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Impacts of Farm Policies and Technology on the Economic Viability of Southern High Plains Wheat Farms

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IMPACTS OF FARM POLICIES AND TECHNOLOGY ON THE ECONOMIC VIABILITY OF SOUTHERN HIGH PLAINS WHEAT FARMS

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Executive Summary

Three different-sized wheat farms in the Southern High Plains, which are representative of a majority of the commercial agricultural production for the region, were analyzed under alternative agricultural policies, federal income tax provisions, technology levels, and financial assistance programs. The purpose of this study was to estimate the impacts of alternative government policies and technology on the growth and economic viability of representative wheat farms in the Southern Plains. The farms--initially operating 1,280, 1,920, and 3,200 acres--had debt to asset ratios typical of farms in the area, owned the necessary machinery complement, and farmed both owned and leased cropland.

The results indicate that under the most likely technology scenario and continuation of the provisions of the 1981 Farm Bill (Base Scenario), all three representative wheat farms will have a high probability of remaining solvent through 1992. Additionally, all three farms had a high probability of generating a 3% or greater return on equity and will be able to grow over the 10-year planning horizon. The greatest percentage increase in average ending farm size was evident for the 1,280-acre farm, followed by the 1,920-acre operation.

Imposing an acreage reduction program (acreage set aside and paid diversion) increased net farm incomes and average net present value for all three farms. Acreage reduction programs increased average ending farm size slightly more for the 3,200-acre farm than for the 1,280-acre farm.

Removing the deficiency payment program (income supports) reduced the probability of survival only for the 1,920-acre farm. Although each farm suffered a reduction in average annual net farm income, the reduction was significantly greater for the 1,280-acre farm. Average annual growth rates declined even more for the two smaller farms.

Removing both price (CCC loan and FOR) and income supports (deficiency payments) reduced the probability of survival for both the 1,280- and 1,920-acre farms. All three farms experienced slower rates of growth as a result of eliminating price and income supports. Average ending farm size ranged from 19 to 16% less than under the Base Scenario. On the average, all three farms experienced negative annual net farm incomes.

Removing all farm program provisions reduced the probability of survival for all three farms. Probability of survival (100% under the Base) declines to 48% for the 1,280-acre farm, 32% for the 1,920-acre farm, and 92% for the 3,200-acre farm. Average ending net worth for the farms declined over the period due to a decline in land values.

Imposing a more restrictive set of federal income tax provisions (no ITC, forced depreciation recapture, and extended depreciation period) slowed the average annual growth rate and net income more for the two larger farms than for the smallest farm. Farm growth occurred more often by leasing cropland than by purchasing land due to reduced cash reserves.

Yield-enhancing technology anticipated over the next 10 years will likely contribute to farm growth. Farms which initially adopt new technology will accrue the greatest benefits.

A 2-year, interest rate subsidy program rather than a debt restructure program would provide greater benefits to highly leveraged wheat farms. Probability of survival for a highly leveraged 1,920-acre farm was increased from 40 to 80% by an interest rate subsidy.

The results of this study indicate that moderate-sized wheat farms, 1,280 to 1,920 acres, rather than larger farms in the Southern High Plains are more dependent upon farm program provisions for their continued growth and economic viability. However, the loss of any farm program provision negatively impacts farms of all sizes.

Impacts of Farm Policies and Technology on the Economic Viability of Southern High Plains Wheat Farms

The economic impacts of farm policy, income tax provisions, and technology have not been clearly linked to changes in farm structure (Gardner). Numerous economists have suggested that farm programs have accelerated the growth of large-scale farms, while other economists suggest that the link between government programs and increased farm size has never been empirically demonstrated in a *ceteris paribus* world (Quance and Tweeten; Gardner; Gardner and Pope).

The purpose of this study is to analyze the impacts of selected farm programs, federal income tax provisions, and technology on the viability of three different-sized wheat farms in the Southern High Plains.

Methodology

The first step in achieving the objectives of this study was to describe three different-sized wheat farms representative of the study area. The second step involved a simulation of the representative farms using a Monte Carlo, whole-farm simulation model (FLIPSIM V) under alternative farm policy, income tax, finance, and technology scenarios.

Representative Farms

Results of a stratified random sample of wheat producers in Ochiltree County, Texas, obtained in 1980 by researchers at Texas A&M, were used to initially identify characteristics for representative farms in the Southern High Plains. County agents and farmers were asked to review and comment on three different-sized farms as to the appropriate cropmix, machinery complement, yields, off-farm income, level of annual family consumption, use of hired labor, and crop share rental arrangements. Their suggested changes, along with financial data obtained from the 1979 Farm Finance Survey and the 1982 Texas Agricultural Extension Service Enterprise Budgets for High Plains Region I, were used to develop the representative farms described in this section of the report.

A 3,200-acre wheat farm was developed to represent the scale of agriculture typical of the largest 10% of all wheat farms in northern Texas, western Kansas, the Oklahoma Panhandle, and eastern Colorado--as defined in a 1979 Farm Finance Survey. A 1,920-acre wheat farm was used to represent the next smaller 20%, 1,400-2,500 acres according to the *Farm Finance Survey;* while a 1,280-acre farm was typical of approximately 30% of the farms in the four-state area.

The initial characteristics for the three representative farms are summarized in Table 1. The proportion of cropland owned by each farm was obtained from the 1979 *Farm Finance Survey* which summarized wheat farmers in western Kansas, eastern Colorado, the Oklahoma Panhandle and the northern High Plains of Texas who had real estate debt. Acres of pastureland owned, and proportion of cropland irrigated for each farm size, was obtained from the Texas A&M survey of farmers in Ochiltree County. The average value of cropland and pastureland for 1982-83 was obtained from lending institutions in the region. Beginning cash reserves for each farm were based on the 1979 *Farm Finance Survey.* The value of machinery for each farm was derived simply as the sum of market values for all items in the respective farm's initial machinery complement. Average values of off-farm investments reported for each farm in the 1979 *Farm Finance Survey* were used to

TABLE 1. FINANCIAL CHARACTERISTICS OF THREE REPRESENTATIVE WHEAT FARMS BY SIZE IN THE SOUTHERN HIGH PLAINS

	Farm Size (acres)		
Characteristics	1,280	1,920	3,200
Cropland acres owned	640	840	1,400
Cropland acres leased	640	1,080	1,800
Acres of pastureland owned	120	220	360
Value of owned cropland ($1,000)	296.0	388.5	647.5
Value of owned pastureland ($1,000)	29.4	53.9	88.2
Value of machinery ($1,000)	241.9	352.2	477.2
Value of off-farm investments ($1,000)	37.3	49.0	53.5
Beginning cash reserve ($1,000)	10.0	12.0	20.0
Long-term debt ($1,000)	60.2	86.3	143.5
Intermediate-term debt ($1,000)	83.2	126.5	171.3
Initial net worth ($1,000)	470.3	642.3	970.7
Equity ratio (fraction)[a]	0.77	0.75	0.75
Leverage ratio (fraction)[b]	0.31	0.33	0.33
Long-term debt/asset (fraction)	0.19	0.20	0.20
Intermediate term debt/asset (fraction)	0.34	0.36	0.36
Off farm income ($1,000)	12.4	9.8	9.0
Minimum family living expenses ($1,000)	18.0	20.0	23.0
Maximum family living expenses ($1,000)	40.0	50.0	50.0

[a]The equity ratio is the ratio of total net worth and total assets.

[b]Leverage ratio is the ratio of total debt to total net worth.

complete each farm's initial assets.

Average long- and intermediate-term debt asset ratios from the *Farm Finance Survey* were used to estimate initial values for these debts. All three wheat farms had approximately the same beginning equity level, 0.75 (Table 1). Minimum family living expenses were based on values obtained from a Texas A&M survey of Ochiltree County farmers. Average annual off-farm income from wages and salaries was obtained from the *Farm Finance Survey.*

A typical cropping pattern in the High Plains is to irrigate 50% of all cropland. Wheat is generally raised on the dryland portion of the cropland, with grain sorghum on the irrigated portion. This cropping pattern was assumed for all three farms. Numerous crop share arrangements prevail in the region for leased land. However, these arrangements typically involve the producer paying the landlord about 25% of the crop and the landlord paying none of the production and harvesting costs. This crop share arrangement was assumed for all leased cropland. All native pastureland, owned by the farm operator, was assumed to be leased out for $5/acre.

