1997 North Dakota Agricultural Outlook:
Representative Farms 1996-2005

Won W. Koo
Marvin R. Duncan
Richard D. Taylor

Department of Agricultural Economics
Agricultural Experiment Station
North Dakota State University
Fargo, ND 58105-5636

1997 North Dakota Agricultural Outlook:
Representative Farms 1996-2005

Won W. Koo
Marvin R. Duncan
Richard D. Taylor

Department of Agricultural Economics
North Dakota State University
Fargo, ND 58105-5636

The analyses and views reported in this paper are those of the author. They are not necessarily endorsed by the Department of Agriculture or by North Dakota State University.

Acknowledgments

Table of Contents

List of Tables

List of Figures

Abstract

Net farm income for all representative farms will be lower in 2003 than in 1995-96, but net farm income will be level throughout the 1997-2005 period. Cropland prices are projected to fall in all regions of North Dakota after peaking in 1996-97. Cash rental rates are projected to follow cropland prices. Debt-to-asset ratios for most farms, although rising across the forecast period, will not reach levels that imperil credit worthiness. 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 ratio, cropland prices, land rental rates, farm operating expenses, capitalization rate

Highlights

For all representative farms, net farm income is projected to decline from the higher income level in 1996, but is projected to increase gradually from 1998 to 2005. Net farm income is projected to be $133 thousand, $85 thousand, and $34 thousand for large, medium, and small size representative farms, respectively, in 2005, and $111 thousand, $63 thousand, and $2 thousand for high, average, and low profit representative farms, respectively, in the same year.

Debt-to-asset ratios for all representative farms are projected to rise slowly throughout the forecast period. Debt-to-asset ratios are projected to be 33% for large and medium size representative farms and 42% for small size representative farms in 2005. The ratios are also projected at 29%, 38%, and 53% for high, average, and low profit representative farms, in 2005, respectively.

For medium size representative farms, under the 1996 FAIR Act, cropland prices fall 6.4% from $623 per acre in 1996 to $583 in 2005.

For average profit representative farms, under the 1996 FAIR Act, cropland prices fall 9.3% from $558 per acre in 1996 to $506 in 2005.
.

For medium size representative farms, under the 1996 FAIR Act, cash rents rise 28.6% from $35 per acre in 1996 to $45 in 2005.

For average profit representative farms, under the 1996 FAIR Act, cash rents rise 10.8% from $37 per acre in 1996 to $41 in 2005.

Very low net farm income earned by low profit representative farms, coupled with a rising debt-to-asset ratio, point towards mounting financial problems for these farms.

1997 North Dakota Agricultural Outlook:
Representative Farms 1996-2005

Won W. Koo, Marvin R. Duncan,
and Richard D. Taylor[*]

Introduction

The Federal Agriculture Improvement and Reform Act (FAIR) will limit spending for government commodity payments to $35.63 billion between 1996 and 2002. It is projected to achieve a savings of $13 billion over the 7-year period (compared to an extension of 1992 legislation).

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. Producers will be able to plant whatever they wish on their program acres, except for fruits and vegetables. Annual benefits to program participants are determined in advance. The legislation substitutes a 7-year fixed-benefit contract for an annually determined entitlement farm payment. Though it is likely that the terms of the contracts will be honored by the USDA, it is useful to note that no Congress can bind a succeeding Congress to contract terms.

The main objective of this analysis was to evaluate changes in net farm income and debt-to-asset ratios for different sizes and profit categories of representative farms developed from the North Dakota Farm and Ranch Business Management Association farm records over a 1996 to 2005 forecast horizon. The secondary objective of this analysis was to evaluate the reaction of cropland prices and cash rental rates to the farm income estimates over the same horizon.

Methodology

This analysis is based on the North Dakota Representative Farm Model which uses Food and Agricultural Policy Research Institute (FAPRI) price projections as an input. The model has 24 representative farms, six farms in each of four regions: the Red River Valley (RRV), North Central (NC), South Central (SC), and Western (West). The farms in each region are representative of large, medium, and small size farms and average, high, and low profit farms enrolled in the North Dakota Farm and Ranch Business Management Association. The representative farms are developed from the North Dakota Vocational Agriculture Department farm record system data provided by cooperating North Dakota farmers.

---

[*]Koo and Duncan are professors and Taylor is a research associate in the Department of Agricultural Economics at North Dakota State University, Fargo.

This study forecasted net farm income, debt-to-asset ratios, cash rent, and cropland prices for representative farms producing five major crops: wheat, barley, corn, soybeans, and sunflowers. The representative farms average 1,200 acres of cropland and 410 acres of pasture.

Table 1 shows the characteristics of the representative North Dakota farms. The large farm is an average of the largest 25% of farms in cropland acres for each production region. The small representative farm is an average of the smallest 25% of farms for each production region. The average large farm has 2,170 cropland acres in the NC region and 2,523 cropland acres in the SC. The average medium size farm has 1,007 cropland acres in the West region and 1,333 cropland acres in the NC region. The average small farm has 373 cropland acres in the West region and 669 cropland acres in the NC region.

The average profit representative farm is an average of all farms in the Farm and Ranch Business Management Records System 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 each production region.

