	Richland	$909	5.1
59	1991	Richland	$1,289	5.1
60	1991	Richland	$553	5.1
61	1991	Richland	$1,186	5.1
62	1991	Teton	$625	2.8
63	1991	Teton	$468	2.8
64	1991	Teton	$379	2.8
65	1991	Teton	$475	2.8
66	1991	Treasure	$632	0.9

Index	Sale Year	County	Price Per Acre	Population Density
67	1991	Treasure	$484	0.9
68	1991	Yellowstone	$1,493	43.0
69	1991	Yellowstone	$1,000	43.0
70	1991	Yellowstone	$1,112	43.0
71	1991	Yellowstone	$850	43.0
72	1991	Yellowstone	$1,563	43.0
73	1992	Big Horn	$713	2.3
74	1992	Big Horn	$777	2.3
75	1992	Blaine	$339	1.6
76	1992	Blaine	$339	1.6
77	1992	Broadwater	$348	2.8
78	1992	Broadwater	$852	2.8
79	1992	Broadwater	$644	2.8
80	1992	Broadwater	$500	2.8
81	1992	Broadwater	$435	2.8
82	1992	Carbon	$1,989	3.9
83	1992	Carbon	$497	3.9
84	1992	Carbon	$4,135	3.9
85	1992	Carbon	$4,500	3.9
86	1992	Carbon	$252	3.9
87	1992	Carbon	$1,575	3.9
88	1992	Carbon	$1,131	3.9
89	1992	Carbon	$1,074	3.9
90	1992	Carbon	$1,180	3.9
91	1992	Carbon	$1,313	3.9
92	1992	Carbon	$1,338	3.9
93	1992	Carbon	$1,182	3.9
94	1992	Carbon	$816	3.9
95	1992	Carbon	$750	3.9
96	1992	Carbon	$821	3.9
97	1992	Carbon	$583	3.9
98	1992	Cascade	$2,500	28.8
99	1992	Cascade	$800	28.8
100	1992	Cascade	$500	28.8

Index	Sale Year	County	Price Per Acre	Population Density
101	1992	Cascade	$706	28.8
102	1992	Cascade	$800	28.8
103	1992	Cascade	$500	28.8
104	1992	Cascade	$550	28.8
105	1992	Cascade	$743	28.8
106	1992	Cascade	$972	28.8
107	1992	Cascade	$750	28.8
108	1992	Cascade	$550	28.8
109	1992	Cascade	$2,500	28.8
110	1992	Cascade	$706	28.8
111	1992	Cascade	$750	28.8
112	1992	Cascade	$743	28.8
113	1992	Cascade	$972	28.8
114	1992	Custer	$338	3.1
115	1992	Custer	$1,421	3.1
116	1992	Custer	$534	3.1
117	1992	Custer	$565	3.1
118	1992	Prairie	$609	0.8
119	1992	Richland	$1,708	5.1
120	1992	Richland	$1,496	5.1
121	1992	Richland	$1,366	5.1
122	1992	Richland	$566	5.1
123	1992	Rosebud	$496	2.1
124	1992	Stillwater	$477	3.6
125	1992	Stillwater	$808	3.6
126	1992	Stillwater	$493	3.6
127	1992	Stillwater	$2,131	3.6
128	1992	Stillwater	$1,623	3.6
129	1992	Sweetgrass	$833	1.7
130	1992	Sweetgrass	$341	1.7
131	1992	Sweetgrass	$671	1.7
132	1992	Sweetgrass	$870	1.7
133	1992	Sweetgrass	$1,447	1.7
134	1992	Teton	$628	2.8

Index	Sale Year	County	Price Per Acre	Population Density
135	1992	Teton	$234	2.8
136	1992	Teton	$469	2.8
137	1992	Teton	$1,000	2.8
138	1992	Teton	$750	2.8
139	1992	Treasure	$773	0.9
140	1992	Treasure	$773	0.9
141	1992	Treasure	$698	0.9
142	1992	Yellowstone	$2,028	43.0
143	1992	Yellowstone	$487	43.0
144	1992	Yellowstone	$487	43.0
145	1992	Yellowstone	$4,813	43.0
146	1992	Yellowstone	$788	43.0
147	1992	Yellowstone	$1,747	43.0
148	1992	Yellowstone	$1,484	43.0
149	1992	Yellowstone	$657	43.0
150	1992	Yellowstone	$1,424	43.0
151	1992	Yellowstone	$1,425	43.0
152	1992	Yellowstone	$2,000	43.0
153	1993	(missing)	$515	(missing)
154	1993	Big Horn	$1,264	2.3
155	1993	Big Horn	$2,024	2.3
156	1993	Big Horn	$592	2.3
157	1993	Blaine	$1,288	1.6
158	1993	Blaine	$427	1.6
159	1993	Blaine	$325	1.6
160	1993	Blaine	$1,288	1.6
161	1993	Blaine	$127	1.6
162	1993	Blaine	$325	1.6
163	1993	Broadwater	$2,375	2.8
164	1993	Broadwater	$764	2.8
165	1993	Carbon	$750	3.9
166	1993	Carbon	$1,418	3.9
167	1993	Carbon	$1,094	3.9
168	1993	Carbon	$1,155	3.9