Typically farm operators in the region harvest their own irrigated sorghum and most of their irrigated wheat. Dryland wheat is predominately custom harvested. The machinery complements for the three farms were developed to reflect this practice, and modified based on producer feedback. An initial complement for each farm was developed from the Texas A&M survey prior to soliciting comments from local producers.

The 1,280-acre farm hired one full-time farmhand, while the 1,920- and 3,200-acre farms each employed two. Annual salaries for full-time employees were estimated at $13,000. Part-time labor was assumed to be available as needed at a wage rate of $4.32/hour.

In the simulation model, as each farm grew, it was forced to buy the necessary machinery and irrigation equipment. After growing 640 acres, each farm had to buy a complete machinery complement costing approximately $175,000. After growing an additional 960 acres, each farm had to buy $211,000 of machinery and irrigation equipment. In this manner, growing farms continued to have machinery complements consistent with larger representative farms. The 1,280-acre farm had to hire one additional full-time employee when it grew beyond 1,919 acres.

Under high level management conditions, average annual yields were 50 bushels/acre (bu/A), for irrigated wheat and 15 bu/A for dryland wheat (Table 2). Under similar conditions, irrigated sorghum averaged 50 hundred weight (cwt)/A in the study area. Irrigated wheat yields have taken a dramatic increase over the past 5 years due to the introduction of a new wheat variety (TAM105). This increase in average irrigated wheat yields was reflected in the mean yields for the three farms. Average yields for irrigated wheat on representative farms in the region averaged 51 bu/A from 1974-1983 (Table 2), and after adjusting for weather (hail), yields averaged 60 bu/A after 1980. All farms were assumed to have the same variability in wheat and sorghum yields and prices based on the historical variability from 1974-1983 (Table 2).

Projected cash production expenses (excluding labor and interest) for irrigated wheat in 1982 were $2.43/bu. Similar costs for dryland wheat and irrigated sorghum were $1.16/bu and $2.39/cwt, respectively. "Out-of-pocket" cash costs for harvesting were estimated at $12/acre for irrigated wheat, $9/acre for dryland wheat and $20.40/acre for sorghum. All three farms were assumed to have the same non-labor per acre production and harvesting costs.

Simulation Model

The General Firm Level Policy Simulator--FLIPSIM V (Richardson and Nixon)--was used to

TABLE 2. ANNUAL YIELDS AND PRICES FOR TYPICAL WHEAT FARMS IN THE SOUTHERN HIGH PLAINS, 1974-1983

Year	Irrigated Sorghum (cwt/acre)	Irrigated Wheat (bu/acre)	Non-Irrigated Wheat (bu/acre)	Wheat Price[a] ($/bu)	Sorghum Price ($/cwt)
1974	50.8	28.3	00.0	4.23	4.02
1975	49.4	61.4	24.0	3.90	3.97
1976	51.9	48.2	10.0	3.12	3.38
1977	48.6	54.4	15.6	1.97	3.21
1978	49.1	57.4	8.00	2.79	3.78
1979	54.3	54.0	30.9	3.83	4.12
1980	44.0	61.4	13.9	3.72	5.85
1981	49.4	60.5	12.1	3.63	4.16
1982	53.8	37.5	17.1	3.21	4.18
1983	55.0	49.5	24.0	3.30	5.01
Historical Averages	50.63	51.26	15.56	3.37	4.17

[a]Wheat prices are average August cash prices for wheat north of the Canadian River in Texas. Sorghum prices are average October cash prices for grain sorghum north of the Canadian River in Texas. Wheat and sorghum yields are per harvested acre yields of whole farms in the region.

simulate the three representative wheat farms for selected policy and technology scenarios. The model is capable of simulating the annual functions of a crop farm, i.e., production, marketing, financial growth and decay, machinery depreciation and replacement, family consumption, incurring fixed and variable costs, and participation in farm programs.

Each representative farm was simulated over the 10-year planning horizon beginning in 1983 and extending through 1992. The planning horizon was then repeated 50 times (iterations) using a different set of random wheat and sorghum prices and yields for each iteration. At the end of each iteration, values for key output variables were calculated.

The model began each year of the planning horizon by determining the production costs for the current size of the farm. The cropmix and fraction of cropland irrigated were assumed constant across different-sized farms.

After determining the relevant costs for the farm, the model selected the random crop prices and yields for that year. Random yields for irrigated wheat, sorghum and dryland wheat, as well as random prices for wheat and sorghum, were drawn to reflect the historical variability typical of the study area. Yields for actual farms in the study area were used to estimate this typical variability in yields.

Average yields were increased annually based on the technology scenario being analyzed. The most likely technology scenario for wheat and feed grains over the next 10 years was used as a base. Since not all farms adopt new technology at the same time, it was assumed the 3,200-acre farm would adopt wheat-related technology during years 1-6. The 1,920-acre farm was assumed to adopt wheat-related technology during years 7-10, and the 1,280-acre farm would not adopt during the 1983-1992 planning horizon. Feed grain-related technology was assumed to be adopted during years 1-5 for the 3,200-acre farm and between years 6-10 for the 1,920-acre farm. Prior to adoption, mean yields were equal to historical averages in Table 2. However, after adoption, wheat yields were held constant at 126% of their historical means. Sorghum yields were similarly increased to 105% of their historical means after adoption.

Variable production costs for each crop were simulated by multiplying the per acre input costs by planted acreages for the respective crops. Labor costs were calculated as the sum of full-time labor charges plus the cost of part-time labor. Part-time labor needs were based on the difference between hours of monthly labor available from full-time employees and non-paid family members, and the monthly labor needs for all crops. Harvesting costs were the product of the out-of-pocket per unit harvesting costs, random yield, and harvested acreage. Each farm's initial production and harvesting costs were expressed in 1982 dollars.

Property taxes were based on the price of land and the actual property tax rate for the study area. Other fixed costs were exogenously determined by the analyst. The model amortized all outstanding loans assuming they were simple interest mortgages. Annual interest rates for existing debt on land, machinery, and operating loans were 8.5, 13.4, and 14.4%, respectively. Annual interest rates for new debts and refinance loans long- and intermediate-term assets were 11.4 and 13.4%, respectively. Cash reserves and off-farm investments were allowed to earned 10% interest annually. The market value of farm machinery was updated assuming the real market value of used equipment decreased 1%/year. The market value of cropland was estimated using the historical

relationship between the capital gains rate for cropland and the rate of returns for farms in the study area.[1]

Each piece of equipment on the farm was depreciated for income tax purposes. Equipment purchased prior to 1981 was depreciated using the double declining balance method and a 5- to 7-year life. Equipment placed in use after 1980 was cost recovered assuming a 5-year life and the Accelerated Cost Recovery System (ACRS) rules. Regular purpose and special purpose buildings were depreciated using ACRS rules or the double declining balance method where applicable. Equipment that has passed its economic life (7 to 10 years) was replaced by trading the existing piece for a replacement. The cost of replacement equipment expressed in 1982 dollars was held constant throughout the planning horizon. First year expensing and maximum investment tax credit were calculated for all equipment purchases.

The fraction of each crop marketed in the current tax year was estimated internally based on the operator's desired taxable income ($7,400), estimated cash receipts, and income tax deductions.[2] If the market price was less than the effective loan rate for a crop, it was placed in the CCC loan when available rather than being sold. After nine months in the CCC loan, the wheat and sorghum was moved into the farmer-owned reserve (FOR). Stocks were released from the loan (or FOR) if the market price exceeded the release price. Deficiency payments were paid if the season average price was less than the target price. The deficiency payment was a function of the payment rate, farm program yield, and harvested acreage. When an acreage set-aside or diversion program was simulated, the model reduced planted acreage in the specified amount and accounted for increases in production on the more productive land left in production (slippage).

After simulating the farm policies specified by the user, the model determined the farm operator's year-end financial position, calculated family cash withdrawals,[3] and income taxes payable in the following year. Cash surpluses were deposited in a 10% interest bearing account.