Table 1. Characteristics of Representative North Dakota Farms, 1994

	Size			Profit		
	Large	Medium	Small	High	Average	Low
	------------------acres-------------------					
Total cropland	2358	1182	475	1636	1200	995
Spring Wheat	1043	489	201	742	544	449
Durum Wheat	352	182	88	131	90	54
Barley	245	152	57	221	165	140
Corn	50	44	25	42	33	42
Sunflowers	193	91	27	88	66	56
Soybeans	118	61	13	90	70	84

The basic structure of the model is shown in Figure 1. Farm policies and cropping affect net farm income for the representative farms. Changes in return to cropland, given the market-determined capitalization rate, change land prices. Changes in land prices affect cash rental rates 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 model consists of two components: revenues and costs. The revenue component represents the total income from the farm operation, including farm program payments from the federal government. The cost components include all expenses incurred in producing the crop and livestock.
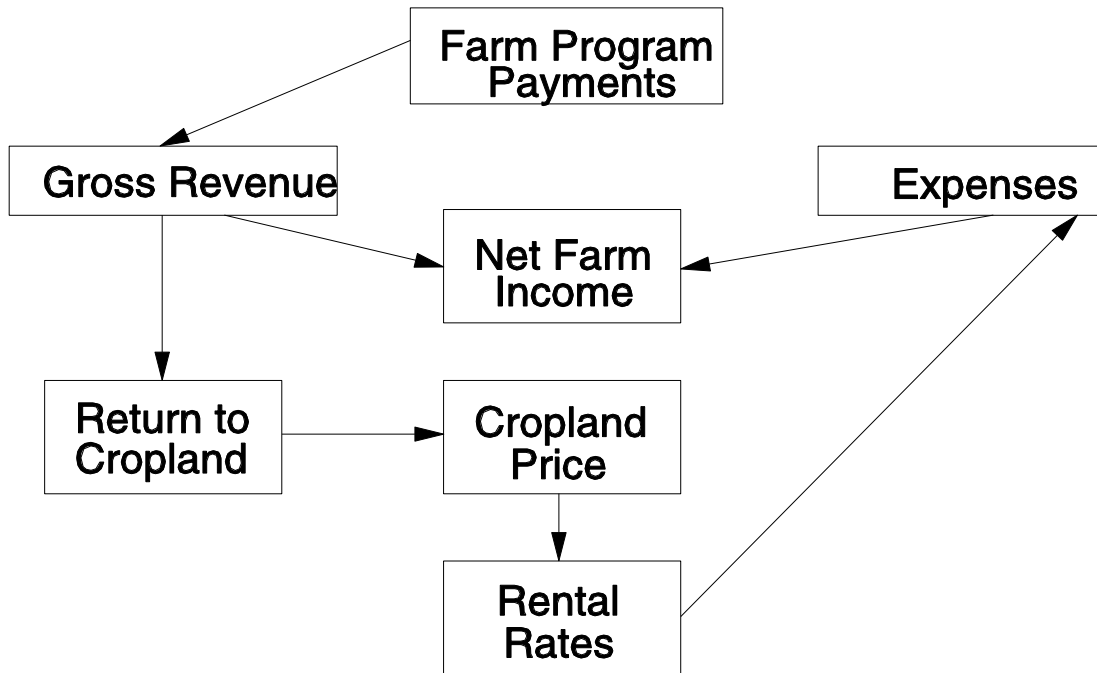
Figure 1. Structure of the North Dakota Representative Farm Model

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, seed, fertilizer, fuel, repairs, feed, supplies, feeder livestock purchases, and hired labor, and indirect costs, including 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. 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 are based on the historical relationships between North Dakota prices and U.S. export prices of the commodities. Annual data from 1974 to 1993 were used to estimate price equations.

       FAPRI projected prices of agricultural commodities are used in the North Dakota price equations to predict cash prices of agricultural commodities produced in North Dakota for 1996-2005 (Table 2). Since supply of the crop is sensitive to prices, high prices in 1996 will increase supply in subsequent years under normal weather conditions, causing a gradual price decline for the forecast period.

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

	Spring Wheat	Durum Wheat	Malt Barley	Feed Barley	Soybean	Corn	Sunflowers
	----------------$/bu-----------------						$/cwt
1996	4.38	5.20	2.74	2.18	6.57	2.60	12.65
1997	3.46	3.85	2.30	1.88	6.01	2.25	11.68
1998	3.38	3.74	2.17	1.78	5.64	2.24	11.10
1999	3.71	4.22	2.24	1.84	5.62	2.30	11.18
2000	3.71	4.22	2.34	1.91	5.73	2.32	11.53
2001	3.86	4.44	2.40	1.95	5.78	2.42	11.77
2002	3.86	4.44	2.39	1.94	5.87	2.47	12.09
2003	3.86	4.44	2.42	1.96	5.96	2.52	12.40
2004	3.86	4.44	2.48	2.00	6.07	2.61	12.75
2005	3.90	4.50	2.53	2.03	6.27	2.67	13.28

Regional North Dakota yield equations were estimated from historical yield data reported by NASS from 1974 to 1993. The estimated equations were used to forecast changes in crop yield trends for future years. A dummy variable was used to compensate for two drought years: 1980 and 1988.