Index	Sale Year	County	Price Per Acre	Population Density
169	1993	Carbon	$1,616	3.9
170	1993	Carbon	$1,271	3.9
171	1993	Carbon	$1,055	3.9
172	1993	Carbon	$920	3.9
173	1993	Cascade	$216	28.8
174	1993	Cascade	$750	28.8
175	1993	Cascade	$786	28.8
176	1993	Cascade	$800	28.8
177	1993	Cascade	$750	28.8
178	1993	Cascade	$786	28.8
179	1993	Cascade	$694	28.8
180	1993	Cascade	$597	28.8
181	1993	Cascade	$694	28.8
182	1993	Cascade	$1,050	28.8
183	1993	Cascade	$712	28.8
184	1993	Cascade	$712	28.8
185	1993	Cascade	$2,308	28.8
186	1993	Cascade	$800	28.8
187	1993	Cascade	$575	28.8
188	1993	Cascade	$597	28.8
189	1993	Cascade	$1,240	28.8
190	1993	Cascade	$1,050	28.8
191	1993	Cascade	$722	28.8
192	1993	Cascade	$575	28.8
193	1993	Cascade	$722	28.8
194	1993	Cascade	$216	28.8
195	1993	Cascade	$2,308	28.8
196	1993	Cascade	$1,240	28.8
197	1993	Custer	$793	3.1
198	1993	Custer	$828	3.1
199	1993	Stillwater	$1,713	3.6
200	1993	Stillwater	$332	3.6
201	1993	Stillwater	$2,730	3.6
202	1993	Sweetgrass	$2,462	1.7

Index	Sale Year	County	Price Per Acre	Population Density
203	1993	Teton	$515	2.8
204	1993	Teton	$974	2.8
205	1993	Teton	$750	2.8
206	1993	Teton	$480	2.8
207	1993	Teton	$2,002	2.8
208	1993	Teton	$354	2.8
209	1993	Teton	$847	2.8
210	1993	Teton	$1,267	2.8
211	1993	Treasure	$866	0.9
212	1993	Yellowstone	$205	43.0
213	1993	Yellowstone	$1,333	43.0
214	1993	Yellowstone	$1,244	43.0
215	1993	Yellowstone	$1,556	43.0
216	1993	Yellowstone	$1,961	43.0
217	1993	Yellowstone	$3,335	43.0
218	1993	Yellowstone	$3,767	43.0
219	1993	Yellowstone	$1,961	43.0
220	1993	Yellowstone	$10,041	43.0
221	1993	Yellowstone	$6,000	43.0
222	1993	Yellowstone	$825	43.0
223	1993	Yellowstone	$1,750	43.0
224	1993	Yellowstone	$174	43.0
225	1993	Yellowstone	$1,484	43.0
226	1993	Yellowstone	$1,102	43.0
227	1994	(missing)	$778	(missing)
228	1994	Big Horn	$1,143	2.3
229	1994	Big Horn	$700	2.3
230	1994	Big Horn	$919	2.3
231	1994	Big Horn	$1,406	2.3
232	1994	Blaine	$254	1.6
233	1994	Blaine	$254	1.6
234	1994	Blaine	$519	1.6
235	1994	Blaine	$519	1.6
236	1994	Blaine	$354	1.6

Index	Sale Year	County	Price Per Acre	Population Density
237	1994	Blaine	$1,363	1.6
238	1994	Blaine	$354	1.6
239	1994	Blaine	$1,363	1.6
240	1994	Blaine	$296	1.6
241	1994	Blaine	$296	1.6
242	1994	Broadwater	$1,200	2.8
243	1994	Broadwater	$963	2.8
244	1994	Broadwater	$666	2.8
245	1994	Broadwater	$528	2.8
246	1994	Broadwater	$747	2.8
247	1994	Broadwater	$1,090	2.8
248	1994	Carbon	$640	3.9
249	1994	Carbon	$754	3.9
250	1994	Carbon	$1,174	3.9
251	1994	Carbon	$1,942	3.9
252	1994	Carbon	$921	3.9
253	1994	Carbon	$749	3.9
254	1994	Carbon	$963	3.9
255	1994	Carbon	$1,592	3.9
256	1994	Carbon	$1,863	3.9
257	1994	Carbon	$892	3.9
258	1994	Carbon	$2,337	3.9
259	1994	Carbon	$2,503	3.9
260	1994	Cascade	$778	28.8
261	1994	Cascade	$778	28.8
262	1994	Cascade	$1,000	28.8
263	1994	Cascade	$750	28.8
264	1994	Cascade	$750	28.8
265	1994	Custer	$709	3.1
266	1994	Custer	$645	3.1
267	1994	Custer	$1,056	3.1
268	1994	Custer	$494	3.1
269	1994	Custer	$1,984	3.1
270	1994	Custer	$1,946	3.1

