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2001 North Dakota Agricultural Outlook: Representative Farms 2001-2010

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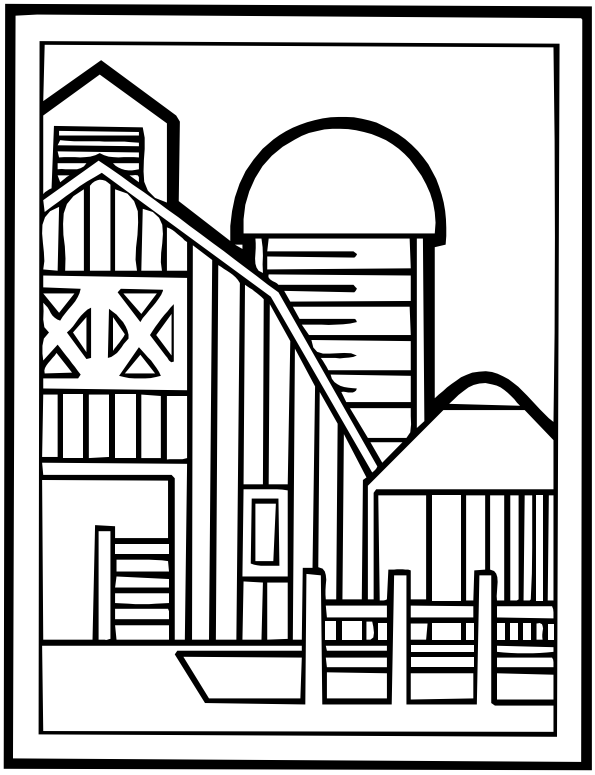

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Table of Contents

List of Tables

List of Figures

Abstract

Net farm income for most representative farms in 2010 will be lower than in 2000. Low profit farms, which consist of 25% of the farms in the study, may have negative net farm income throughout the forecasting period, and may not have financial resiliency to survive. Cropland prices and cash rental rates are projected to increase slightly except in the Red River Valley where they are projected to fall. Debt-to-asset ratios for most farms will increase slightly throughout the forecast period. Debt-to-asset ratios for the low profit and small size farms are higher than those for large and high profit farms.

Key Words: Net Farm Income, Debt-to-asset Ratios, Cropland Prices, Land Rental Rates, Farm Operating Expenses, Capitalization Rate, Risk

Highlights

Net farm income for the large size farm is predicted to decrease from $122 to $91 thousand for the 2000-2010 period, and the net farm income for the medium size farm will decrease from $68 to $53 thousand. Net farm income for the small size farm will decrease from $33 to $26 thousand for the same period. Net farm income also differs among different farms in the profit categories and decreases for the period.

Net farm income is predicted to decrease from $192 to $147 thousand for the 2000-2010 period for the high profit farm, and from $77 to $53 thousand for the average profit farm, and will range between $-16 and $-6 thousand for the low profit farm.

Risk analysis shows that North Dakota farm net income is very sensitive to changes in total crop return. For the RRV medium size farm, a 9.7% reduction in total crop return resulted in a 50% reduction in net farm income.

Debt-to-asset ratios for all representative farms are predicted to increase slightly throughout the forecast period. Debt-to-asset ratios are projected to be 37% for the large size, 46% for the medium size, and 60% for the small size representative farms in 2010. The ratios are also projected to be 41%, 49%, and 67% for high, average, and low profit representative farms in 2010, respectively.

For the average profit representative farm, state average cropland prices will increase 4.4% from $430 per acre in 2000 to $449 per acre in 2010. Cash rents will increase 5.7% from $35 per acre in 2000 to $37 per acre in 2010.

2001 North Dakota Agricultural Outlook: Representative Farms 2001-2010

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INTRODUCTION

North Dakota represents a major agricultural area with distinctive climate and crop mix in the United States. The state is uniquely situated in terms of marketing and logistics within the United States because it shares a border with Canada, which is the United States' largest trading partner. Changes in government policies through the 1996 Federal Agriculture Improvement Reform (FAIR) Act and the Uruguay Round Agreement (URA) have affected the region's economy.

The main objective of this analysis is to evaluate changes in net farm income and debt-to-asset ratios for different sizes and profit categories of representative farms. The representative farms are developed from the North Dakota Farm and Ranch Business Management Education Program farm records and are forecasted over the 2001 to 2010 period under the 1996 FAIR Act, the URA, and the Canada - United States Free Trade Agreement (CUSTA). The secondary objective is to evaluate the reaction of cropland prices and cash rental rates to the farm income estimates over the same time horizon.

The North Dakota agricultural outlook for the 2001-2010 period is based on the baseline results produced by the Food and Agricultural Policy Research Institute (FAPRI) global model and the North Dakota Global Wheat Policy Simulation Model. Uncertainty or risk is incorporated into the model to estimate the effect of variable commodity prices and crop yields.

U.S. agriculture has been influenced by major changes in agricultural and trade policies. The FAIR Act intended to limit spending for government commodity payments to $35.63 billion between 1996 and 2002. This legislation represents a departure from the supply management and income support strategies of farm programs since the 1930s. The legislation decouples government farm subsidy payments from both price and production and provides farmers with nearly complete planting flexibility. The legislation substitutes a 7-year fixed benefit contract for an annually determined farm payment based on target prices and continues the marketing assistance loan programs. In addition, several trade agreements, such as CUSTA, the North American Free Trade Agreement (NAFTA), and the URA, have liberalized agricultural trade and will continue to liberalize agricultural trade for the next decade. Due to falling prices, loan deficiency payments (LDPs), and marketing loans are now subsidies and are coupled to production. The emergency payments made by the federal government for 2000 have been included in the model. Additional payments are assumed to be made for 2001. Figure 1 shows the FAPRI forecasts for national government spending from 2000 through 2010. Government spending will decrease from $24 billion in 2000 to about $7 billion in 2010.

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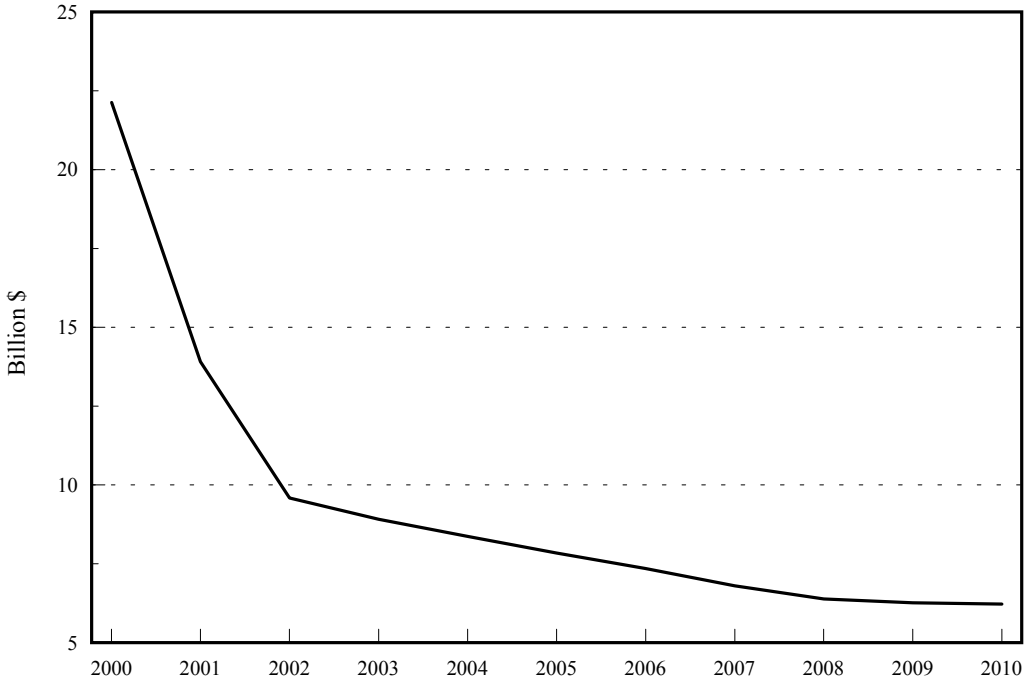