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[1] The annual capital gain rate for cropland (cgrate) is calculated as a function of the lagged capital gain rate and the real rate of return to production assets (rret) in the previous period:

$$\underset{}{\text{cgrate}} = \underset{(-1.37)}{-0.0559} + \underset{(1.76)}{0.0582\ \text{Dummy}} + \underset{(1.73)}{0.3673\ \text{cgrate}_{t-1}} + \underset{(3.46)}{2.490\ \text{rret}_{t-1}}$$

The Dummy variable is one for 1979 and 1980, and zero otherwise. The student-t ratios are below their respective coefficients. The R square for this equation was 68.6% and the F ratio was 6.55. The coefficients were estimated using national capital gain rates for farmland, 1970-1983 (USDA, *Farm Real Estate Market Developments)* and national residual returns to farm assets as a percent of total assets (pp. 105-106, USDA, *Economic Indicators).*

[2] Income tax consequences frequently determine the fraction of crops sold during the income tax year they are harvested. The first step in calculating this fraction is to determine the operator's expected income tax deductions and cash receipts. Estimated deductions include: fixed costs, interest payments, variable production and harvesting costs, labor costs, depreciation, crop insurance premiums, and personal income deductions ($1,000 per dependent plus excess itemized deductions). Estimated cash receipts include: value of all crops if sold in the current tax year; value of crops held over from the previous year and sold in the current year; all off-farm income; and other farm income. If estimated cash receipts are less than estimated tax deductions plus the targeted taxable income ($7,400), all crop production is sold in the current tax year. When cash receipts exceed deductions plus $7,400, the proportion of crops sold in the next tax year equals the percentage of the crop that must be carried over for current cash receipts to equal deductions plus $7,400.

[3] A linear family consumption function was assumed for wheat farmers in the Texas Northern High Plains. The function assumed a minimum level of annual family living expenses was incurred regardless of the farm's financial condition. Beyond the minimum, the operator had a 0.25 marginal propensity to consume out of disposable income. The consumption function was bounded on the top side by a maximum level of annual family living expenses (Table 1).

Year-end cash flow deficits were handled in the following order: (a) grant a lien on crops in storage at the operating loan interest rate, (b) refinance long-term equity, (c) refinance intermediate-term equity, and/or (d) sell cropland. If the operator was unable to cover the deficit in any one of these ways, the farm was declared insolvent and the model proceeded to the next iteration after calculating the operator's accrued income and self-employment taxes.

Personal income taxes and self-employment taxes were calculated assuming the operator was married, filed a joint income tax return, and itemized personal deductions.[4] The regular income tax liability was computed using two methods: (a) income averaging (if qualified), and (b) the standard tax tables. The model selected the tax strategy which resulted in the lower income tax liability.[5]

The farm was permitted to grow at the end of each year by purchasing cropland if the operator had cash available (after meeting all expenses) to cover a 30% downpayment for land and a 35% downpayment for any additional machinery necessary for the proposed larger farm. The operator was permitted to borrow against equity in owned land to meet up to 50% of the downpayment for land. The farm operation could also grow by leasing land if the operator had sufficient cash available to cover the 35% downpayment requirement for purchasing additional machinery required to operate the larger-sized farm. If machinery was purchased due to growth, the machinery was depreciated, investment tax credit calculated, and the operator's income taxes recomputed.

After checking the farm's prospects for growth, the model updated the farm operator's balance sheet, and cash flow statement, and prepared to simulate the next year of the planning horizon. The steps in the simulation process described above were repeated for 10 years or until the farm was declared insolvent. After completing each iteration, the model summarized the information for numerous key output variables and returned the farm to its initial economic situation (year one). This insures that each farm faced the same economic, policy, and physical relationships for each of 50 iterations analyzed.

Policy and Technology Scenarios

The three representative wheat farms were simulated for 10 years under the alternative scenarios described below. Seven farm policy scenarios (including a continuation of the 1981 Farm Bill), one income tax provision scenario, two financial bailout scenarios, and three alternative technology scenarios were simulated for each farm. These policies represent the current farm program and alternative policies which remove some or all program provisions that are thought to affect farm growth and viability. All assumptions and policy values associated with each scenario were held constant across farm sizes to allow direct comparison of their impacts.

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[4] Depreciation recapture, capital gains and losses, investment tax credit, and depreciation allowances are explicitly accounted for in calculating the sole proprietor's accrued income tax liability. If there is a net operating loss from prior years, taxable income in the current year is appropriately reduced. If there is a net operating loss in the current year it is automatically carried forward. Net operating loss carryback is not permitted in the model.

[5] All investment tax credit allowances were deducted from the regular tax liability and the result was compared to the income tax liability under the alternative minimum tax. The operator paid the excess of the alternative minimum tax over the sum of the regular income tax liability and the regular minimum tax. Income tax rate schedules for 1983 and 1984 were included in the model, as well as a procedure to develop tax rate schedules for 1985-1992 based on changes in the Consumer Price Index.

Farm Policy Scenarios

1. Base Policy -- The Base Policy Scenario involves continuation of the 1981 Farm Bill through 1992 and continuation of the income tax provisions under the 1982 Tax Act (TEFRA) through 1992. Annual mean crop yields were assumed to increase based on expected adoption of new technology, as identified in the previous section. For this scenario it was assumed the following farm policies were in effect.

- CCC loan program is available for sorghum and wheat.
- A 3-year indirect farmer-owned reserve (FOR) is available for sorghum and wheat.
- An acreage diversion/set-aside program in effect for 1983-1985, is utilized, excluding PIK. No acreage diversion/set-aside program is in effect for 1986-1992.
- A target price-deficiency payment program is available for sorghum and wheat in all years.
- The $50,000 payment limitation for deficiency and diversion payments is in effect.
- Farms of all sizes are eligible to participate in these farm program provisions.

Values for loan rates, target prices, diversion rates, and diversion payment rates for 1983, 1984, and 1985 were set at their actual values in terms of 1982 dollars. Loan rates and target prices for 1986/1992 were held constant at their 1985 levels. Annual loan rates and target prices used in the analysis are summarized in Table 3 for 1983-1992. Historical farm policy parameters for Southern High Plains farms are outlined in Table 4. The average relationship between real loan rates and real prices for 1977-1982 was used to determine the real average annual prices for wheat and sorghum in 1983-1992. (This was done to minimize any bias created by setting mean prices too close to either the loan rate or the target price.)

It was assumed the following options for depreciating machinery and calculating income taxes were used for the Base Scenario.

- Machinery and buildings placed in use prior to 1981 are depreciated using the double declining balance method.
- Machinery and buildings placed in use after 1980 are depreciated using an accelerated cost recovery method.
- The operator elects to claim first-year expensing for all depreciable items.
- The operator elects to take maximum investment tax credit (ITC) and reduce the basis.
- The operator adjusts crop sales across tax years to reduce current-year taxes.
- The operator may use either the regular income tax computation or income averaging to calculate federal income tax liabilities.
- There is no maximum interest deduction for calculating taxable income.
- The actual self employment tax rates and maximum income levels subject to this tax for 1983 and 1984 are used. Announced values for these variables in 1985-1986 are used

TABLE 3. LOCALIZED LOAN RATES AND TARGET PRICES FOR WHEAT AND SORGHUM IN THE SOUTHERN HIGH PLAINS, 1983-1992[a]

Years	Sorghum		Wheat	
	Loan Rates	Target Prices	Loan Rates	Target Prices
	- - - ($/cwt) - - -		- - - ($/bu) - - -	
1983	4.386	4.757	3.557	3.948
1984	4.107	4.886	3.137	4.088
1985	4.008	4.768	3.062	4.063
1986	4.008	4.768	3.062	4.063
1987	4.008	4.768	3.062	4.063
1988	4.008	4.768	3.062	4.063
1989	4.008	4.768	3.062	4.063
1990	4.008	4.768	3.062	4.063
1991	4.008	4.768	3.062	4.063
1992	4.008	4.768	3.062	4.063

[a]All values are expressed in 1982 dollars.