Cropland Prices

Financial data from average representative farms for each region are used to calculate a dollar return to land. 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 return allocated to cropland is divided by the market price for cropland obtained from NASS to determine the implicit capitalization rate for land.

In forecast years, this capitalization rate is applied to cropland income per acre to determine cropland value for land utilized to produce wheat, corn, soybeans, barley, and sunflowers. Income allocated to cropland changes cropland prices, based on a 4-year weighted average of cropland income. The calculated price of cropland can be defined as the amount an average profit or medium size representative farm is willing to pay for the cropland on which to produce wheat, barley, corn, soybeans, and sunflowers.

Cash Rent

A 3-year moving average of cropland prices determines cash rental rates charged for rented cropland based on the market-determined relationship of cropland prices to cash rental rates.

Debt-to-asset Ratio

The debt-to-asset ratio is calculated by dividing total outstanding farm debt by total farm assets. Total debt includes debt on land, intermediate debt, and short-term debt. Total assets include price of farmland times acres of farmland and the depreciated value of farm equipment and supplies, livestock, and liquid assets.

Assumptions

This analysis is based of the following assumptions:

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

2. The size of all farm enterprises remains constant.
3. The farm equipment stock remains constant, indicating that depreciation allowances are reinvested in farm equipment.
4. Inventory, accounts receivable, accounts payable, and prepaid expenses and supplies are constant from year to year.
5. All farms within a region have the same crop mix.
6. All farms within a region receive the same price for commodities.
7. Yield differentials that existed in 1993 continue throughout the forecast period for high, average, and low profit farms and large, medium, and small size farms.
8. Government payments continue after 2002, at the same level as 2002.

Results

**Net Farm Income, Debt-to-asset Ratios, Land Prices,
and Cash Rent for Different Sizes of Representative Farms**

Table 3 presents the net farm income for the large, medium, and small size representative farms. From 1996 to 2005, net farm income falls 28.9% from $187 thousand in 1996 to $133 thousand in 2005 for the large size farm, 20.9% from $110 thousand in 1996 to $87 thousand in 2005 for the medium size farm, and 30.6% from $49 thousand in 1996 to $34 thousand in 2005 for the small size farms.

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

	Large	Medium	Small
	----1000 dollars---		
1995	168	101	47
1996	187	110	49
1997	123	80	38
1998	105	71	34
1999	114	76	35
2000	112	76	34
2001	122	81	35
2002	124	81	35
2003	126	82	34
2004	128	84	34
2005	133	87	34
1995-2005			
Ave	131	85	37

Figure 2a shows changes in net farm income for the large, medium, and small size representative farms for the forecasting period. Net farm income was the highest for all the representative farms in 1996. It is expected to decline until 1998, and to increase thereafter. The

increase in the net farm income is due mainly to an increasing trend in crop prices. Demand for agricultural commodities from developing countries is predicted to be strong from 1998 through 2005, raising U.S. crop prices.

Table 4 presents debt-to-asset ratios for representative farms. From 1996 to 2005, the debt-to-asset ratio rises from 0.27 to 0.33 for the large size farm, from 0.29 to 0.33 for the medium size farm, and from 0.38 to 0.42 for the small size farm.

Figure 2b shows debt-to-asset ratios for the large, medium, and small representative farms for the forecasting period. The debt-to-asset ratios for all representative farms was the lowest in 1996, mainly because net farm income peaked in that year. The debt-to-asset ratios are predicted to increase from 1997 to 2003, followed by a slight decrease in 2004 and 2005.

Table 5 presents cropland prices for the medium size representative farm. Cropland prices fall 6.4% from $623 per acre in 1996 to $583 in 2005. Figure 3a shows the average price for cropland that the medium size representative farm would be willing pay over the forecast period. Cropland prices are predicted to peak in 1997 and then decline throughout the remaining period.

Table 4. State Average Debt-to-asset Ratios for Different Size Representative Farms