Figure 1. FAPRI's Forecast of Government Agricultural Spending

DEVELOPMENT OF AN EMPIRICAL MODEL

Major crops produced in North Dakota are hard red spring wheat, durum wheat, barley (malting and feed), corn, soybeans, and minor oilseeds, including sunflower and canola. In addition, the region produces sugarbeets and potatoes. The agricultural sector contributes the largest share to the state economy, followed by the energy sector. Most farms in this state differ from farms of other states in terms of farm structure and marketing options. The average farm size in North Dakota is 1,300 crop acres. About 43% of total farms in North Dakota have a farm size less than 1,000 crop acres. In addition, small farms (less than 200 acres) account for 26% of total farms in North Dakota and only 3% of total farmland.

The North Dakota Representative Farm Model is a deterministic simulation model designed to analyze the impacts of policy changes on farm income. The model projects average net farm incomes, debt-to-asset ratios, cash rents, and cropland prices for representative farms producing five major crops: wheat, barley, corn, soybeans, and sunflowers. The model is linked to the FAPRI and North Dakota econometric simulation models, and uses the prices of the crops generated from the models (Figure 2). The base model assumes an average trend yield based on historical data and average predicted prices received by farmers based on the historical relationships between FAPRI prices and North Dakota prices received by farmers. The risk model incorporates price discounts due to loss of crop quality or decreases in yields due to disease or weather conditions, such as scab or drought, for the forecasting period. In addition, macro policies and assumptions, trade policies, and agricultural policies are incorporated into the model directly or indirectly by the assumptions made by the FAPRI in their price series.

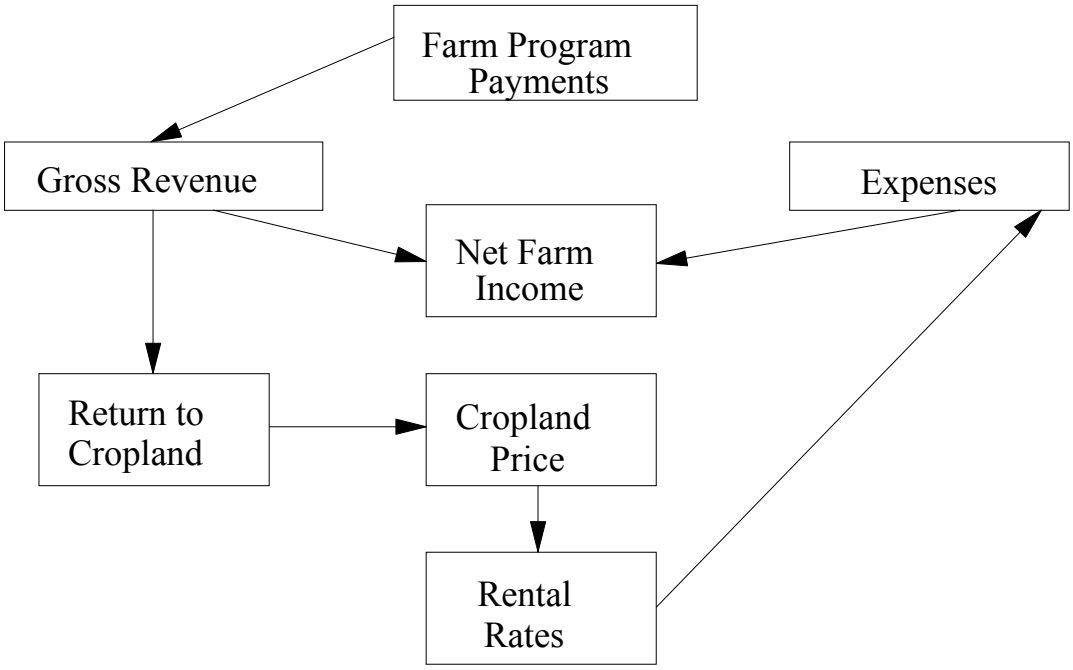


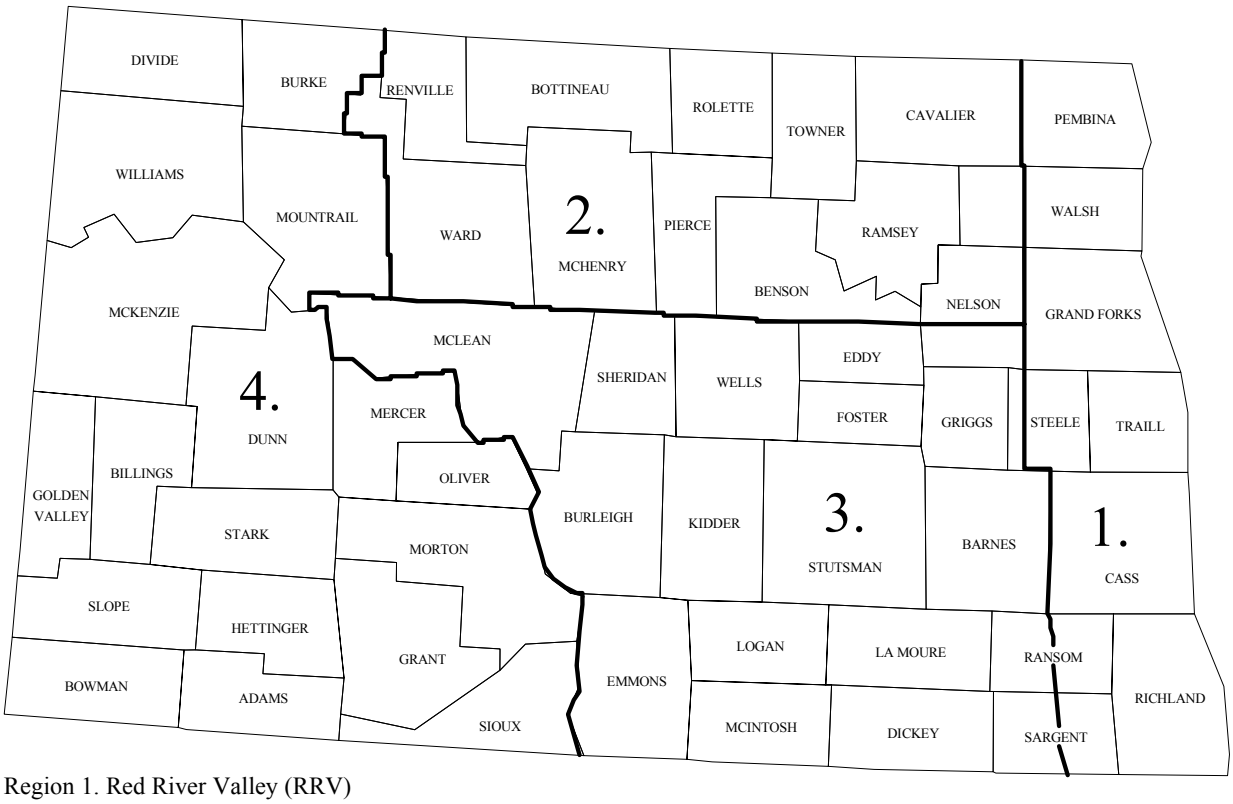
Figure 2. Structure of the North Dakota Representative Farm Model

Alternative farm policies affect net farm income for the representative farms. Changes in return to cropland, given the market-determined capitalization rate, result in changes in land prices. Changes in return to cropland affect cash rental rates that farmers are willing to pay on land used to produce crops. Changes in land price and cash rental in turn affect net farm income through adjustments in farm expenses. These changes affect the debt-to-asset ratios of the representative farms.