TABLE 4. LOAN RATES, TARGET PRICES, AND ACREAGE SET ASIDE/DIVERSION LEVELS FOR WHEAT AND SORGHUM, 1977-1985

Year	Loan Rate	Target Price	Set Aside Rate	Diversion Rate	Diversion Payment Rate
			wheat		
	($/bu)	($/bu)	(%)	(%)	($/bu)
1977	2.25	2.90			
1978	2.35	3.40			
1979	2.50	3.40			
1980	3.30	3.63			
1981	3.50	3.81			
1982	4.00[a]	4.05	15.0	0.0	---
1983	3.65	4.30	15.0	5.0	2.70
1984	3.30	4.38	20.0	10.0	2.70
1985	3.30	4.38	20.0	10.0	2.70
			sorghum		
	($/cwt)	($/cwt)	(%)	(%)	($/cwt)
1977	3.39	4.07			
1978	3.39	4.07			
1979	3.57	4.18			
1980	3.82	4.46			
1981	4.07	4.55			
1982	4.32	4.64	10.0	0.0	2.54
1983	4.50	4.88	10.0	10.0	2.54
1984	4.32	5.14	0.0	0.0	0.00
1985	4.32	5.14	20.0	7.5	2.54

[a]Farmer-Owned Reserve entry price in 1982 exceeded the $3.55/bu loan rate for wheat.

Source: U.S. Department of Agriculture. *ASCS Commodity Fact Sheets; Wheat and Feedgrains,* 1983.

and the 1986 values are held constant through 1992.

- The operator elects to trade-in old machinery on new replacements at the end of each item's economic life.

2. A 20% Acreage Reduction -- The provisions of the Base Policy Scenario were modified by adding a 15% set aside with a 5% diversion for sorghum and wheat in 1986-1992. Reasonable slippage (70% for wheat and sorghum) and program participation rates were used to estimate the resulting increase in mean prices for these crops in 1986-1992.[6] All other provisions of the Base Scenario were used without change.

3. No Farm Program Payment Limitation -- All provisions of the Base Scenario were used except there was no limitation on diversion and deficiency payments.

4. No Price and Income Supports -- The CCC loan, FOR, and target price provisions under the Base Scenario were assumed to have been eliminated for all years in the planning horizon (1983-1992). Annual mean prices for all crops were decreased based on the expected impact of removing the price and income support programs. Relative variability in prices was increased based on the work of Morton, Devadoss, and Heady as to the effects of no farm programs on U.S. agriculture.[7] To isolate the impact of the price and income supports on the representative farms, the paid diversion and set-aside programs in the Base were assumed to remain in effect.

5. No Target Price/Deficiency Payment -- The target price and deficiency payment program was assumed to be eliminated for all years of the planning horizon (1983-1992). All other provisions of the Base Scenario were used without change to isolate the effects of removing only the deficiency payment program.

6. Target Farm Program Benefits -- All farm program and income tax provisions of the Base Scenario were used, except that farms with more than $300,000 of sales were not eligible to participate in farm program provisions. This program restriction excluded the 3,200-acre farm from participating directly in the program provisions (CCC loan, FOR, target price/deficiency payments, and diversion payments). Mean prices and relative variability in prices were not adjusted because sufficient "small" farms were assumed to participate in the farm program for the price support actions of the CCC loan and FOR to function normally.

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[6] The price response from a 15% acreage set-aside and 5% diversion for wheat was calculated assuming the own price flexibility for wheat of -1.50, slippage of 70%, and program participation of 60%. Based on these assumptions the price response would be about 5.4%--so the annual mean wheat prices in Table 3 were increased 5.4% in 1986-1992. The price response from a 15% acreage set-aside and 5% diversion for sorghum was calculated assuming a -1.75 price flexibility for feed grains with 30% slippage and 40% participation by feed grain producers. Based on these assumptions the price response would be about 9.8%, and annual sorghum prices in Table 3 were increased 9.8%, in 1986-1992.

[7] Morton, Devadoss, and Heady estimated the effect of removing all farm programs on wheat and corn. Their results suggest that the relative variability in the price of wheat and corn would increase 207% and 131%, respectively, and the mean prices for these crops would decline 1% and 8%. The removal of price supports (CCC loan and FOR) is generally expected to increase the variability more for the price of wheat than for the price of corn because price support mechanisms have influenced the season average price of wheat more than the corn price over the past decade. Deviates about mean prices for wheat (in Table 3) were multiplied by 2.07 to reflect the increased price variability Morton, Devadoss, and Heady estimated would occur without farm programs. Similarly, deviates about mean sorghum prices were multiplied by 1.31 for the no price support and no farm program scenarios. The annual mean prices for wheat were reduced about 5% and sorghum prices were reduced about 2% to reflect the effect of no price supports on mean prices. These decreases in mean prices were estimated by calculating mean sorghum and wheat prices for 1983 using the empirical distributions in Table 3, both with and without the price supports.

7. No Farm Program -- All farm program provisions outlined for the Base Scenario were eliminated for all 10 years of the planning horizon. Mean annual prices and relative variance in prices for the No Price and Income Supports Scenario (4) were used due to eliminating provisions of the CCC loan and FOR reserve under this scenario.

Income Tax Scenarios

8. Reduced Income Tax Benefits and Base Farm Program -- The federal income tax provisions in place for the Base Policy Scenario were made more restrictive. All farm policy provisions of the Base Scenario were left unchanged. The more restrictive federal income tax provisions included the following items.

- Machinery and buildings were depreciated using the straight line cost recovery method.
- First year expensing provisions were eliminated for all depreciable items.
- Investment tax credit (ITC) provisions were continued but the maximum ITC provision was eliminated.
- The maximum annual interest expense which could be used to reduce taxable income was $15,600. This value represents the annual interest expense deductions a consumer might have for a home, automobiles, etc.
- The operator must sell obsolete machinery upon disposition rather than trading it in on new replacements, thus forcing recapture of excess depreciation deductions.

All other federal income tax provisions for the Base Scenario were used as outlined earlier.

Financial Stress Scenarios

9. Base Finance Scenario -- Each farm's long-term debt to asset ratio was increased to 0.55, and its intermediate-term debt to asset ratio was increased to 0.60 to represent a highly leveraged farm. Annual long- and intermediate-term interest rates were increased to their average values for 1980-1983 (.1139 and .1343, respectively) to represent a farm which had been forced to refinance its assets during the past 4 years. The farm program provisions associated with the Base Policy Scenario (1) are continued for this scenario.

10. Debt Restructure -- The length of intermediate-term loans was increased by one year and a portion of intermediate debt was converted to long-term debt. The conversion of intermediate-term debt was permitted if the long-term debt to asset ratio did not exceed 0.65. For some farms, this allowed all intermediate-term debt to be converted to long-term debt. For other farms, this constraint substantially restricted debt conversion. Total debt loads and farm program provisions were the same as those used for the Base Finance Scenario (9).

11. Interest Subsidy -- The annual interest rates, debt levels, and farm program provisions in the Base Finance Scenario (9) were simulated with the exception of an interest subsidy provided during the first 2 years. The interest subsidy took the form of an interest rate reduction equal to 3.4 percentage points for long-term interest rates and 5.4 percentage points for intermediate-term interest rates. These interest rate reductions were the amounts necessary to reduce their respective interest rates (.1137 and .1343) to 8%.

Technology Scenarios

12. No New Technology and Base Farm Policy -- The federal income tax and farm program provisions in the Base Policy Scenario (1) were simulated assuming no increase in mean yields over the planning horizon. For the No New Technology Scenarios, annual mean yields were fixed in all years at the values in Table 2 for all three representative farms.

13. No New Technology and No Deficiency Payments -- The farm program provisions in the No Target Price/Deficiency Payments Scenario (5) were simulated assuming no change in annual mean crop yields.

14. No New Technology and No Farm Program -- All farm program provisions were eliminated (Scenario 8), and annual average crop yields were assumed to remain constant over time.

Evaluation Criterion

The FLIPSIM V model provides considerable detail about the viability of a representative farm at the end of each iteration, e.g., ending leverage ratio, ending net worth, ending farm size, total assets, total debt, net present value, and whether the farm remained solvent for 10 years. By repeating each scenario for 50 iterations, the model generates the information necessary to estimate probability distributions for key output variables. The means of these key output distributions are used to compare the economic impacts of selected policy and technology scenarios on representative farms. The following output variables for the model were selected to compare the impacts of the scenarios described in the previous section.

- *Probability of survival* is defined as the probability that the representative farm will remain solvent for 10 years. In other words, it is the probability that the operator would maintain the minimum financial ratios required by local bankers for all years of the planning horizon (debt to asset ratios less than 0.70).