Index	Sale Year	County	Price Per Acre	Population Density
271	1994	Dawson	$601	4.0
272	1994	Richland	$1,315	5.1
273	1994	Richland	$1,115	5.1
274	1994	Richland	$1,296	5.1
275	1994	Rosebud	$583	2.1
276	1994	Sweetgrass	$1,308	1.7
277	1994	Sweetgrass	$396	1.7
278	1994	Sweetgrass	$2,932	1.7
279	1994	Sweetgrass	$2,197	1.7
280	1994	Sweetgrass	$962	1.7
281	1994	Sweetgrass	$500	1.7
282	1994	Sweetgrass	$1,160	1.7
283	1994	Teton	$1,269	2.8
284	1994	Teton	$286	2.8
285	1994	Teton	$683	2.8
286	1994	Teton	$288	2.8
287	1994	Teton	$425	2.8
288	1994	Teton	$206	2.8
289	1994	Teton	$566	2.8
290	1994	Teton	$450	2.8
291	1994	Teton	$654	2.8
292	1994	Teton	$469	2.8
293	1994	Yellowstone	$833	43.0
294	1994	Yellowstone	$996	43.0
295	1994	Yellowstone	$892	43.0
296	1994	Yellowstone	$1,388	43.0
297	1994	Yellowstone	$1,579	43.0
298	1994	Yellowstone	$736	43.0
299	1994	Yellowstone	$2,034	43.0
300	1994	Yellowstone	$996	43.0
301	1994	Yellowstone	$441	43.0
302	1994	Yellowstone	$467	43.0
303	1994	Yellowstone	$1,096	43.0
304	1994	Yellowstone	$2,045	43.0

Index	Sale Year	County	Price Per Acre	Population Density
305	1995	(missing)	$710	(missing)
306	1995	(missing)	$312	(missing)
307	1995	Big Horn	$1,155	2.3
308	1995	Big Horn	$3,182	2.3
309	1995	Big Horn	$1,068	2.3
310	1995	Big Horn	$1,068	2.3
311	1995	Big Horn	$311	2.3
312	1995	Big Horn	$1,060	2.3
313	1995	Blaine	$555	1.6
314	1995	Blaine	$421	1.6
315	1995	Blaine	$184	1.6
316	1995	Blaine	$421	1.6
317	1995	Blaine	$581	1.6
318	1995	Blaine	$184	1.6
319	1995	Blaine	$580	1.6
320	1995	Blaine	$555	1.6
321	1995	Blaine	$581	1.6
322	1995	Blaine	$570	1.6
323	1995	Broadwater	$1,201	2.8
324	1995	Broadwater	$482	2.8
325	1995	Broadwater	$1,224	2.8
326	1995	Broadwater	$1,063	2.8
327	1995	Carbon	$781	3.9
328	1995	Carbon	$1,140	3.9
329	1995	Carbon	$810	3.9
330	1995	Carbon	$1,735	3.9
331	1995	Carbon	$1,735	3.9
332	1995	Carbon	$1,544	3.9
333	1995	Carbon	$1,838	3.9
334	1995	Carbon	$1,526	3.9
335	1995	Cascade	$1,125	28.8
336	1995	Cascade	$890	28.8
337	1995	Cascade	$906	28.8
338	1995	Cascade	$2,830	28.8

Index	Sale Year	County	Price Per Acre	Population Density
339	1995	Cascade	$633	28.8
340	1995	Cascade	$2,830	28.8
341	1995	Cascade	$2,087	28.8
342	1995	Cascade	$2,167	28.8
343	1995	Cascade	$2,167	28.8
344	1995	Cascade	$917	28.8
345	1995	Cascade	$1,154	28.8
346	1995	Cascade	$1,154	28.8
347	1995	Cascade	$917	28.8
348	1995	Cascade	$1,364	28.8
349	1995	Cascade	$1,000	28.8
350	1995	Cascade	$906	28.8
351	1995	Cascade	$1,034	28.8
352	1995	Cascade	$2,087	28.8
353	1995	Cascade	$1,125	28.8
354	1995	Cascade	$1,034	28.8
355	1995	Cascade	$633	28.8
356	1995	Cascade	$890	28.8
357	1995	Custer	$1,949	3.1
358	1995	Custer	$1,533	3.1
359	1995	Custer	$1,056	3.1
360	1995	Custer	$1,000	3.1
361	1995	Custer	$689	3.1
362	1995	Custer	$589	3.1
363	1995	Dawson	$985	4.0
364	1995	Dawson	$798	4.0
365	1995	Dawson	$468	4.0
366	1995	Prairie	$684	0.8
367	1995	Prairie	$392	0.8
368	1995	Richland	$616	5.1
369	1995	Richland	$2,041	5.1
370	1995	Stillwater	$1,240	3.6
371	1995	Stillwater	$2,064	3.6
372	1995	Sweetgrass	$1,281	1.7