The North Dakota Representative Farm

The model has 24 representative farms; six farms in each of four regions of North Dakota. These regions are the Red River Valley (RRV), North Central (NC), South Central (SC), and Western (West) (Figure 3). The farms in each region are representative of the average, high, and low profit farms and small, medium, and large size farms enrolled in the North Dakota Farm and Ranch Business Management Education Program..

The representative farms average 1,630 acres of cropland and 410 acres of pasture. The farms in the study are about 30% larger than the state average reported by the North Dakota Agricultural Statistics Service. A reason for this difference is the state average farm includes all farms with $1,000 or more in sales; therefore, hobby farms, farms operated as part of combined larger farms, semi-retired farms, and commercial farms are included, while the farms used in this study mainly represent commercial farms.



Region 1. Red River Valley (RRV)
Region 2. North Central (NC)
Region 3. South Central (SC)
Region 4. Western (West)

Figure 3. North Dakota Farm and Ranch Business Management Regions

The average representative farm is an average of all farms in the Farm and Ranch Business Management Records System for the state in each production region. The high profit representative farm is an average of farms in the top 20% of farm profitability for each production region. The low profit representative farm is an average of farms in the low 20% of farm profitability for the state or for each production region. Average farm sizes are 2,542 cropland acres for the high profit farm, 1,630 cropland acres for the average profit farms, and 1,106 cropland acres for the low profit farms (Table 1).

The large farm is the average of the largest 25% of farms in cropland acres for each producing region. The small representative farm is an average of the smallest 25% of the farms for each producing region. Average farm sizes are 3,164 cropland acres for the large size farm, 1,424 cropland acres for the medium size farms, and 564 cropland acres for the small size farms (Table 1).

Table 1. Characteristics of Representative North Dakota Farms, 2000

	Size			Profit		
	Large	Medium	Small	High	Average	Low
Number of Farms	139	275	139	111	553	111
Total Cropland	3,164	1,424	544	2,542	1,630	1,106
Spring Wheat	972	441	145	570	375	253
Durum Wheat	505	201	66	427	266	163
Barley	299	145	52	290	214	165
Corn	190	61	36	166	119	84
Sunflower	298	102	30	360	237	160
Soybeans	399	190	87	176	157	117

Structure of the Representative Farm Model

The model consists of five components: net farm income, debt-to-asset ratio, land price, cash rent, and the risk component for net farm income. This section discusses the definition of each component and the formulas used to calculate the components.

Net Farm Income. Net farm income is calculated by subtracting total crop and livestock expenses from total farm income. Crop and livestock expenses consist of direct costs, including seed, fertilizer, fuel, repairs, feed, supplies, feeder livestock purchases, and hired labor; and indirect costs that include machinery depreciation, overhead such as insurance and licenses, land taxes, and land rent or interest on real estate debt. Total farm income is the sum of cash receipts from crop and livestock enterprises, government payments, CRP payments, custom work, patronage dividends, insurance income, and miscellaneous income. Net farm income is calculated as:

$$NFI = \sum_{j=1}^{n} Y_j P_j A_j + \sum_{h=1}^{m} P_h L_h + \sum_{j=1}^{n} S_j A_j + I^o - \sum_{h=1}^{m} EX_h^L - \sum_{j=1}^{n} EX_j^C \quad (1)$$

where

Y_j = yield per acre for crop j
P_j = price of crop j
A_j = planted acres of crop j
P_h = price of livestock h
L_h = number of livestock h sold
S_j = government subsidies for crop j per acre
I^o = other farm income
EX^C_j = total expenses in producing crop j
EX^L_h = total expenses in producing livestock h

Inventory changes, accounts receivable, accounts payable, and prepaid expenses and supplies are assumed to be constant from year to year. Cash receipts are based on predicted cash prices and yields in North Dakota. Cash prices received by farmers are estimated from North Dakota price equations which were estimated on the basis of the historical relationships between North Dakota prices and U.S. export prices of the commodities. Annual data from 1974 to 1999 were used to estimate price equations. The price equations were used to estimate cash prices received by North Dakota farmers for the 2001-2010 period. The FAPRI prices are used as exogenous variables in the price estimates.

Regional North Dakota yield trend equations were estimated from historical yield data reported by the North Dakota Agricultural Statistics Service from 1974 to 1999. The estimated equations were used to forecast crop yield trends for future years. A dummy variable was used to compensate for two drought years: 1980 and 1988.

Cropland Prices and Cash Rent. Land prices for representative farms are estimated on the basis of the implicit discount rate the farms have previously used and the expected return on land. Therefore, the land prices are defined as the amount that farms can afford to pay for farmland. They are not prevailing market prices. Financial data from average representative farms for each region are used to calculate a dollar return to land. To do this, all production expenses for the crops, including depreciation, land taxes, a labor charge for unpaid family labor, net return from a livestock enterprise, and a management fee equivalent to that charged by bank trust departments for management of share-rented farms, are subtracted from gross farm income. To the remaining balance, interest on real estate debt is added back because the return to land is not affected by ownership of the land. This figure is used as the return allocated to cropland.

The average return allocated to each acre of cropland per year is divided by the average cropland price to determine the long-run capitalization rate used by farmers as follows:

(2) $$R_g = \frac{M_g}{PL_g}$$

where

R_g = long-run capitalization rate in region g
M_g = average net return allocated to cropland in region g
PL_g = average observed price of cropland in region g

For the forecast years, this capitalization rate is applied to the estimated average income per acre allocated to cropland to determine cropland value for land utilized to produce wheat, corn, soybeans, barley, and sunflowers. The average income is an n-year weighted moving average of annual per acre income. Calculation of cropland prices is summarized as:

(3) $$PL_{gT} = \frac{1}{R_g} \sum_{t=T-n}^{T} W_t M_{tg}$$

where

PL_{gT} = cropland price in region g in time T
W_t = weighting factor for year t
M_{tg} = net return allocated to cropland in region g and year t

The price of cropland calculated in Equation 3 can be defined as the amount farmers are willing to pay for the cropland to produce wheat, barley, corn, soybeans, and sunflowers.

Cash Rent. Cash rent for cropland is calculated by multiplying a k-year moving average of estimated price of cropland by the long-run capitalization rate, plus taxes on land. Calculation of cash rent is summarized by

$$(4) \qquad CR_{gT} = \sum_{t=T-k}^{T} EM_{gt} R_g + TX_T$$

CR_{gT} = cropland cash rent in region g in time T
EM_{gt} = estimated price of cropland in region g and year t
TX_T = taxes on land in time T

The cash rent is defined as the amount farmers are willing to pay for the rented cropland to produce wheat, barley, corn, soybeans, and sunflowers.