- *Probability of a positive net present value* is the probability that the representative farm will have a positive after-tax net present value. An after-tax, real discount rate of 3% was used to calculate the farm's net present value. This statistic indicates the probability of the representative farm providing at least a 3% real rate of return to the operator's initial net worth.

- *After-tax net present value (NPV)* is the present value of the operator's annual cash withdrawals (CW) plus the present value of the change in net worth (NW) minus the present value of annual off-farm income (OY):

$$NPV = \sum_{t=1}^{T} \frac{CW_t - OY_t}{(1.03)^t} + \frac{NW_T}{(1.03)^T} - NW_o$$

Cash withdrawals equal family living expenses plus state and federal income taxes and self-employment taxes. Initial net worth (NW_o) and ending net worth (NW_T) include the value of off-farm investments and accrued taxes. A 3% after-tax, real discount rate was used to calculate net present value for all representative farms.

- *Present value of ending net worth* is used to indicate the change in the farms real net worth over the planning horizon. Net worth is affected by increases (or decreases) in asset (land, machinery, and livestock) value and retained earnings. This value can be compared directly to initial net worth (Table 1) to indicate the relative magnitude of real financial growth.

- *Acres owned, leased, and controlled* at the end of the planning horizon for each iteration indicate the impacts of alternative scenarios on the rate of growth for representative farms. These three statistics provide an indication of how the farm grew by purchasing or leasing land. Also, they indicate whether the farm was forced to sell cropland to remain solvent.

- *Total long- and intermediate-term debts* at the end of the planning horizon provide an insight into the financial stress of the farm over the planning horizon. Increases in average ending debt from one scenario to another can be due to either rapid growth through purchasing land and machinery, or the farm operator being forced to refinance large cash flow deficits. When surplus cash is available, the operator is permitted to prepay intermediate-term debts and new long-term debts. Therefore, large ending intermediate-term debts indicate insufficient cash was available to reduce intermediate-term debt through prepayment of principal.

- *Ending equity ratio* is the ratio of total net worth to total assets at the end of each iteration. This ratio provides a "bottom-line" measure for comparing the representative farm's ending financial position across scenarios.

- *Average Annual Net Farm Income* is the average net farm income received by the operator over all years simulated. Net farm income equals total farm receipts plus total government payments minus all cash production expenses, interest payments, labor costs, fixed costs (excluding principal payments), and depreciation. This value excludes all non-farm income and interest earned on cash reserves.

- *Average Annual Government Payments* is the average government payment (deficiency and diversion payments) received over all years simulated.

Results

The results of simulating Scenarios 1-8 for the three representative wheat farms are summarized in Tables 5-7. Under the Base Policy Scenario, all three farms had a 100% chance of remaining solvent for 10 years and an equal chance of receiving a positive net present value. On the average, all three farms were able to substantially increase their real net worth and all three experienced increases in their average equity to asset ratio. In addition, all three farms were able to increase the average total acres farmed by 1992. The 1,280-acre farm grew an average of 49%, while the 1,920- and 3,200-acre farms grew 44 and 32%, respectively.

Acreage Reduction Program

Imposing a 20% acreage reduction program (Scenario 2) increased the three representative farm's average net present value, average ending net worth, and average ending farm size. These results were expected because acreage reduction programs increase the mean price of wheat and sorghum and provide a limited diversion payment to offset part of the costs for diverting land. The increase in mean price reduced the deficiency payment rate. However, average deficiency payments

TABLE 5. COMPARISON OF SELECTED POLICY SCENARIOS ON A REPRESENTATIVE 1,280-ACRE HIGH PLAINS WHEAT FARM

Criteria	Initial Situation	Alternative Scenarios[a] 1	2	3	4	5	6	7	8
Probability of survival (%)	--	100	100	100	76	100	100	48	100
Probability of positive net present value (%)	--	100	100	100	20	50	96	10	100
After-tax net present value mean ($1,000)	--	427.3	691.8	436.1	-136.9	11.4	387.6	-236.6	341.1
Average present value of ending net worth ($1,000)	470.3	803.0	1,032.3	811.1	282.8	425.7	761.3	189.0	709.9
Average ending cropland owned (acres)	640.0	995.2	1,052.8	995.2	755.2	748.0	969.6	681.6	822.4
Average ending cropland leased (acres)	640.0	905.6	902.4	905.6	809.6	864.0	940.8	796.8	934.4
Average ending cropland controlled (acres)	1,280.0	1,900.8	1,955.2	1,900.8	1,564.8	1,648.0	1,910.4	1,478.4	1,756.8
Average ending long-term debts ($1,000)	60.2	122.4	94.8	117.9	198.9	170.6	142.4	177.5	80.0
Average ending intermediate-term debts ($1,000)	83.2	40.4	24.0	39.8	152.3	78.0	53.3	193.7	35.4
Average ending equity ratio (fraction)	0.77	0.84	0.88	0.84	0.46	0.67	0.81	0.35	0.87
Average internal rate of return (fraction)	--	0.09	0.12	0.09	-0.04	0.02	0.08	-0.09	0.09
Average annual net farm income ($1,000)	--	2.6	18.3	3.1	-33.6	-21.4	-0.9	-41.6	-8.3
Average annual gov't payment ($1,000)	--	30.9	31.5	31.6	2.5	2.5	27.7	0.0	29.4

[a]The scenarios are:
1 -- Base Policy or continuation of the 1981 Farm Bill and 1983 federal income tax provisions.
2 -- A 20% Acreage Reduction in 1986-1992.
3 -- No Farm Program Payment Limitation in 1983-1992.
4 -- No Price Support and No Deficiency Payment in 1983-1992.
5 -- No Target Price/Deficiency Payment in 1983-1992.
6 -- Target Farm Program Benefits to farms that produce less than $300,000 in program crops.
7 -- No Farm Program in 1983-1992.
8 -- Reduced Income Tax Benefits and the Base Farm Program.

TABLE 6. COMPARISON OF SELECTED POLICY SCENARIOS ON A REPRESENTATIVE 1,920-ACRE HIGH PLAINS WHEAT FARM

Criteria	Initial Situation	Alternative Scenarios[a] 1	2	3	4	5	6	7	8
Probability of survival (%)	--	100	100	100	50	90	96	32	100
Probability of positive net present value (%)	--	100	100	100	12	34	76	6	100
After-tax net present value mean ($1,000)	--	519.8	894.8	622.9	-265.8	-74.2	159.6	-393.0	369.2
Average present value of ending net worth ($1,000)	642.3	1,028.1	1,359.4	1,117.4	294.4	474.6	695.8	178.7	833.1
Average ending cropland owned (acres)	840.0	1,233.6	1,352.0	1,227.2	955.2	1,048.0	1,144.0	862.4	1,067.2
Average ending cropland leased (acres)	1,080.0	1,531.2	1,537.6	1,528.0	1,278.4	1,291.2	1,473.6	1,230.4	1,432.0
Average ending cropland controlled (acres)	1,920.0	2,764.8	2,889.6	2,755.2	2,233.6	2,339.2	2,617.6	2,092.8	2,499.0
Average ending long-term debts ($1,000)	86.3	167.0	134.6	114.5	289.9	315.9	275.5	250.9	203.6
Average ending intermediate-term debts ($1,000)	126.5	21.9	37.7	19.0	265.9	179.9	87.1	318.5	66.4
Average ending equity ratio (fraction)	0.75	0.86	0.88	0.89	0.35	0.53	0.69	0.24	0.77
Average internal rate of return (fraction)	--	0.09	0.12	0.10	-0.08	0.00	0.04	-0.18	0.08
Average annual net farm income ($1,000)	--	9.0	28.5	17.3	-52.5	-34.9	-17.6	-67.9	-21.8
Average annual gov't payments ($1,000)	--	39.0	39.1	44.7	4.2	3.7	16.2	0.0	37.3

[a]The scenarios are:
1 -- Base Policy or continuation of the 1981 Farm Bill and 1983 federal income tax provisions.
2 -- A 20% Acreage Reduction in 1986-1992.
3 -- No Farm Program Payment Limitation in 1983-1992.
4 -- No Price Support and No Deficiency Payment in 1983-1992.
5 -- No Target Price/Deficiency Payment in 1983-1992.
6 -- Target Farm Program Benefits to farms that produce less than $300,000 in program crops.
7 -- No Farm Program in 1983-1992.
8 -- Reduced Income Tax Benefits and the Base Farm Program.