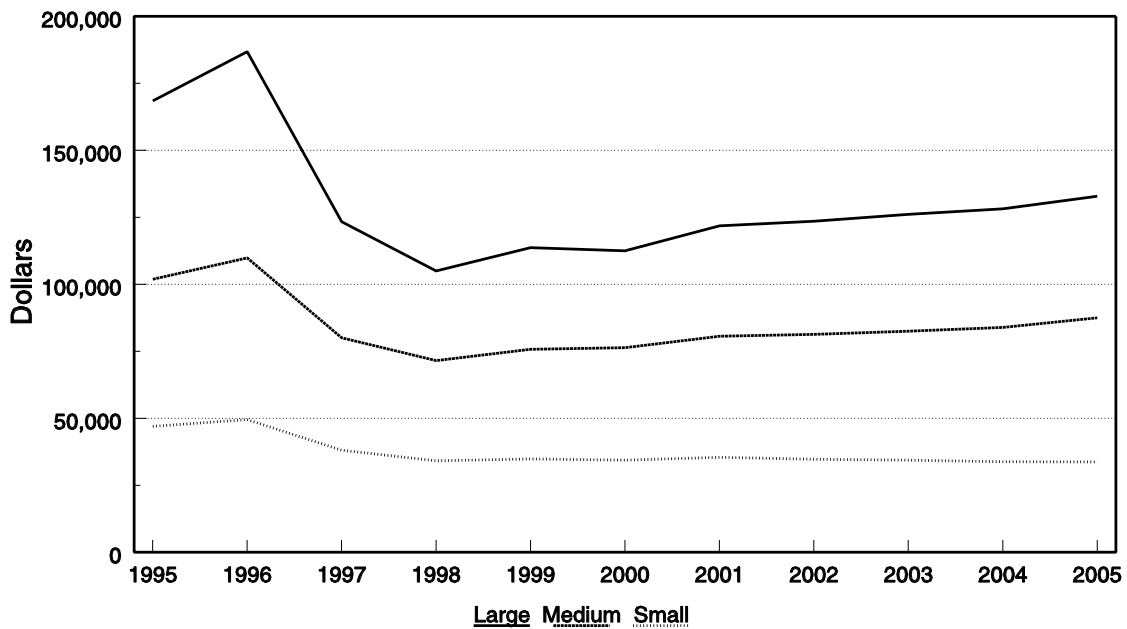|	Large	Med	Small
1995	0.30	0.32	0.41
1996	0.27	0.29	0.38
1997	0.30	0.32	0.40
1998	0.32	0.34	0.42
1999	0.32	0.34	0.43
2000	0.33	0.35	0.43
2001	0.32	0.34	0.43
2002	0.33	0.34	0.43
2003	0.33	0.35	0.44
2004	0.34	0.34	0.43
2005	0.33	0.33	0.42
1996-2005			
Ave	0.32	0.33	0.42

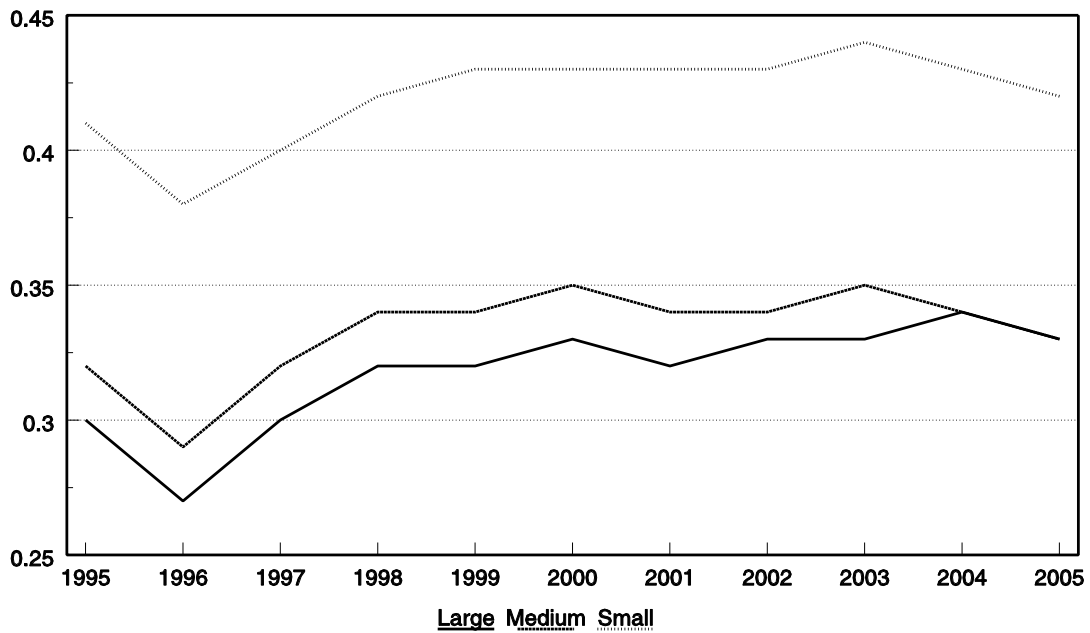Figure 2a. Net Income for North Dakota Representative Farms under the 1996 FAIR Act