Risk Risk is the term used to explain the concept recognizing that the future is uncertain. Typical price or yield forecasts are mean or average values. These forecasts are values which are most likely to occur. However, other values may occur. For example, FAPRI forecasts that wheat price should be $2.93/ bushel in 2003, but the forecast may be incorrect. Risk analysis takes into consideration the uncertainty and estimates a confidence interval in addition to the mean value.

The software program *@Risk: Advanced Risk Analysis for Spreadsheets* was used to estimate the confidence intervals for net farm income for the average profit and medium size representative farms. The standard deviation was calculated for each commodity price and each crop yield.

Typically, crop prices are correlated to each other; i.e., they move together. A correlation matrix was developed among crop prices and crop yields. When crop yields are high, prices tend to be lower. Also, when one crop price is high, all crop prices trend in that direction.

The standard deviation determines the spread in the distribution of yield and price variables. The larger the standard deviation, the larger the difference between the minimum and maximum values selected by the program. The correlation is used to prevent the program from choosing a high spring wheat yield and a low barley or durum yield. Commodity price is also regulated by the correlation matrix. Some crop prices are highly correlated: soybeans and sunflowers, barley and corn, and spring wheat and durum wheat. Also, crop yields have an effect on prices. Durum wheat and barley yields are negatively correlated with their respected price. Soybean and corn yields in North Dakota have very little affect on their respective prices.

DATA USED FOR THE REPRESENTATIVE FARM

The commodity prices for crops are obtained from the FAPRI and ND simulation models for average farm prices of the crops in the United States. The national average farm prices are converted to the prices received by North Dakota representative farms by regressing average farm price of each crop produced in North Dakota against the national average farm price of the same crop. The price equation used for this study is specified in a dynamic framework on the basis of Nerlove's partial adjustment hypothesis as follows:

(5) $$P_{it} = a_0 + a_1 P_t + a_2 P_{it-1} + e_{it}$$

where P_{it} = average farm price of a crop in region i in time t.
P_t = national average farm price of a crop in time t.

The price equation is estimated for each crop produced in North Dakota using the time series data from 1975 to 1999. The estimated equations are used to predict average prices received by farmers in each region in North Dakota from the national average prices from the FAPRI and ND simulation models. The predicted farm prices are shown in Table 2. Figure 4 shows that prices for oilseeds, soybeans, and sunflowers are forecasted to increase faster than prices for other crops.

Crop yields in each region also are predicted by using the estimated yield equations for crops produced in each region. The yield equation for each crop in each region is specified in the same dynamic framework as that in the price equation as follows:

(6) $$y_{it} = b_0 + b_1 \text{ trend} + b_2 y_{it-1} + e_{it}$$

where y_{it} represents yield of a crop in region i in time t and e_{it} is a random error term. A dummy variable was used to compensate for two drought years: 1980 and 1988. The trend variable is included to capture changes in production technology.

This equation is estimated for each crop in each region using time series data from 1976 to 1999. The estimated equations are used to predict crop yields in each region.

Crop mix changes over time as a function of prices of the crops produced in each region. A dynamic acreage equation for each crop is specified on the basis of Nerlove's partial adjustment hypothesis as follows:

(7) $$A_{jit} = c_o + \sum_{j=1}^{n} c_j P_{jit} + c_{n+1} A_{jit-1} + c_{n+2} G_{it} + e_{jit}$$

where A_{jit} = the total acres of the jth crop in region i in time t,
P_{jit} = the price of the jth crop in region i in time t,
G_{it} = government policy variables applied to the jth crop in time t,
$e_{jit.}$ = a random error term.

Table 2. North Dakota Baseline Price Estimates from the Projected FAPRI Baseline

	Spring Wheat	Durum Wheat	Malting Barley	Feed Barley	Soybeans	Corn	Sunflower
	----------dollars/bushel----------						-$/cwt-
2000	2.57	2.35	1.70	1.37	4.14	1.57	6.56
2001	2.78	2.66	1.84	1.47	3.94	1.73	6.30
2002	2.81	2.70	1.89	1.50	3.97	1.78	6.49
2003	2.93	2.87	1.93	1.53	4.09	1.82	6.86
2004	3.01	2.99	1.97	1.55	4.27	1.85	7.35
2005	3.07	3.08	2.02	1.59	4.42	1.91	7.79
2006	3.15	3.20	2.07	1.62	4.55	1.96	8.18
2007	3.24	3.33	2.10	1.65	4.71	2.02	8.63
2008	3.29	3.40	2.15	1.68	4.88	2.07	9.09
2009	3.36	3.50	2.20	1.72	4.98	2.12	9.42
2010	3.42	3.56	2.28	1.77	5.07	2.19	9.73

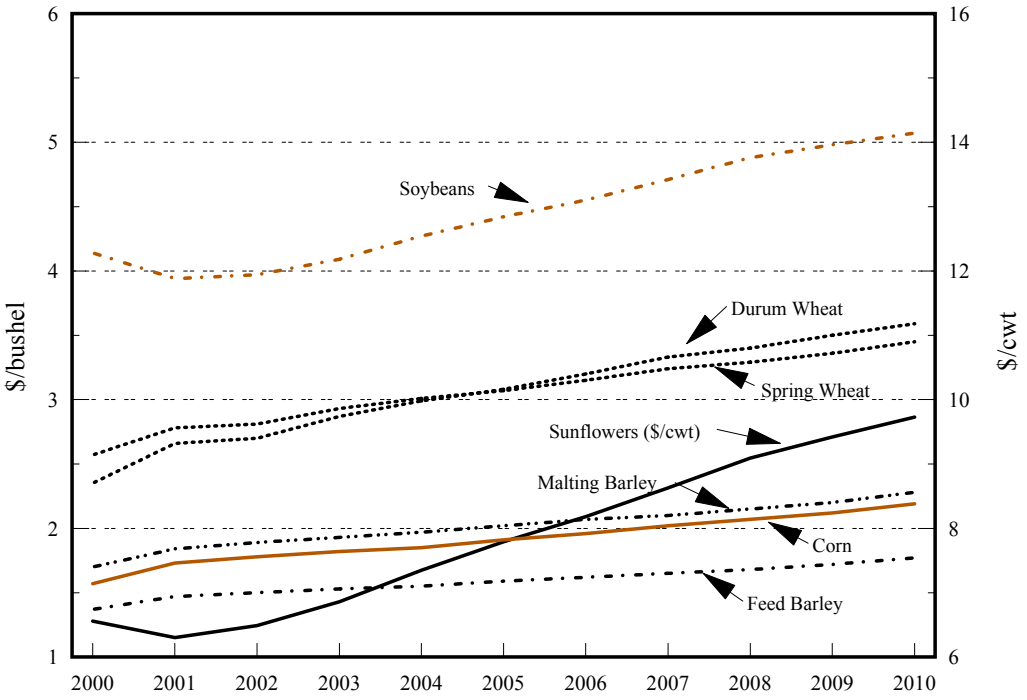


Figure 4. North Dakota Baseline Price Estimations from the Projected FAPRI Baseline

The equations are estimated using time series data from 1976 to 1999. The estimated equations are used to predict the total acres of each crop produced in each region. The predicted prices from Equation 5 are used in the acreage equations. The jth crop share in region i in time t is then calculated as follows:

(8) $$S_{jit}=A_{jit}/\sum_{j=1}^{i} A_{jit}$$

where S_{jit} is an acreage share of the jth crop in region i in time t.