Index	Sale Year	County	Price Per Acre	Population Density
373	1995	Teton	$4,333	2.8
374	1995	Teton	$1,313	2.8
375	1995	Teton	$273	2.8
376	1995	Teton	$312	2.8
377	1995	Teton	$958	2.8
378	1995	Teton	$710	2.8
379	1995	Teton	$806	2.8
380	1995	Teton	$649	2.8
381	1995	Teton	$2,245	2.8
382	1995	Teton	$563	2.8
383	1995	Treasure	$362	0.9
384	1995	Yellowstone	$1,515	43.0
385	1995	Yellowstone	$1,502	43.0
386	1995	Yellowstone	$372	43.0
387	1995	Yellowstone	$1,650	43.0
388	1995	Yellowstone	$970	43.0
389	1995	Yellowstone	$1,082	43.0
390	1995	Yellowstone	$2,314	43.0
391	1995	Yellowstone	$2,064	43.0
392	1995	Yellowstone	$1,118	43.0
393	1995	Yellowstone	$1,094	43.0
394	1995	Yellowstone	$875	43.0
395	1995	Yellowstone	$2,500	43.0
396	1996	(missing)	$3,000	(missing)
397	1996	(missing)	$775	(missing)
398	1996	Big Horn	$901	2.3
399	1996	Big Horn	$1,491	2.3
400	1996	Big Horn	$900	2.3
401	1996	Big Horn	$1,187	2.3
402	1996	Big Horn	$1,191	2.3
403	1996	Big Horn	$1,255	2.3
404	1996	Big Horn	$1,138	2.3
405	1996	Blaine	$369	1.6
406	1996	Blaine	$369	1.6

Index	Sale Year	County	Price Per Acre	Population Density
407	1996	Broadwater	$1,111	2.8
408	1996	Broadwater	$999	2.8
409	1996	Carbon	$1,992	3.9
410	1996	Carbon	$1,230	3.9
411	1996	Carbon	$743	3.9
412	1996	Carbon	$1,299	3.9
413	1996	Carbon	$1,992	3.9
414	1996	Carbon	$1,448	3.9
415	1996	Carbon	$1,580	3.9
416	1996	Carbon	$1,230	3.9
417	1996	Carbon	$1,094	3.9
418	1996	Carbon	$2,529	3.9
419	1996	Carbon	$1,590	3.9
420	1996	Carbon	$743	3.9
421	1996	Cascade	$1,389	28.8
422	1996	Cascade	$1,389	28.8
423	1996	Cascade	$1,101	28.8
424	1996	Cascade	$625	28.8
425	1996	Cascade	$4,375	28.8
426	1996	Cascade	$845	28.8
427	1996	Cascade	$4,375	28.8
428	1996	Cascade	$1,350	28.8
429	1996	Cascade	$625	28.8
430	1996	Cascade	$1,101	28.8
431	1996	Cascade	$1,350	28.8
432	1996	Cascade	$657	28.8
433	1996	Cascade	$657	28.8
434	1996	Custer	$1,198	3.1
435	1996	Custer	$808	3.1
436	1996	Custer	$988	3.1
437	1996	Dawson	$328	4.0
438	1996	Dawson	$737	4.0
439	1996	Dawson	$818	4.0
440	1996	McCone	$599	0.9

Index	Sale Year	County	Price Per Acre	Population Density
441	1996	Prairie	$478	0.8
442	1996	Prairie	$854	0.8
443	1996	Prairie	$545	0.8
444	1996	Richland	$503	5.1
445	1996	Richland	$1,213	5.1
446	1996	Sweetgrass	$320	1.7
447	1996	Teton	$347	2.8
448	1996	Teton	$606	2.8
449	1996	Teton	$844	2.8
450	1996	Teton	$591	2.8
451	1996	Teton	$938	2.8
452	1996	Teton	$505	2.8
453	1996	Teton	$3,000	2.8
454	1996	Teton	$775	2.8
455	1996	Teton	$2,775	2.8
456	1996	Teton	$850	2.8
457	1996	Teton	$1,331	2.8
458	1996	Treasure	$1,259	0.9
459	1996	Treasure	$1,063	0.9
460	1996	Treasure	$574	0.9
461	1996	Treasure	$1,294	0.9
462	1996	Yellowstone	$1,696	43.0
463	1996	Yellowstone	$1,089	43.0
464	1996	Yellowstone	$1,975	43.0
465	1996	Yellowstone	$2,190	43.0
466	1996	Yellowstone	$1,645	43.0
467	1996	Yellowstone	$2,500	43.0
468	1996	Yellowstone	$4,211	43.0
469	1997	(missing)	$835	(missing)
470	1997	Big Horn	$1,667	2.3
471	1997	Big Horn	$1,557	2.3
472	1997	Broadwater	$1,295	2.8
473	1997	Broadwater	$1,058	2.8
474	1997	Broadwater	$2,542	2.8