Figure 2b. Debt-to-asset ratio for North Dakota Representative Farms under the 1996 FAIR Act
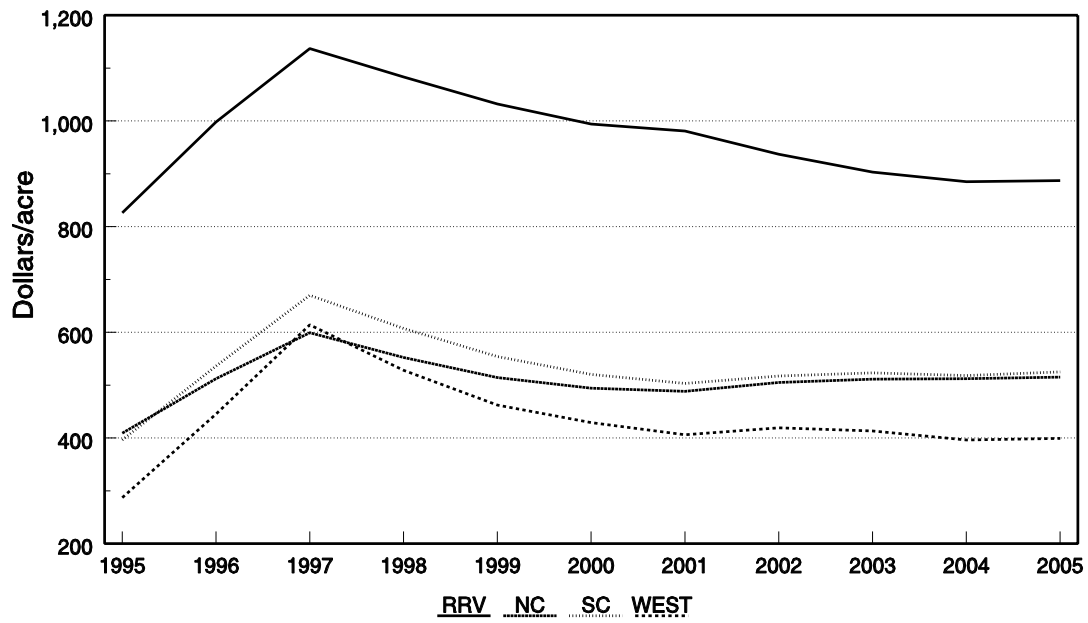
Figure 3a. Average Prices of Cropland for Medium Size
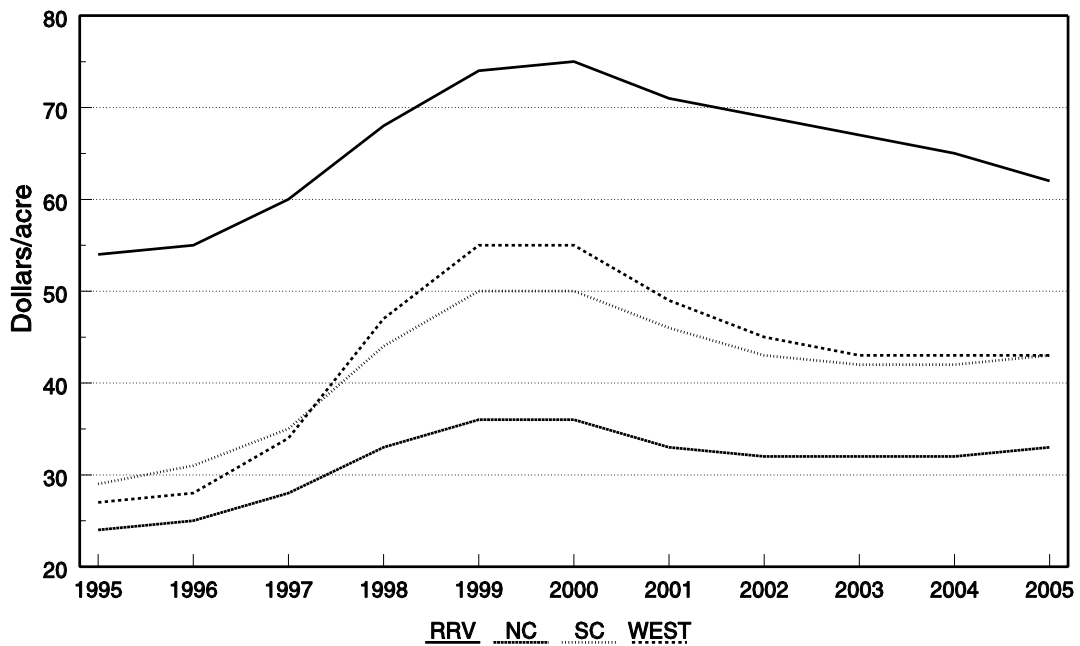Representative Farm under the 1996 FAIR Act

Figure 3b. Cash Rent Paid by Medium Size Representative
Farms under the 1996 FAIR Act

9

Table 5. North Dakota Land Prices
for Different Size Representative Farms

	RRV	NC	SC	WEST	State Ave
	------dollars per acre-------				
1995	826	409	396	287	479
1996	998	512	536	445	623
1997	1137	599	670	614	755
1998	1083	552	607	528	692
1999	1032	514	554	462	640
2000	994	494	520	429	609
2001	981	488	503	406	595
2002	937	505	517	419	594
2003	903	511	523	413	588
2004	885	512	518	396	578
2005	887	515	525	399	581
1996-2002 Ave	969	510	533	436	612

Table 6 presents cash rents that the medium size representative farm would be willing to pay for cropland. Cash rent rises 28.6% from $35 per acre in 1996 to $45 in 2005. Figure 3b shows cash rents that the medium size representative farms would be willing to pay over the forecast period. Cash rents are predicted to peak during 1999-2000 and then decline throughout the remaining period.