The estimated share of a crop is applied to calculate the total acres of the crop produced in the region by multiplying the total acres in the region by the share.

Other data needed for the model are obtained from the North Dakota Farm and Ranch Business Management Association (farm record system data).

AGRICULTURAL OUTLOOK FOR THE REPRESENTATIVE FARMS, 2001-2010

The North Dakota Representative Farm Model was used to estimate net farm income, debt-to-asset ratio, land prices, and rental rates under the 1996 FAIR Act for 2001-2010.

Additional assumptions used in this study are

1. Net farm income from livestock operation and production of other crops, including potatoes, canola, and dry beans, remains constant during the period.

2. All farm enterprises in size and operation remain constant in the analysis.

3. The farm equipment stock remains constant, indicating that depreciation allowances are invested back into farm equipment.

4. Inventory changes, accounts receivable, accounts payable, and prepaid expenses and supplies are constant from year to year.

5. Government payments continue for the years after 2002 at a similar level as 2002.

Net Income for North Dakota Representative Farms

Table 3 presents net farm income for farms by size and profitability. Average net income for North Dakota representative farms varies, depending upon the size of farm and its profitability. The net income for the large size farm will decrease from $122 thousand in 2000 to $82 thousand in 2002 and then slowly increase to $91 thousand in 2006, and then remain relatively flat to 2010 (Figure 5). The net income in 2010 will be 25% lower than that in 2000. Net farm income for the medium size farm is $68 thousand in 2000, and will decrease to $47 thousand in 2002, and then increase to $53 thousand in 2010. All representative farms benefitted in 2000 from government payments and cash crop insurance proceeds. In 2002 and beyond, it is assumed that government payments will be reduced to the FAIR Act level. Net farm income for the small size farm is $33 thousand in 2000 and will decrease to $24 thousand in 2002 and then increase to $26 thousand in 2010. State average net farm income over the 10-year, 2001-2010 period, is $87 thousand for the large size farm, $48 thousand for the medium size farm, and $25 thousand for the small size farm. This result implies that the large size farm has enough net income to survive and expand, but the medium and small size farms under the 1996 FAIR Act and the current international market conditions may not be able to expand and take advantage of current and future technology.

The small increases in net farm income from 2002 to 2010 are mainly due to strong import demand for agricultural crops from developing countries. Crop production in the United States and around the world is predicted to be consistent with annual trend line increases, while demand is predicted to increase faster than supply due mainly to the expected increases in income and slow but steady growth in population in developing countries.

Table 3. State Average Net Farm Income for Different Size and Profit Representative Farms

	Size			Profit		
	Large	Medium	Small	High	Average	Low
	thousand $					
2000	122	68	33	192	77	2
2001	91	52	26	140	49	-16
2002	82	47	24	125	43	-12
2003	83	48	24	130	48	-9
2004	84	50	25	136	54	-7
2005	88	52	25	140	57	-6
2006	91	52	25	141	55	-7
2007	90	53	26	140	56	-7
2008	89	51	26	141	55	-7
2009	89	52	26	140	52	-7
2010	91	53	26	147	53	-6
2001-2010 Average	87	51	25	138	52	-8

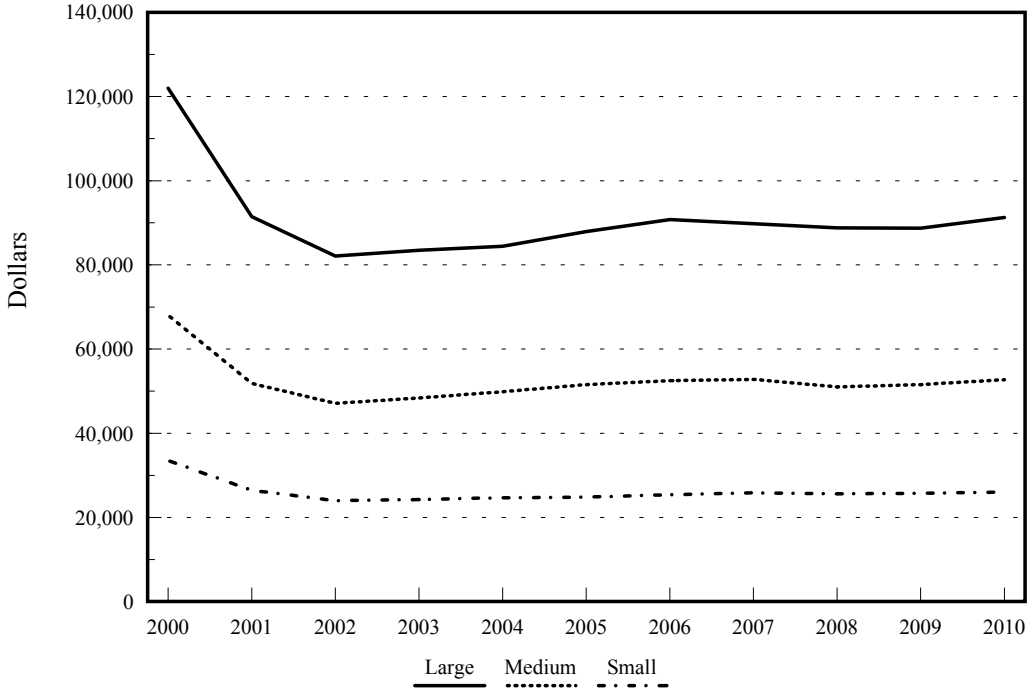


Figure 5. Net Farm Income by Size for North Dakota Representative Farms

Net farm income for the high profit farm was $192 thousand in 2000 and will decrease until 2002, and then increases to $147 thousand in 2010 (Figure 6). The income in 2010 is 23% lower than that in 2000. Net farm income for the low profit farm is negative in 2001 and remains negative throughout the forecast period. The low profit farm may not have financial resiliency to survive less government involvement in agriculture. State average net farm income over the 2001-2010 period is $138 thousand for the high profit farm, $52 thousand for the average profit farm, and $-8 thousand for the low profit farm.

Table 4 shows the 95% confidence intervals for net farm income for the medium size and average profit farms by region. Risk analysis indicates that net farm income is very sensitive to variations in crop yield and prices. For example, in 2003 for the RRV medium size farm, the 95% confidence interval for net farm income is $25 thousand to $78 thousand with a mean of $50 thousand. For that farm, the 95% confidence interval for total crop production was $243 thousand to $296 thousand with a mean value of $269 thousand. A 9.7% reduction in total crop production resulted in a 50% reduction in net farm income. Likewise, a 10% increase in total crop production resulted in a 56% increase in net farm income. Other regions are just as sensitive to changes in total crop production as the RRV.

Figure 7 shows that the 95% confidence interval follows the mean values, but slowly widens farther out in the forecast. There is more uncertainty in 2007 than there is in 2002.