TABLE 7. COMPARISON OF SELECTED POLICY SCENARIOS ON A REPRESENTATIVE 3,200-ACRE HIGH PLAINS WHEAT FARM

Criteria	Initial Situation	Alternative Scenarios[a] 1	2	3	4	5	6	7	8
Probability of survival (%)	--	100	100	100	100	100	100	92	100
Probability of positive net present value (%)	--	100	100	100	88	100	92	66	100
After-tax net present value mean ($1,000)	--	1,241.2	1,530.5	1,642.0	278.2	628.6	249.2	89.7	1,154.3
Average present value of ending net worth ($1,000)	970.7	1,936.1	2,203.7	2,230.6	1,096.4	1,412.4	1,086.7	925.1	1,657.1
Average ending cropland owned (acres)	1,400.0	1,912.0	1,960.0	2,094.4	1,521.6	1,678.4	1,499.2	1,486.4	1,611.2
Average ending cropland leased (acres)	1,800.0	2,305.6	2,404.8	2,388.8	2,030.4	2,155.2	1,995.2	1,985.6	2,193.6
Average ending cropland controlled (acres)	3,200.0	4,217.6	4,364.8	4,483.2	3,552.0	3,833.6	3,494.4	3,472.0	3,804.8
Average ending long-term debts ($1,000)	143.5	108.5	113.2	109.9	183.4	130.6	196.5	262.2	94.8
Average intermediate-term debts ($1,000)	171.3	28.8	23.1	9.4	138.8	85.4	130.8	175.9	26.5
Average ending equity ratio (fraction)	0.75	0.92	0.92	0.91	0.80	0.88	0.80	0.70	0.90
Average internal rate of return (fraction)	--	0.11	0.13	0.14	0.05	0.08	0.05	0.03	0.12
Average annual net farm income ($1,000)	--	48.9	59.5	78.4	-7.8	15.6	-13.6	-25.1	28.1
Average annual gov't payments ($1,000)	--	44.2	45.0	76.9	5.8	5.9	0.0	0.0	44.1

[a]The scenarios are:
1 -- Base Policy or continuation of the 1981 Farm Bill and 1983 federal income tax provisions.
2 -- A 20% Acreage Reduction in 1986-1992.
3 -- No Farm Program Payment Limitation in 1983-1992.
4 -- No Price Support and No Deficiency Payment in 1983-1992.
5 -- No Target Price/Deficiency Payment in 1983-1992.
6 -- Target Farm Program Benefits to farms that produce less than $300,000 in program crops.
7 -- No Farm Program in 1983-1992.
8 -- Reduced Income Tax Benefits and the Base Farm Program.

were increased slightly (less than 2%) due to increased average ending farm size. The average ending farm size for the smaller farm was 2.9% greater than the Base while the larger farms grew an average of 4% over the Base.

No Payment Limitation

Eliminating the $50,000 payment limitation (Scenario 2) resulted in substantial increases in average annual government payments for the 3,200-acre wheat farm. The 1,280-acre wheat farm had virtually no increase in government payments and the 1,920-acre farm had only a $5,700 increase in payments. Average net farm income for the 3,200-acre farm increased about $30,000 (or 60%) while the 1,280-acre farm had no increase in net farm income. The 3,200-acre farm had a 6.3% increase in average ending farm size due to removing the $50,000 payment limitation. The two smaller farms did not exceed their growth under the Base.

No Price and Income Supports

Removing both price and income supports (Scenario 4) did not reduce the probability of survival for the 3,200-acre farm. However, it reduced the probability of survival by 50 percentage points for the 1,920-acre farm and 24 percentage points for the 1,280-acre farm. The probability of receiving a positive net present value declined 12, 88, and 80 percentage points for the 3,200-, 1,920-, and 1,280-acre farm, respectively. Average annual net farm income for the 1,280-acre farm declined from $2,600 under the Base to -$33,600, while average net present value declined by 132%. In contrast, the 3,200-acre farm experienced a decline in net farm income from $48,900 to -$7,800 with a 78% decline in average net present value.

Compared to the Base Scenario, the average ending farm size under Scenario 4 was 17.6%, 19.2%, and 15.8% lower for the 1,280-, 1,920-, and 3,200-acre farms, respectively. The results suggest large-scale farms with 75% or greater equity should be able to withstand increased price variability better than smaller farms, while smaller farms are more dependent on price and income support farm programs. All farm sizes, however, suffer losses in income, wealth, and growth potentials when income and price supports are removed.

No Income Supports

Removing the target price/deficiency payment Scenario (5) reduced the probability of survival and the probability of receiving a positive net present value more for the 1,920-acre farm than the other two farms. Average ending farm size for the 1,920-acre farm was 15.4% less than the Base, while average ending farm size fell 13.3% for the 1,280-acre farm and 9.1% for the 3,200-acre farm. The loss in deficiency payments reduced average annual government payments $38,300 for the largest farm and $28,400 for the 1,280-acre farm. On a per-acre basis, the reduction in government payments was 300% greater for the 1,280-acre farm than the 3,200-acre farm.

Target Farm Program Benefits

If farm program provisions were to be targeted to farms producing $300,000 or less (Scenario 6), the largest wheat farm would be precluded from participating directly in the farm program in all

years. The two smaller farms would be able to participate in the farm program until they grew beyond the $300,000 threshold. The elimination of government payments for the 3,200-acre farm resulted in a 44% decrease in average ending net worth and a 17% decline in average ending farm size, relative to the Base. The 1,280-acre farm experienced a 10% decrease in its average annual government payments and the 1,920-acre farm showed a 58.5% decrease. Average net present value declined 9, 69, and 80% for the 1,280-, 1,920-, and 3,200-acre farms, respectively. These results indicate that targeting farm program benefits accomplished its objective in reducing the rate of growth for large-scale wheat farms while not affecting the rate of growth for small and moderate-size (1,280-acre) farms.

Under Scenario 6 (target farm program benefits) the 3,200-acre farm did not experience a decrease in its probability of survival as it did when all farm program benefits were removed (Scenario 7). This was due to indirect benefits from reduced price variability resulting from smaller farms participating in the CCC loan and FOR.

No Farm Program

Removing all farm program benefits (Scenario 7) reduced the probability of survival for all three representative wheat farms. The probability of survival fell from 100% under the Base to 48, 32, and 92% for the 1,280-, 1,920-, and 3,200-acre farms, respectively. The 3,200-acre farm was able to maintain a strong survival probability due to a strong initial financial position. Average ending net worth was less than initial net worth for all three farms. The three farms experienced negative average annual net farm incomes ranging from -$67,000 to -$25,000. As a result, the farms grew less than under the Base, although all three farms continued to grow by purchasing and leasing cropland. The 3,200-acre farm grew 17.6% less than under the Base while the 1,280- and 1,920-acre farms grew 22 and 24.3%, respectively.

More Restrictive Income Taxes

Imposing a more restrictive set of federal income tax provisions (Scenario 8) reduced average ending net worth, average net present value, and average ending farm size for all three farms. Probability of survival was not reduced from the Base for the representative farms. As expected, less favorable income tax provisions reduced the propensity of farms to grow through purchasing cropland in favor of growing through leasing land. The two larger farms experienced an average 9.7% decrease in average ending farm size from the Base while the 1,280-acre farm had an 8% decline. The greatest decine in average net present value was for the 1,920-acre farm while the smallest decline was for the 3,200-acre farm. This same pattern was also observed for the decline in average annual net farm income.

Financial Bailout Strategies

To analyze the effects of alternative financial bailout strategies, the financial positions for the three representative farms were modified to approximate highly leveraged farms. These modified wheat farms were simulated under the Base Policy Scenario, and with two alternative financial bailout strategies. The long-term debt to asset ratio for each farm was increased to 55%, the intermediate-term debt to assets ratios were increased to 68%, and annual interest rates were increased to their average values for 1980-1983 (11.37% for long term and 13.4% for intermediate term), and off-farm assets were set equal to zero. The results of these analyses are summarized in Tables 8-10.