Table 6. Cash Rent for Medium Size
Representative Farms

	RRV	NC	SC	WEST	State Ave
	-----dollars per acre-----				
1995	54	24	29	27	33
1996	55	25	31	28	35
1997	60	28	35	34	39
1998	68	33	44	47	48
1999	74	36	50	55	53
2000	75	36	50	55	54
2001	71	33	46	49	50
2002	69	32	43	45	47
2003	67	32	42	43	46
2004	65	32	42	43	46
2005	62	33	43	43	45
1995-2005 Ave	65	31	39	43	45

**Net Farm Income, Debt-to-asset Ratios, Land Prices, and Cash Rent
for Different Profit Categories of Representative Farms**

Table 7 presents net farm income for high, average, and low profit representative farms. Net farm income falls 27.0% from $157 thousand in 1996 to $111 thousand in 2005 for the high profit farm, 31.5% from $92 thousand in 1996 to $63 thousand in 2005 for the medium profit farm, and from $35 thousand in 1996 to $2 thousand in 2005 for the low profit farm.

Figure 4a shows changes in net farm income for high, average, and low profit representative farms for the forecast period. Net farm income is the highest in 1996, and is predicted to decline until 1998, and then to increase gradually. The changes in net farm income are mainly because of increasing crop prices.

Table 7. State Average Net Farm Income for Different Profit Representative Farms

	High	Ave	Low
	----1000 dollars---		
1995	138	82	27
1996	152	92	35
1997	107	61	11
1998	96	52	2
1999	103	57	3
2000	103	57	2
2001	109	60	4
2002	110	60	4
2003	111	60	3
2004	112	64	3
2005	111	63	2
1995-2005 Ave	114	64	9

Table 8 presents debt-to-asset ratios for representative farms. The debt-to-asset ratios rise from 0.24 in 1996 to 0.29 in 2005 for the high profit farm, from 0.33 in 1996 to 0.40 in 2005 for the average profit farm, and from 0.47 in 1996 to 0.56 in 2005 for the low profit farm.
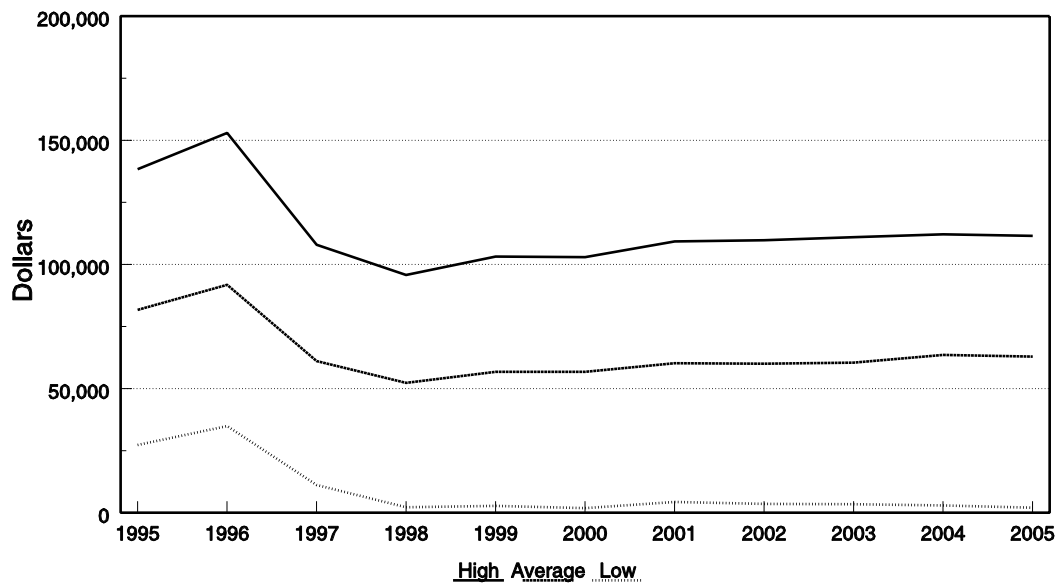
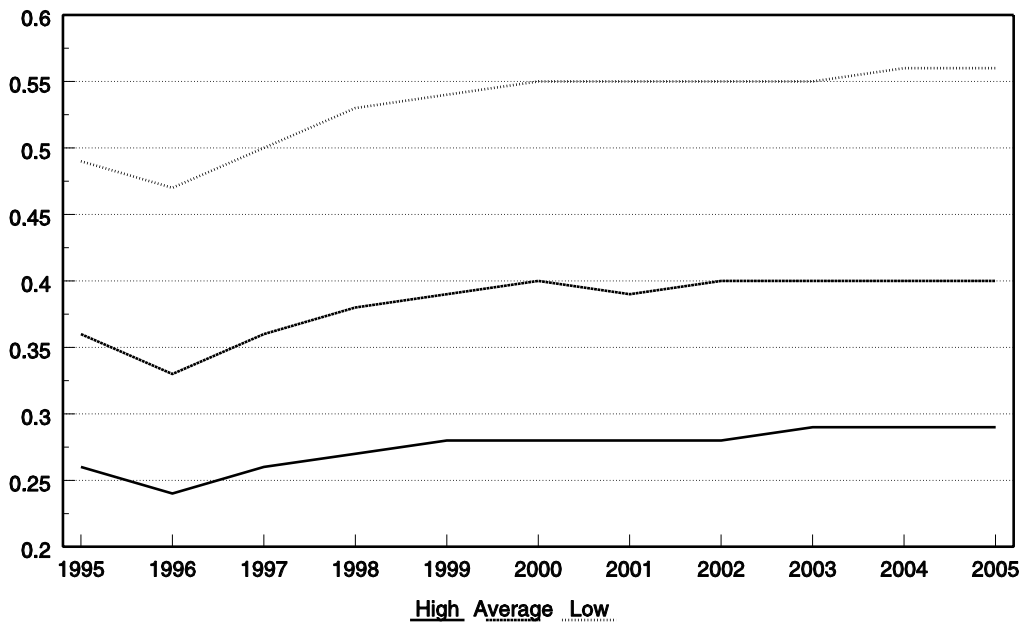Figure 4a. Net Income for North Dakota Representative
Farms under the 1996 FAIR Act