Index	Sale Year	County	Price Per Acre	Population Density
475	1997	Broadwater	$1,059	2.8
476	1997	Broadwater	$1,019	2.8
477	1997	Carbon	$626	3.9
478	1997	Carbon	$1,438	3.9
479	1997	Carbon	$741	3.9
480	1997	Carbon	$527	3.9
481	1997	Carbon	$1,779	3.9
482	1997	Carbon	$1,687	3.9
483	1997	Carbon	$1,242	3.9
484	1997	Carbon	$1,125	3.9
485	1997	Cascade	$700	28.8
486	1997	Cascade	$1,313	28.8
487	1997	Cascade	$1,694	28.8
488	1997	Cascade	$1,694	28.8
489	1997	Cascade	$590	28.8
490	1997	Cascade	$590	28.8
491	1997	Cascade	$1,313	28.8
492	1997	Cascade	$692	28.8
493	1997	Cascade	$1,138	28.8
494	1997	Cascade	$7,000	28.8
495	1997	Custer	$239	3.1
496	1997	Custer	$2,154	3.1
497	1997	Custer	$1,161	3.1
498	1997	Dawson	$901	4.0
499	1997	Dawson	$554	4.0
500	1997	Garfield	$442	0.3
501	1997	Prairie	$888	0.8
502	1997	Prairie	$797	0.8
503	1997	Prairie	$442	0.8
504	1997	Richland	$1,681	5.1
505	1997	Richland	$2,003	5.1
506	1997	Richland	$1,842	5.1
507	1997	Rosebud	$1,171	2.1
508	1997	Stillwater	$1,018	3.6

Index	Sale Year	County	Price Per Acre	Population Density
509	1997	Sweetgrass	$1,661	1.7
510	1997	Teton	$667	2.8
511	1997	Teton	$1,225	2.8
512	1997	Teton	$447	2.8
513	1997	Teton	$332	2.8
514	1997	Teton	$950	2.8
515	1997	Teton	$222	2.8
516	1997	Teton	$787	2.8
517	1997	Teton	$604	2.8
518	1997	Teton	$835	2.8
519	1997	Yellowstone	$2,375	43.0
520	1997	Yellowstone	$1,333	43.0
521	1997	Yellowstone	$707	43.0
522	1997	Yellowstone	$2,219	43.0
523	1997	Yellowstone	$2,224	43.0
524	1997	Yellowstone	$2,770	43.0
525	1998	(missing)	$1,078	(missing)
526	1998	Big Horn	$1,000	2.3
527	1998	Big Horn	$1,775	2.3
528	1998	Big Horn	$638	2.3
529	1998	Big Horn	$510	2.3
530	1998	Big Horn	$1,000	2.3
531	1998	Broadwater	$1,000	2.8
532	1998	Carbon	$2,599	3.9
533	1998	Carbon	$2,101	3.9
534	1998	Carbon	$3,099	3.9
535	1998	Carbon	$1,568	3.9
536	1998	Carbon	$1,469	3.9
537	1998	Carbon	$1,600	3.9
538	1998	Carbon	$973	3.9
539	1998	Carbon	$1,109	3.9
540	1998	Cascade	$4,375	28.8
541	1998	Cascade	$800	28.8
542	1998	Cascade	$933	28.8

Index	Sale Year	County	Price Per Acre	Population Density
543	1998	Cascade	$800	28.8
544	1998	Cascade	$1,157	28.8
545	1998	Cascade	$4,375	28.8
546	1998	Cascade	$1,109	28.8
547	1998	Cascade	$1,071	28.8
548	1998	Cascade	$1,071	28.8
549	1998	Cascade	$1,109	28.8
550	1998	Cascade	$800	28.8
551	1998	Cascade	$933	28.8
552	1998	Cascade	$787	28.8
553	1998	Cascade	$800	28.8
554	1998	Cascade	$2,713	28.8
555	1998	Cascade	$491	28.8
556	1998	Cascade	$1,157	28.8
557	1998	Custer	$1,784	3.1
558	1998	Custer	$2,219	3.1
559	1998	Custer	$1,294	3.1
560	1998	Custer	$874	3.1
561	1998	Custer	$307	3.1
562	1998	Dawson	$818	4.0
563	1998	Dawson	$154	4.0
564	1998	Dawson	$778	4.0
565	1998	Dawson	$951	4.0
566	1998	Dawson	$804	4.0
567	1998	Dawson	$750	4.0
568	1998	Richland	$893	5.1
569	1998	Richland	$1,849	5.1
570	1998	Rosebud	$772	2.1
571	1998	Rosebud	$1,039	2.1
572	1998	Rosebud	$2,083	2.1
573	1998	Stillwater	$962	3.6
574	1998	Stillwater	$1,971	3.6
575	1998	Teton	$833	2.8
576	1998	Teton	$1,096	2.8