TABLE 8. COMPARISON OF SELECTED FINANCIAL BAILOUT SCENARIOS FOR A REPRESENTATIVE 1,280-ACRE HIGH PLAINS WHEAT FARM

Criteria	Initial High Debt Situation	Alternative Scenarios[a] 9	10	11
Probability of survival (%)	--	86	98	100
Probability of positive net present value (%)	--	78	94	98
After-tax net present value mean ($1,000)	--	91.7	173.4	190.4
Average present value of ending net worth ($1,000)	252.3	288.9	407.6	382.7
Average ending cropland owned (acres)	640.0	662.7	700.8	678.4
Average ending cropland leased (acres)	640.0	770.8	848.0	873.6
Average ending cropland controlled (acres)	1,280.0	1,433.6	1,548.8	1,552.0
Average ending long-term debts ($1,000)	178.9	293.4	300.3	267.3
Average intermediate-term debts ($1,000)	145.2	151.7	95.8	91.9
Average ending equity ratio (fraction)	0.44	0.44	0.56	0.57
Average internal rate of return (fraction)	--	0.05	0.07	0.08
Average annual net farm income ($1,000)	--	-22.5	-21.2	-14.3
Average annual gov't payment ($1,000)	--	25.2	26.4	26.8

[a]9 Base Finance Scenario consists of the Base farm program provisions for a highly leveraged farm.

10 Restructure debt for a highly leveraged farm.

11 Interest rate subsidy (buy-down) in the first 2 years for a highly leveraged farm.

TABLE 9. COMPARISON OF SELECTED FINANCIAL BAILOUT SCENARIOS FOR A REPRESENTATIVE 1,920-ACRE HIGH PLAINS WHEAT FARM

Criteria	Initial High Debt Situation	Alternative Scenarios[a]		
		9	10	11
Probability of survival (%)	--	40	70	80
Probability of positive net present value (%)	--	40	68	78
After-tax net present value mean ($1,000)	--	-15.8	82.7	147.0
Average present value of ending net worth ($1,000)	351.4	258.2	398.8	405.6
Average ending cropland owned (acres)	840.0	868.8	865.6	878.4
Average ending cropland leased (acres)	1,080.0	1,124.8	1,192.0	1,240.0
Average ending cropland controlled (acres)	1,920.0	1,993.6	2,057.6	2,118.4
Average ending long-term debts ($1,000)	243.3	387.4	395.7	388.2
Average intermediate-term debts ($1,000)	211.3	286.7	230.1	203.8
Average ending equity ratio (fraction)	0.44	0.29	0.42	0.44
Average internal rate of return (fraction)	--	-0.02	0.02	0.04
Average annual net farm income ($1,000)	--	-37.9	-35.1	-24.1
Average annual gov't payment ($1,000)	--	34.8	35.2	35.6

[a]9 Base Finance Scenario consists of the Base farm program provisions for a highly leveraged farm.

10 Restructure debt for a highly leveraged farm.

11 Interest rate subsidy (buy-down) in the first 2 years for a highly leveraged farm.

TABLE 10. COMPARISON OF SELECTED FINANCIAL BAILOUT SCENARIOS FOR A REPRESENTATIVE 3,200-ACRE HIGH PLAINS WHEAT FARM

Criteria	Initial High Debt Situation	Alternative Scenarios[a]		
		9	10	11
Probability of survival (%)	--	100	100	100
Probability of positive net present value (%)	--	100	100	100
After-tax net present value mean ($1,000)	--	893.2	973.5	1,016.2
Average present value of ending net worth ($1,000)	540.9	1,248.3	1,372.7	1,348.2
Average ending cropland owned (acres)	1,400.0	1,646.4	1,745.6	1,697.6
Average ending cropland leased (acres)	1,800.0	2,132.8	2,232.0	2,193.6
Average ending cropland controlled (acres)	3,200.0	3,779.2	3,977.6	3,891.2
Average ending long-term debts ($1,000)	404.6	565.9	620.7	515.6
Average intermediate-term debts ($1,000)	286.3	61.5	73.7	53.8
Average ending equity ratio (fraction)	0.44	0.70	0.70	0.73
Average internal rate of return (fraction)	--	0.14	0.13	0.14
Average annual net farm income ($1,000)	--	17.1	12.4	27.5
Average annual gov't payment ($1,000)	--	43.9	44.1	44.0

[a]9 Base Finance Scenario consists of the Base farm program provisions for a highly leveraged farm.

10 Restructure debt for a highly leveraged farm.

11 Interest rate subsidy (buy-down) in the first 2 years for a highly leveraged farm.

The 3,200-acre wheat farm had a 100% chance of remaining solvent for 10 years under all three high initial debt scenarios. Under the Base, no financial bailout Scenario (9), the 1,920-acre farm had only a 40% chance of remaining solvent for 10 years while the 1,280-acre farm had an 86% chance of surviving. The 1,920-acre farm faced greater costs of production than the other two farms because it was at the breaking point when an additional hired hand had to be employed and an additional complement of machinery had been added. The 1,920-acre farm is thus more representative of a rapidly growing, highly leveraged wheat farm than either of the other two farms.

A debt restructuring bailout strategy (Scenario 10) increased the probability of the 1,920-acre farm remaining solvent to 70% and increased average net present value $98,500--from -$15,800 to $82,700 (Table 9). Due to restructuring the 1,920-acre farm's debt, average ending equity ratio for the farm increased from 0.29 to 0.42, although average annual net farm income increased less than $3,000.

A 2-year interest buydown program (Scenario 11) increased the probability of the 1,920-acre farm remaining solvent to 80% and increased average net present value about $163,000. Average annual net farm income was increased about $13,800 over the Base. Average ending farm size was increased 6% over the Base and 10% over the initial farm size of 1,920 acres. Similar effects were observed for the 1,280-acre farm. For both of the smaller farms, the interest buydown bailout strategy provided more benefits than the debt restructure strategy. Both restructure and interest subsidies, however, offered significant positive benefits to the highly leveraged smaller farms.

No New Technology

The simulation results presented above assumed the most likely technology scenario for the 10-year planning horizon. For comparison, three policy scenarios (1, 5, and 7) were analyzed assuming no new technology was adopted by the three representative farms. The results of these analyses are summarized in Tables 11-13. To evaluate the impacts of technology on the different-sized farms, one must compare the no new technology results in Tables 11-13 to their respective results in Tables 5-7.

The 3,200-acre wheat farm benefitted more from the new technology than the other two farms due to its immediate adoption of new technology. The 3,200-acre farm experienced the greatest absolute ($897,800) and percentage (361%) increase in average net present value from adopting new technology, given the current farm program (Scenario 1 vs. 12). The 1,920-acre farm had a 208% increase in average net present value under the Base Scenario, while the 1,280-acre farm had a 126% increase in net present value. These results are consistent with the assumptions made regarding adoption of new technology; the very large farm adopts first, followed by the large farm, which is followed by the moderate-sized farm. These results also hold for the no target price Scenario (5 vs. 13) and the no farm program (Scenario 7 vs. 14).

Average annual net farm incomes are substantially enhanced by the early adoption of new technology. Under the Base farm program, the 3,200-acre farm had a $51,000 increase in average annual net farm income by adopting new technology. The increase in average annual net farm income due to new technology was about $20,000 for the 1,920-acre farm and only about $4,000 for the 1,280-acre farm under the Base Policy Scenario. The increases in average annual net farm incomes due to technology were generally greater for these farms under the no farm program (7 vs. 14) and the no deficiency payment (5 vs. 13) scenarios.

Adoption of new technology for wheat and feed grains increased average ending farm size for all three farms under all three policy scenarios. The increase in average ending farm size over the no new technology scenario was generally greatest under the current farm program (Scenarios 1 vs.