Figure 4b. Debt-to-asset ratio for North Dakota Representative
Farms under the 1996 FAIR Act

12

Table 8. State Average Debt-to-asset Ratio for Different Profit Representative Farms

	High	Ave	Low
1995	0.26	0.36	0.49
1996	0.24	0.33	0.47
1997	0.26	0.36	0.50
1998	0.27	0.38	0.53
1999	0.28	0.39	0.54
2000	0.28	0.40	0.55
2001	0.28	0.39	0.55
2002	0.28	0.40	0.55
2003	0.29	0.40	0.55
2004	0.29	0.40	0.56
2005	0.29	0.40	0.56
1995-2005			
Ave	0.27	0.38	0.53

Figure 4b shows changes debt-to-asset ratios for high, average, and low profit representative farms for the forecasting period. The debt-to-asset ratios for all representative farms were the lowest in 1996, mainly because net farm income peaked in that year. The debt-to-asset ratio is predicted to increase from 1997 to 2005.

Table 9 presents the cropland prices for the average profit representative farm. Cropland prices fall 2.9% from $558 per acre in 1996 to $506 in 2005. Figure 5a shows prices for cropland that the average profit representative farm would be willing to pay. Cropland prices are predicted to peak in 1997 and then to decline except for the RRV, throughout the remaining period. The RRV cropland prices are predicted to increase after 2003 mainly because of higher prices for sugar beets.

Table 10 presents the cash rents that the average profit representative farm would be willing to pay for cropland. Cash rents rise 10.8% from $37 per acre in 1996 to $40 in 2005. Figure 5b shows the changes in cash rent that the average profit representative farm would be willing to pay during the forecast period. Cash rents are predicted to peak during the 1999-2000 period and then to decline throughout the forecast period, except for the RRV.
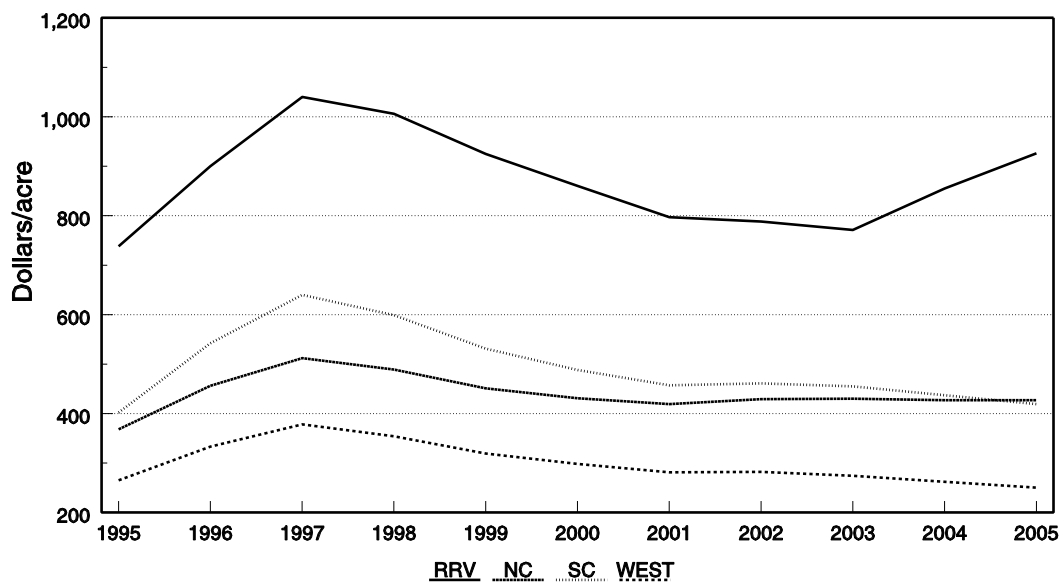
Figure 5a. Average Prices of Cropland for Average Profit
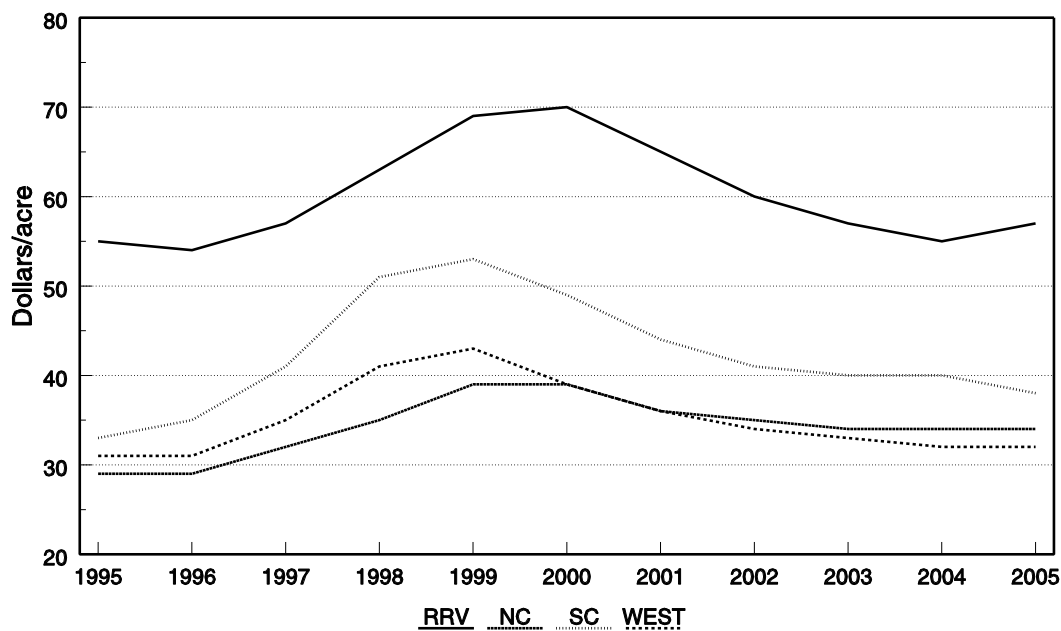Representative Farms under the 1996 FAIR Act