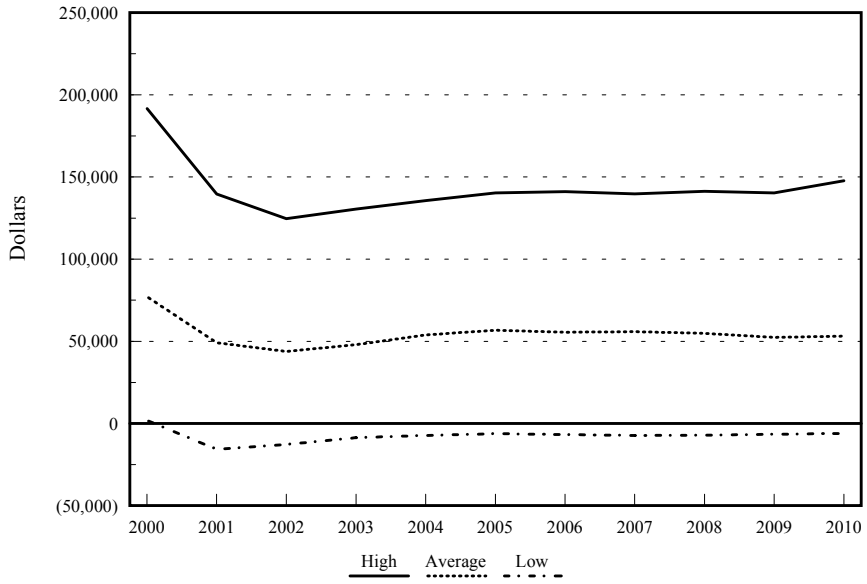


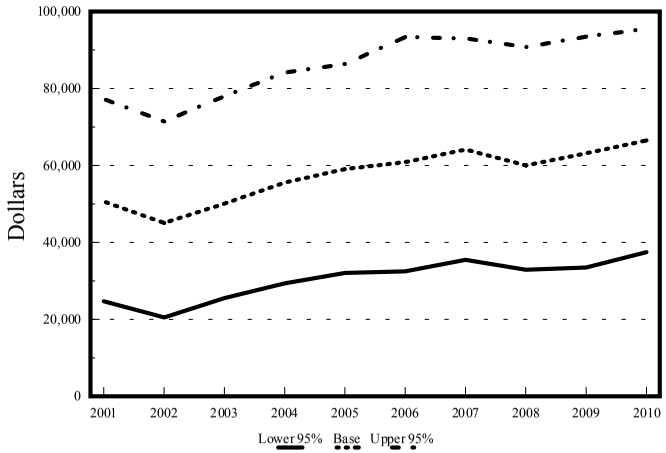
Figure 6. Net Farm Income by Profit for North Dakota Representative Farms

Table 4. 95% Confidence Levels for Medium Size and Average Profit Farm Size

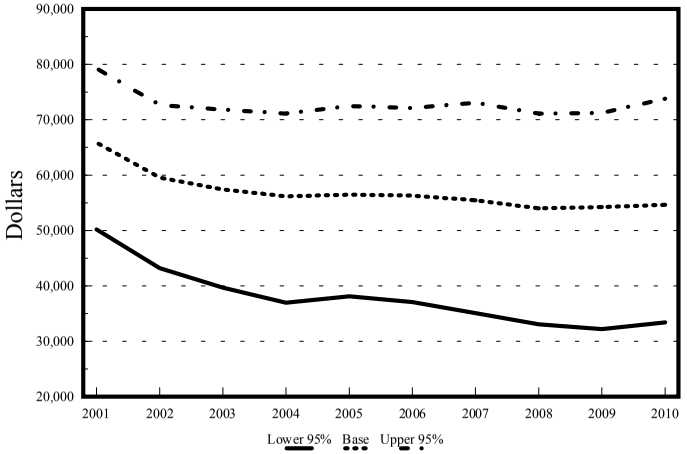
	RRV			NC			SC			West		
	Lower 95%	Base	Upper 95%	Lower 95%	Base	Upper 95%	Lower 95%	Base	Upper 95%	Lower 95%	Base	Upper 95%
	----------1,000$----------											
2001	25	51	77	50	66	79	28	45	61	31	45	60
2002	20	45	71	43	60	73	22	41	58	29	42	57
2003	25	50	78	40	57	72	25	42	59	32	44	59
2004	29	55	84	37	56	71	23	43	60	31	45	62
2005	32	59	86	38	56	72	24	44	64	32	47	62
2006	32	61	93	37	56	72	25	45	63	34	48	64
2007	35	64	93	35	55	73	23	44	62	34	48	64
2008	32	60	90	33	54	71	20	43	62	32	47	63
2009	33	63	93	32	54	71	21	42	62	32	47	63
2010	37	66	95	33	55	74	20	43	64	34	48	64

Profit

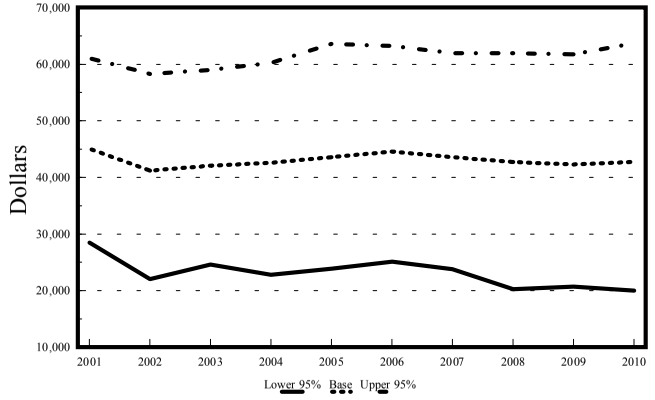
	RRV			NC			SC			West		
	Lower 95%	Base	Upper 95%	Lower 95%	Base	Upper 95%	Lower 95%	Base	Upper 95%	Lower 95%	Base	Upper 95%
2001	36	62	89	39	67	96	27	43	58	33	46	60
2002	25	49	76	18	48	77	23	38	53	24	37	51
2003	28	53	81	17	47	78	29	45	60	26	40	54
2004	27	53	81	20	50	81	27	43	60	24	39	54
2005	28	55	82	24	55	87	28	44	60	23	38	54
2006	27	56	88	28	59	92	25	42	59	22	38	54
2007	27	56	85	27	61	97	23	41	59	21	37	54
2008	29	56	86	28	62	98	23	41	58	19	36	53
2009	28	57	87	31	64	99	22	40	58	18	36	52
2010	29	58	87	33	66	107	22	42	60	18	36	54



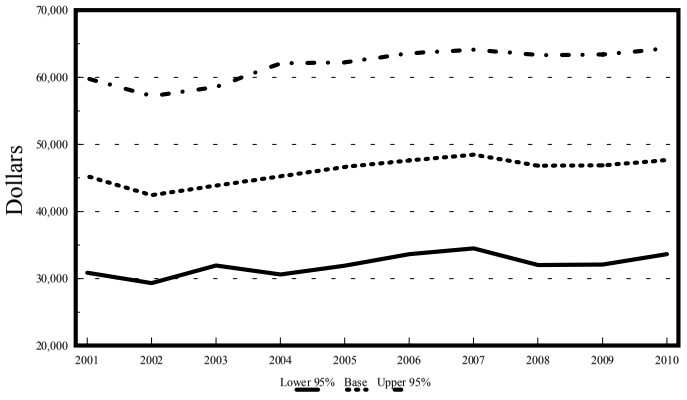
RRV Net Farm Income



NC Net Farm Income



SC Net Farm Income



West Net Farm Income

Figure 7. Risk Analysis for Medium Size North Dakota Farms

Debt-to-asset Ratios for North Dakota Representative Farms

Debt-to-asset ratios for all size farms remain relatively constant throughout the forecast period (Table 5). For the 2001-2010 period, the debt-to-asset ratio decreases slightly for all size farms in 2001 and then increases slightly (Figure 8). The debt-to-asset ratios for the small size farm are higher than those for other farms, but do not reach a critical level that would impair access to new bank credit.