Index	Sale Year	County	Price Per Acre	Population Density
577	1998	Teton	$1,078	2.8
578	1998	Teton	$825	2.8
579	1998	Teton	$1,633	2.8
580	1998	Teton	$857	2.8
581	1998	Treasure	$694	0.9
582	1998	Treasure	$1,125	0.9
583	1998	Yellowstone	$655	43.0
584	1998	Yellowstone	$1,318	43.0
585	1998	Yellowstone	$1,784	43.0
586	1998	Yellowstone	$1,649	43.0
587	1998	Yellowstone	$1,000	43.0
588	1999	Big Horn	$675	2.3
589	1999	Big Horn	$1,691	2.3
590	1999	Big Horn	$1,207	2.3
591	1999	Big Horn	$1,586	2.3
592	1999	Big Horn	$1,000	2.3
593	1999	Carbon	$1,953	3.9
594	1999	Carbon	$886	3.9
595	1999	Carbon	$2,056	3.9
596	1999	Carbon	$1,614	3.9
597	1999	Carbon	$700	3.9
598	1999	Cascade	$1,396	28.8
599	1999	Custer	$2,416	3.1
600	1999	Dawson	$888	4.0
601	1999	Dawson	$571	4.0
602	1999	Richland	$477	5.1
603	1999	Richland	$427	5.1
604	1999	Richland	$2,090	5.1
605	1999	Rosebud	$898	2.1
606	1999	Rosebud	$118	2.1
607	1999	Stillwater	$2,556	3.6
608	1999	Teton	$831	2.8
609	1999	Teton	$1,063	2.8
610	1999	Teton	$596	2.8

Index	Sale Year	County	Price Per Acre	Population Density
611	1999	Teton	$1,423	2.8
612	1999	Teton	$813	2.8
613	1999	Teton	$1,000	2.8
614	1999	Treasure	$1,188	0.9
615	1999	Treasure	$929	0.9
616	1999	Treasure	$199	0.9
617	1999	Yellowstone	$823	43.0
618	1999	Yellowstone	$340	43.0
619	1999	Yellowstone	$1,989	43.0