Figure 5b. Cash Rent Paid by Average Profit Representative
Farms under the 1996 FAIR Act

14

Table 9. North Dakota Land Prices
for Average Profit Representative
Farms

	RRV	NC	SC	WEST	State Ave
	-----dollars per acre-----				
1995	738	368	402	265	443
1996	900	456	542	333	558
1997	1040	512	640	378	643
1998	1006	489	599	354	612
1999	925	451	531	319	556
2000	860	431	488	298	519
2001	797	419	457	281	489
2002	788	429	461	282	490
2003	771	430	455	274	482
2004	855	427	437	262	495
2005	926	427	419	250	506
1995-2005 Ave	873	440	494	300	527

**Table 10. Cash Rent for Average
Profit Representative Farms**

	RRV	NC	SC	WEST	State Ave
	-----dollars per acre-----				
1995	55	29	33	31	37
1996	54	29	35	31	37
1997	57	32	41	35	41
1998	63	35	51	41	48
1999	69	39	53	43	51
2000	70	39	49	39	49
2001	65	36	44	36	45
2002	60	35	41	34	42
2003	57	34	40	33	41
2004	55	34	40	32	40
2005	57	34	38	32	41
1995-2005 Ave	58	32	39	36	40

Implications and Conclusions

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 the entitlement nature of past programs in which government spending was a function of market price levels and farmer eligibility for program benefits. The largest annual decreases in subsidy levels come in the last two years of the 7-year contract. In the final year of the contract, the USDA is providing $4.008 billion in annual farm subsidies.

According to our model, net farm income was the highest in 1996, will decline until 1998, and then increase gradually for the remaining period. Increases in net farm income from 1999 to 2005 are mainly due to strong 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. The increases in the net farm income due to price increases are large enough to offset decreases in transition payments under the FAIR Act.

Land prices are predicted to be highest in 1997 due to the lagged impact of higher net farm income in 1995 and 1996. Prices are predicted to decline slowly throughout the forecast period, except for the RRV high profit representative farm. Increases in net income after 1998 are not sufficient to maintain the higher land prices.

Cash rent levels are predicted to be the highest in 1998 and 1999 due the higher land prices in 1997 and are predicted to decline slowly throughout the remainder of the forecast period, following land prices.

Debt-to-asset ratios are the lowest in 1996 due to the higher net farm incomes in 1995 and 1996. The debt-to-asset ratios are predicted to increase slowly during the forecast period. Debt-to-asset ratios for the low profit and small size representative farms are predicted to be higher than for either the average profit and medium size or high profit and large size representative farms, but do not reach levels that imperil credit worthiness. Higher debt-to-asset ratios for low profit farms when coupled with meager net farm income, suggest serious problems in sustaining the farm business unless substantial off farm income is earned by the farm families.

References

Census of Agriculture, 1992. U.S. Department of Commerce, Washington, DC.

FAPRI Baseline Projections. January, 1997. Food and Agricultural Policy Research Institute, Columbia, MO.

Koo, Won W., Marvin R. Duncan, Richard D. Taylor, and Dwight G. Aakre. 1996. *Impacts of Alternative Farm Programs on the North Dakota Agricultural Economy.* Agricultural Economics Report No. 343. Department of Agricultural Economics, North Dakota State University, Fargo.

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

North Dakota Farm and Ranch Business Management Annual Reports 1993 and 1994.   North Dakota State Board for Vocational Education, Bismarck.

cjj/70/reports/AE373.wpd

17