Table 5. State Average Debt-to-asset Ratios for Different Size and Profit Representative Farms

	Size			Profit		
	Large	Medium	Small	High	Average	Low
2000	0.36	0.45	0.58	0.40	0.49	0.64
2001	0.34	0.42	0.56	0.38	0.46	0.63
2002	0.35	0.44	0.58	0.39	0.46	0.64
2003	0.36	0.45	0.58	0.39	0.47	0.65
2004	0.36	0.46	0.59	0.39	0.47	0.66
2005	0.37	0.46	0.59	0.40	0.48	0.66
2006	0.37	0.46	0.60	0.40	0.48	0.67
2007	0.37	0.46	0.60	0.40	0.49	0.67
2008	0.37	0.47	0.60	0.40	0.49	0.67
2009	0.37	0.46	0.60	0.41	0.49	0.67
2010	0.37	0.46	0.60	0.41	0.49	0.67
2001-2010 Average	0.36	0.45	0.59	0.40	0.48	0.66

Debt-to-asset ratios for high, average, and low profit farms remain relatively constant throughout the forecast period (Figure 9). The debt-to-asset ratio for the high profit farm is 0.40 in 2000, falls to 0.38 in 2001, and then increases to 0.41 in 2010. The debt-to-asset ratio for the average profit farm is 0.49 in 2000, falls to 0.46 in 2001, and then increases to 0.49 in 2010. The debt-to-asset ratio for the low profit farm is 0.64 in 2000, falls to 0.63 in 2001, and then increases to 0.67 in 2010.

Higher debt-to-asset ratios for the low profit and small size farms, when coupled with low net farm income, suggest serious problems in sustaining the farm business unless substantial off-farm income is earned. This is especially true for the low profit farm, which has negative net farm income. Without off-farm income to provide family living requirements, it is unlikely that the low profit farm can survive or is able to obtain operating credit. The farm operator may wish to investigate other investment opportunities in which higher returns can be earned or markedly restructure the farming operation to improve its profitability.

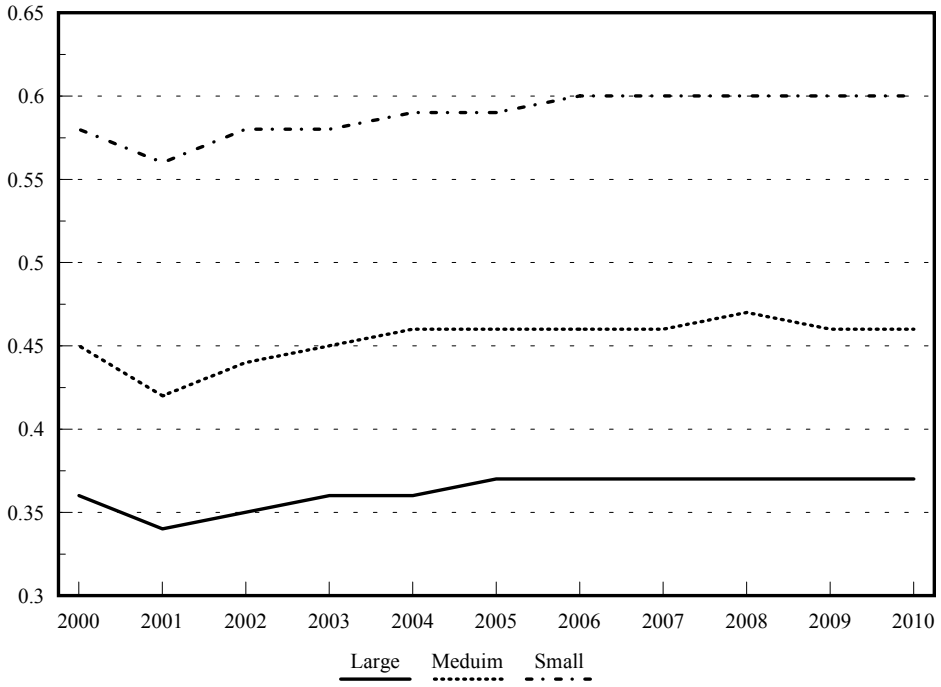


Figure 8. Debt-to-asset Ratio by Size for North Dakota Representative Farms

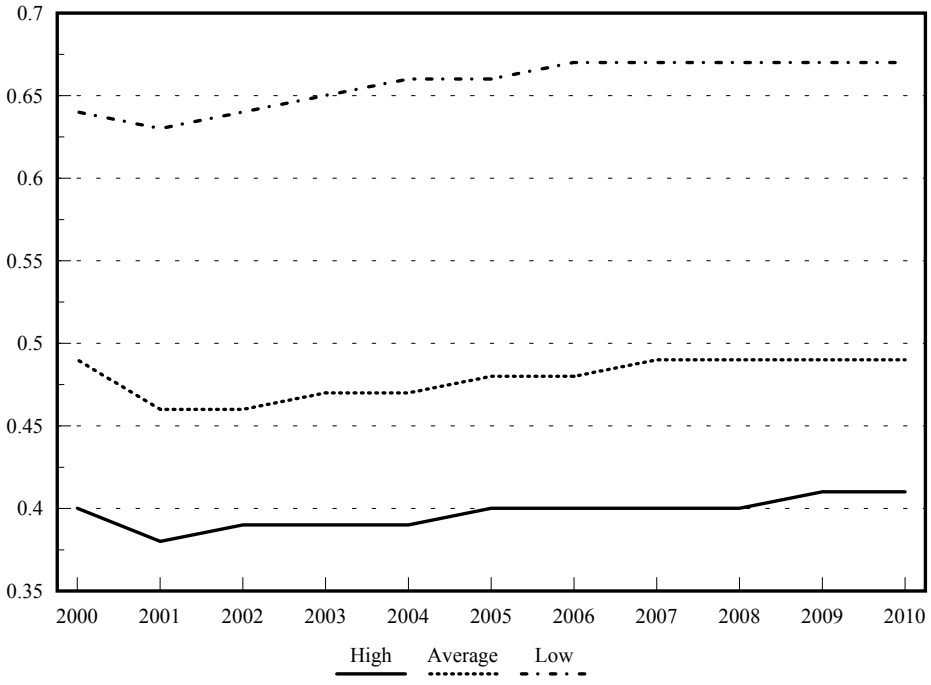


Figure 9. Debt-to-asset Ratio by Profit for North Dakota Representative Farms

Land Value and Cash Rents

Table 6 presents land prices for various representative farms in North Dakota. Land values for the average profit representative farms are shown in Figure 10. Land prices differ between the regions; the highest prices are in the RRV and the lowest are in the West region. Land prices also change over the forecast period. They are highest in 2002 due to the lagged impact of higher net farm income in 1999 and 2000. The prices decrease gradually until 2005-2006, and then they increased modestly until 2010.