APPENDIX B

EXPECTED CROP PRICES

Figure 4. Autocorrelation Function of Alfalfa Prices

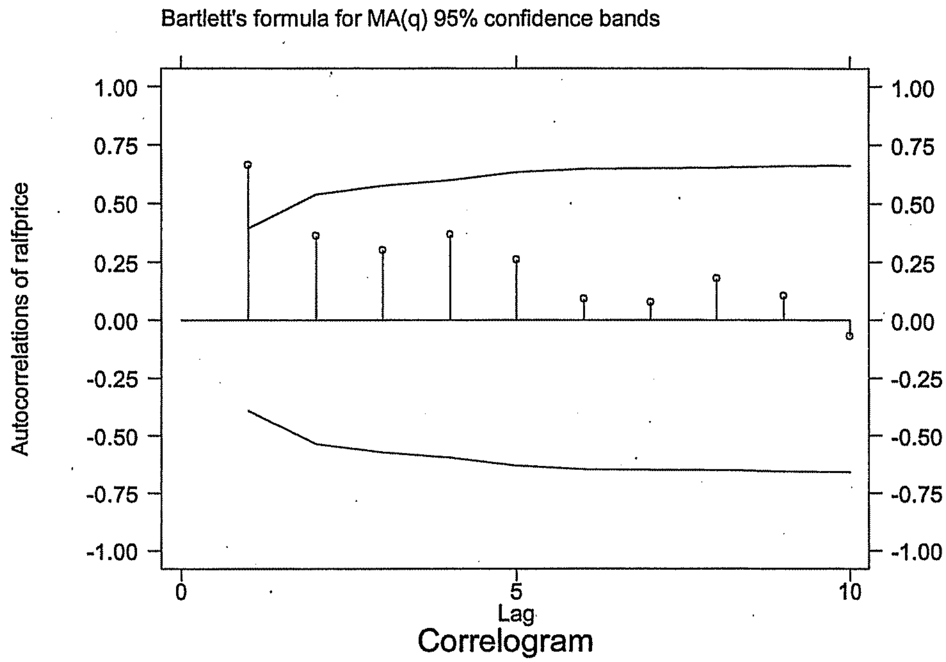

Figure 5. Partial Autocorrelation Function of Alfalfa Prices

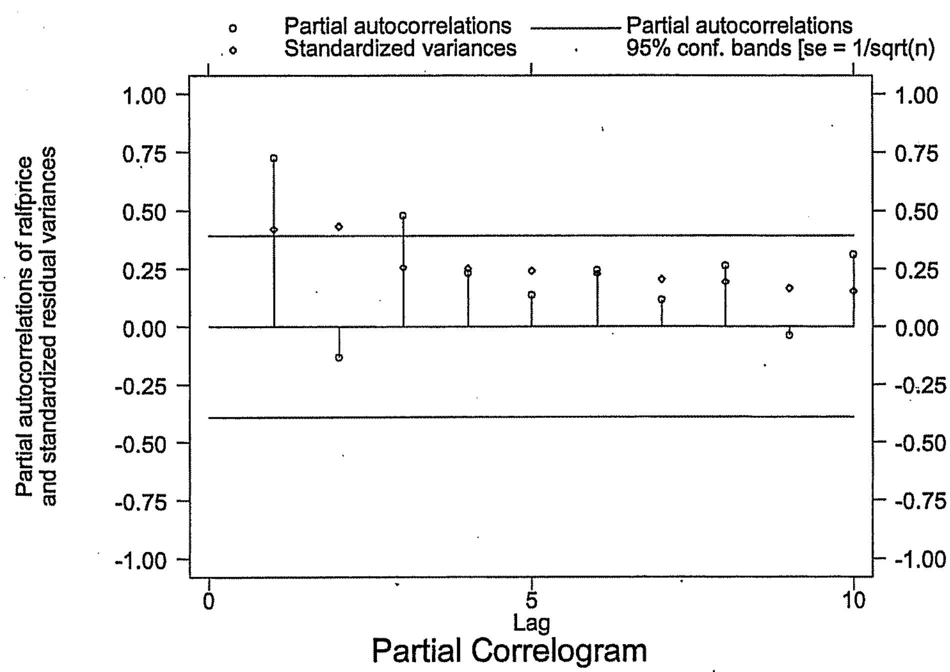

Figure 6. Autocorrelation Function of Dry Bean Prices

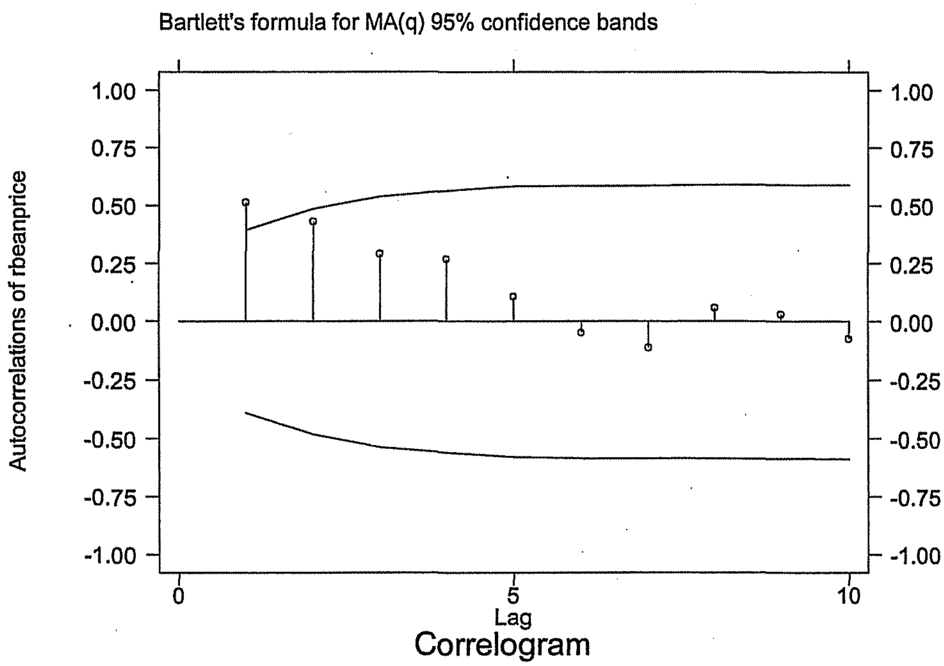

Figure 7. Partial Autocorrelation Function of Dry Bean Prices

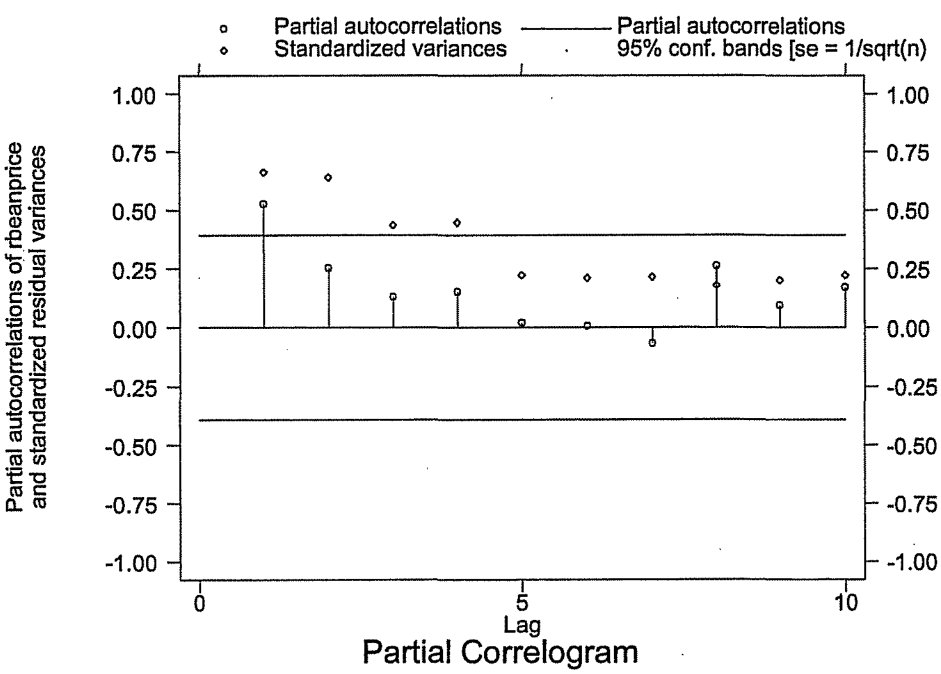

Figure 8. Autocorrelation Function of Sugarbeet Prices