Table 6. North Dakota Land Prices for Average Profit Representative Farms

	RRV	NC	SC	West	State
	----------$/acre----------				
2000	686	383	360	291	430
2001	692	398	371	299	440
2002	699	407	373	305	446
2003	671	399	379	303	438
2004	644	395	387	298	431
2005	638	391	390	295	428
2006	644	387	386	297	429
2007	651	387	384	303	431
2008	657	391	389	307	436
2009	664	399	395	313	443
2010	670	403	404	319	449
2001-2010 Average	683	395	386	304	437

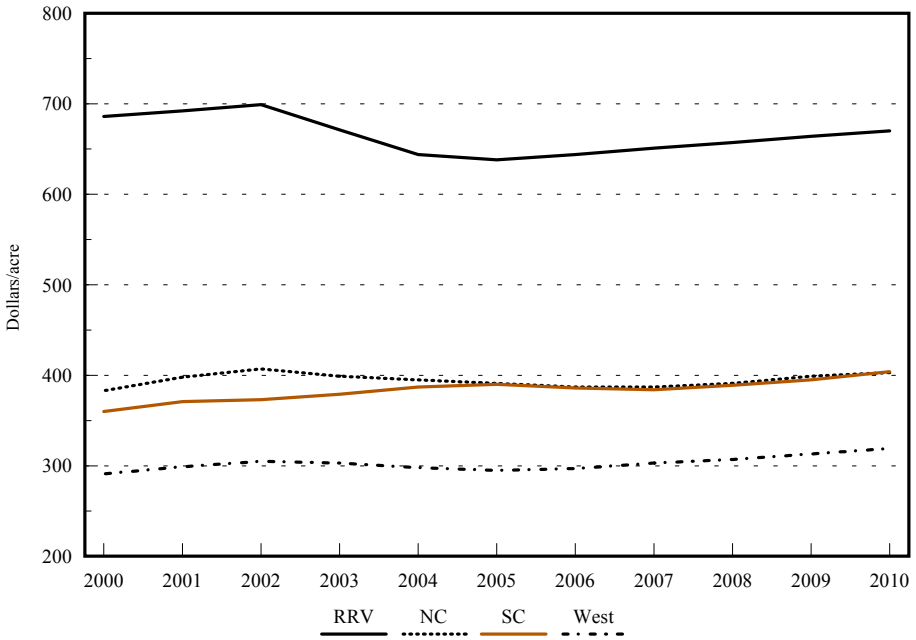


Figure 10. Average Prices of Cropland for North Dakota

Cash rents for the average profit farms are highest in 2002-2003, they decrease until 2005-2006, and then increase modestly over the remaining period (Table 7). Cash rents also differ between regions; the highest are in the RRV and the lowest are in the West (Figure 11). The RRV is the only region where cash rents are projected to be lower in 2010 than in 2000.

Table 7. Cash Rent for Average Profit Representative Farms

	RRV	NC	SC	West	State
	----------$/acre----------				
2000	51	32	31	27	35
2001	52	33	32	28	36
2002	52	34	32	29	37
2003	50	33	33	29	36
2004	48	33	33	28	36
2005	48	32	34	28	35
2006	48	32	33	28	35
2007	49	32	33	29	36
2008	49	32	33	29	36
2009	50	33	34	30	37
2010	50	33	35	30	37
2000-2009 Average	50	33	32	29	36

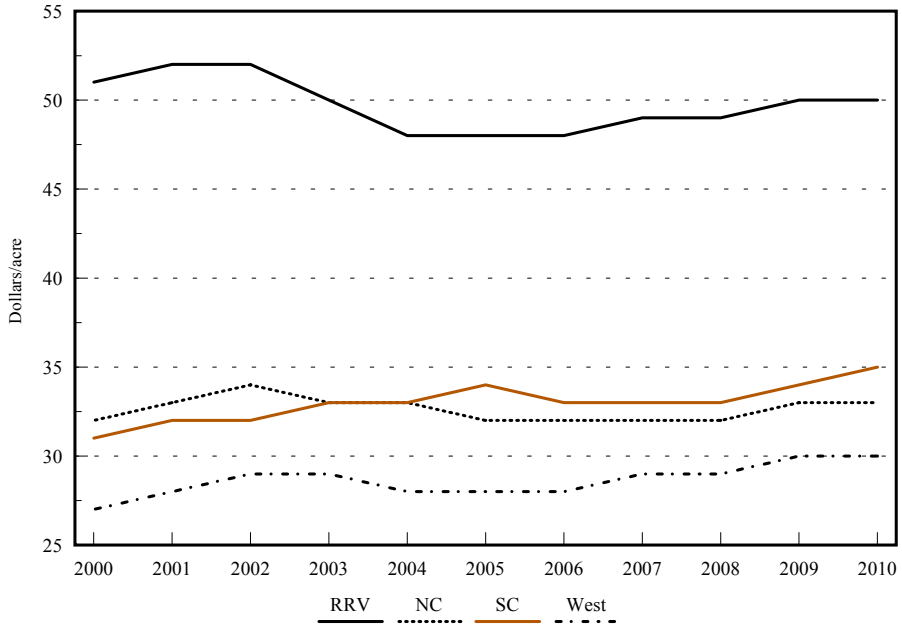


Figure 11. Cash Rent Paid for Cropland for North Dakota

CONCLUDING REMARKS

The federal government no longer manages supplies of program crops through acreage bases and planting controls. Farm subsidy levels are fixed at a decreasing level through a 7-year contract, a sharp change from past programs in which government spending was counter cyclical to market price levels for program crops. Acreage set-asides were used for supply management. The largest annual decreases in subsidy levels come in the last 2 years of the 7-year contract. In the final year of the contract, the USDA is providing about $4 billion in annual farm subsidies and LDPs. Emergency payments have been made in 1998, 1999, and 2000 to offset low commodity prices and low yields due to weather and disease. Emergency payments have been announced for 2001.

Net farm income in 2010 will be lower than in 2000. Net farm income for all representative farms is projected to fall until 2002, and then slowly recover, due mainly to import demand for agricultural crops from developing countries. Crop production in the United States and around the world is assumed to be normal with annual trend-line increases.

Risk analysis shows the sensitivity of net farm income to variations in crop yields and prices. A 10% change in total crop production will change net farm income by over 50%.

Debt-to-asset ratios are predicted to fall early in the forecast period and then rise slowly throughout the forecast period. The debt-to-asset ratios for the small size and low profit farms, when coupled with their low net farm income, suggest problems in sustaining the farm business unless substantial off farm income is earned.

Land prices are predicted to fall through the middle of the forecast period and then increase modestly. Cash rent levels follow a pattern similar to land prices.

It is important to recognize the degree to which North Dakota farmers' fortunes have been integrated into a world marketplace. North Dakota farmers compete with producers of the same commodities in other parts of the world, such as Brazil, the EU, Argentina, and Eastern Europe. Also, the reliance on government spending of North Dakota agriculture is evident as net farm income falls early in the forecast period as government spending returns to estimated FAIR Act levels.

References

Benirschka, Martin, and Won W. Koo. 1995. *World Wheat Policy Simulation Model: Description and Computer Program Documentation*. Agricultural Economics Report No. 340, Department of Agricultural Economics, North Dakota State University, Fargo.

Benirschka, Martin, and Won W. Koo. 1996. *World Sugar Policy Simulation Model: Description and Computer Program Documentation*. Agricultural Economics Report No. 356, Department of Agricultural Economics, North Dakota State University, Fargo.

Conference Report. March 25, 1996. United States House of Representatives and United States Senate. Federal Agricultural Improvement and Reform Act of 1996. Washington, DC.

FAPRI Baseline Projections. January 2001. Food and Agricultural Policy Research Institute, Columbia, MO.

Farmers Union Handout. Information Meeting, January 18, 2000, Fargo, ND.

North Dakota Agricultural Statistics. Various issues. North Dakota Agricultural Statistics Service, Fargo.

North Dakota Farm and Ranch Business Management Annual Reports 1999 and 2000. North Dakota State Board for Vocational Education, Bismarck.

Palisade Corporation. 1997. *@Risk: Advanced Risk Analysis for Spreadsheets*. Newfield, NY.