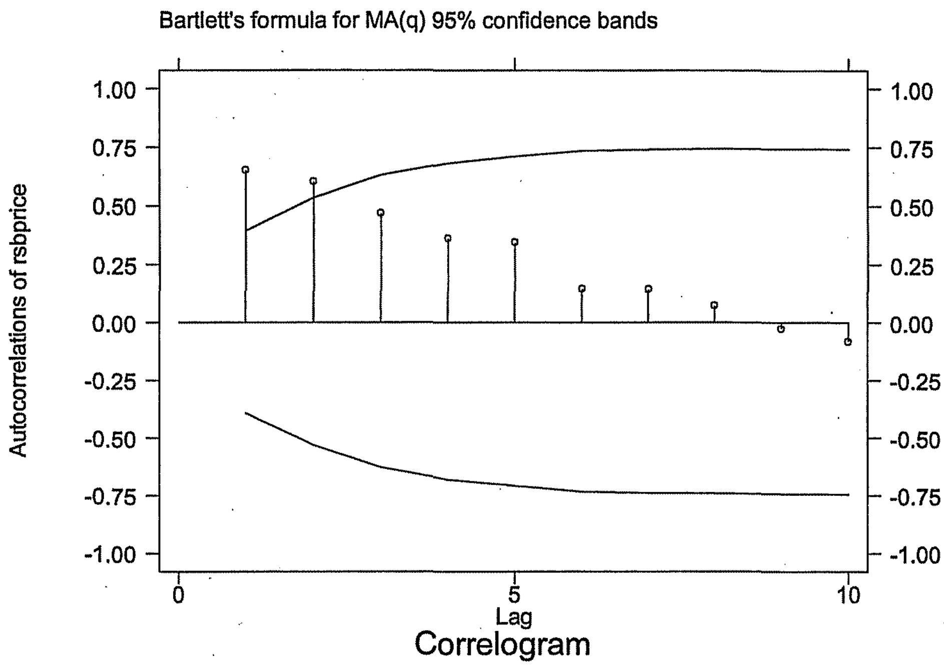

Figure 9. Partial Autocorrelation Function of Sugarbeet Prices

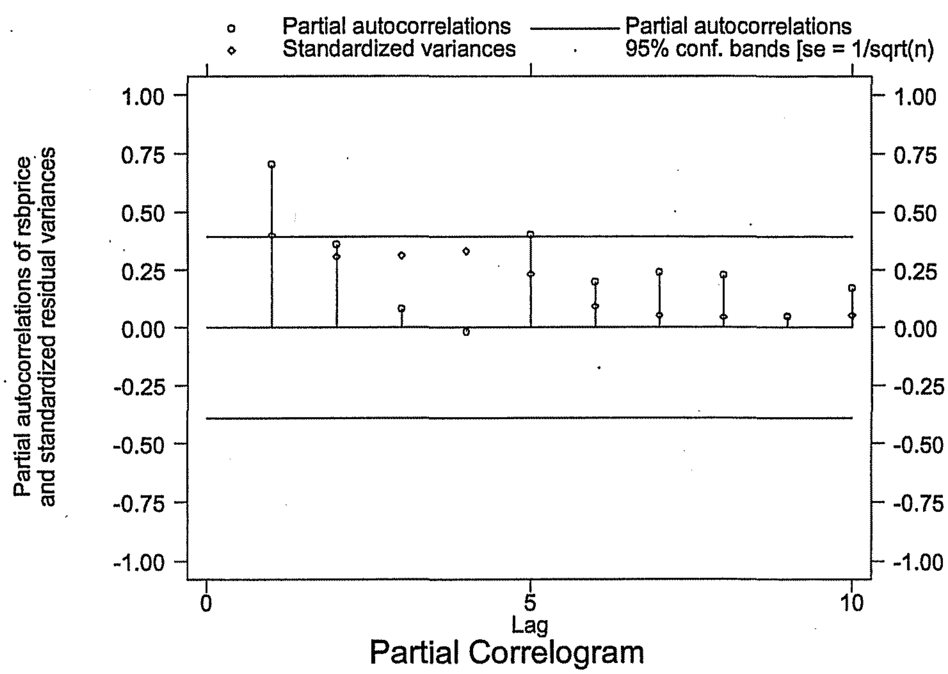

Table 18. Regression Results of Models Predicting Expected Crop Prices

Crop Price	Model	Constant	Lag 1	Lag 2
Alfalfa	AR(1) ARIMA	59.821*** (7.251)	0.772*** (0.178)	--
Dry Edible Bean	AR(1) OLS	7.874*** (3.438)	0.526** (0.172)	--
Sugarbeet	AR(2) OLS	2.684 (5.386)	0.535*** (0.192)	0.359* (0.184)

Standard Errors in parentheses. ***(1%), **(5%), *(10%).