TABLE 11. COMPARISON OF SELECTED FARM POLICY SCENARIOS ASSUMING NO NEW TECHNOLOGY SCENARIO FOR A 1,280-ACRE HIGH PLAINS WHEAT FARM

Criteria	Initial Farm	Alternative Scenarios[a] 12	13	14
Probability of survival (%)	--	100	90	32
Probability of positive net present value (%)	--	100	26	6
After-tax net present value mean ($1,000)	--	339.5	-89.3	-292.8
Average present value of ending net worth ($1,000)	470.3	725.8	325.4	134.3
Average ending cropland owned (acres)	640.0	956.8	774.4	668.8
Average ending cropland leased (acres)	640.0	902.4	857.6	761.6
Average ending cropland controlled (acres)	1,280.0	1,859.2	1,632.0	1,430.4
Average ending long-term debts ($1,000)	60.2	119.4	199.3	178.7
Average ending intermediate-term debts ($1,000)	83.2	38.9	129.7	218.3
Average ending equity ratio (fraction)	0.77	0.84	0.53	0.25
Average internal rate of return (fraction)	--	0.08	-0.01	-0.15
Average annual net farm income ($1,000)	--	-1.3	-28.9	-46.8
Average annual gov't payments ($1,000)	--	30.7	2.5	0.0

[a]12 -- Base Policy, continuation of 1981 Farm Bill, assuming most likely yields.
13 -- No Target Price/Deficiency payments assuming most likely yields.
14 -- No Farm Program assuming most likely yields.

TABLE 12. COMPARISON OF SELECTED FARM POLICY SCENARIOS ASSUMING NO NEW TECHNOLOGY SCENARIO FOR A 1,920-ACRE HIGH PLAINS WHEAT FARM

Criteria	Initial Farm	Alternative Scenarios[a] 12	13	14
Probability of survival (%)	--	100	44	10
Probability of positive net present value (%)	--	98	12	2
After-tax net present value mean ($1,000)	--	250.2	-324.4	-495.2
Average present value of ending net worth ($1,000)	642.3	779.9	228.9	81.3
Average ending cropland owned (acres)	840.0	1,150.4	984.0	856.0
Average ending cropland leased (acres)	1,080.0	1,454.4	1,320.0	1,192.0
Average ending cropland controlled (acres)	1,920.0	2,604.8	2,304.0	2,048.0
Average ending long-term debts ($1,000)	86.3	242.8	316.3	247.9
Average ending intermediate-term debts ($1,000)	126.3	55.2	310.5	362.9
Average ending equity ratio (fraction)	0.75	0.76	0.27	0.11
Average internal rate of return (fraction)	--	0.06	-0.13	-0.27
Average annual net farm income ($1,000)	--	-10.9	-52.9	-77.1
Average annual gov't payments ($1,000)	--	38.1	3.9	0.0

[a]12 -- Base Policy, continuation of 1981 Farm Bill, assuming most likely yields.
13 -- No Target Price/Deficiency payments assuming most likely yields.
14 -- No Farm Program assuming most likely yields.

TABLE 13. COMPARISON OF SELECTED FARM POLICY SCENARIOS ASSUMING NO NEW TECHNOLOGY SCENARIO FOR A 3,200-ACRE HIGH PLAINS WHEAT FARM

Criteria	Initial Farm	Alternative Scenarios[a] 12	13	14
Probability of survival (%)	--	100	82	28
Probability of positive net present value (%)	--	94	22	6
After-tax net present value mean ($1,000)	--	343.6	-260.4	-644.9
Average present value of ending net worth ($1,000)	970.7	1,130.9	561.9	219.9
Average ending cropland owned (acres)	1,400.0	1,672.0	1,528.0	1,412.8
Average ending cropland leased (acres)	1,800.0	2,027.2	2,014.4	1,908.8
Average ending cropland controlled (acres)	3,200.0	3,699.2	3,542.4	3,321.6
Average ending long-term debts ($1,000)	143.5	280.8	432.7	391.8
Average ending intermediate-term debts ($1,000)	171.3	78.5	292.6	453.3
Average ending equity ratio (fraction)	0.75	0.78	0.47	0.20
Average internal rate of return (fraction)	--	0.05	-0.02	-0.18
Average annual net farm income ($1,000)	--	-2.1	-45.4	-85.8
Average annual gov't payments ($1,000)	--	43.7	5.9	0.0

[a]12 -- Base Policy, continuation of 1981 Farm Bill, assuming most likely yields.
13 -- No Target Price/Deficiency payments assuming most likely yields.
14 -- No Farm Program assuming most likely yields.

12). About half of the growth for the 3,200-acre farm, under each policy scenario analyzed, was due to the early adoption of new technology. The proportion of farm growth due to the adoption of new technology was substantially less for the 1,280- and 1,920-acre farms. About 32% of the growth by the 1,920-acre farm was due to new technology while only 7% of farm growth for the 1,280-acre farm was due to new technology. These results indicate that farm programs had greater impacts on average ending farm size than did new technology, and that early adopters benefit more than those who adopt technology later.

Summary of Results

Base Policy Scenario

- All three representative farms had a 100% chance of remaining solvent through the 10-year planning horizon.
- All three farms had a 100% chance of having a positive net present value.
- On the average, all three farms were able to grow by purchasing and leasing cropland.
- The greatest percentage increase in ending farm size was for the 1,280-acre farm (48%) and the smallest increase was for the 3,200-acre farm (32%).

Acreage Reduction Programs

- Average net present value was increased for all three farms as a result of an acreage reduction program.
- A 20% acreage reduction program increased average ending farm size 2.8% for the 1,280-acre farm and 3.5% for the 3,200-acre farm.
- Average ending equity ratios for the two smaller farms were increased 2 percentage points by a 20% acreage reduction program.
- Average annual net farm incomes for the 1,280- and 1,920-acre farms were increased more than twice as much as for the 3,200-acre farm.
- Although average deficiency payment rates were reduced, average annual deficiency payments were increased slightly (less than $1,000) due to greater average ending farm size.

No Payment Limitation

- The larger the farm, the greater the impacts on farm growth and income from removing the $50,000 payment limitation on deficiency and diversion payments. Average net present value increased 32% for the 3,200-acre farm, 20% for the 1,920-acre farm, and only 2% for the 1,280-acre farm.
- Removing the payment limitation increased the average ending farm size 6.3% for the 3,200-acre farm while not affecting average ending farm size for the two smaller farms.

No Price Supports and No Deficiency Payments

- Removing price and income supports for wheat and sorghum reduced the probability of survival for the 1,280- and 1,920-acre farms while not affecting the 3,200-acre farm's probability of survival. The probability of survival for the 1,920-acre farm declined the most, 50 percentage points.
- Average net present value was reduced 132% for the 1,280-acre farm, 151% for the 1,920-acre

farm, and 78% for the 3,200-acre farm.

- Average ending farm size was reduced from the Base scenario for all three farms. The 1,280-acre farm controlled an average of 17% fewer acres, the 1,920-acre farm controlled 19% fewer acres, and the 3,200-acre farm controlled 16% fewer acres.

- Loss of price and income supports reduced average annual net farm incomes to less than zero for all three farms.

- The presence of an effective $50,000 payment limitation causes the income support program to benefit the 1,280-acre farm relatively more than the 3,200-acre farm. In contrast, the price support program benefits the 3,200-acre farm relatively more than the 1,280-acre farm.

No Target Price/Deficiency Payments

- Eliminating deficiency payments reduced the probability of survival more for the 1,920-acre farm than for the 3,200-acre farm. The 1,920-acre farm's probability of receiving a positive net present value also decreased more for the 1,920-acre farm than for the larger farm.

- The $50,000 payment limitation, if effective, reduced the current benefits of the deficiency payment for the 3,200-acre farm, so its loss reduced average ending farm size less than the two smaller farms.

- The loss of deficiency payments reduced the average net present value of smaller farms more than twice as much as for the 3,200-acre farm.

- Average ending farm size was reduced more in percentage terms for the smaller farms (-13.3% and -15.4%) than for the 3,200-acre farm (-9%) if deficiency payments removed.

Target Farm Program Benefits to Small Farms

- The 3,200-acre farm was prevented from participating directly in the various farm program provisions in all years. As the 1,280- and 1,920-acre farm grew beyond the $300,000 threshold, they were similarly excluded from direct farm program provisions.

- The 3,200-acre and 1,920-acre farms experienced greater absolute and percentage declines in average net present value and average ending farm size than the 1,280-acre farm. Average ending farm size for the 3,200-acre farm declined 17% while the 1,280-acre farm did not decrease its average ending farm size.

- Although the 3,200-acre farm was unable to participate directly in the price support program, it benefited indirectly from the price stabilization effect of the loan and FOR.

No Farm Program

- Removing all farm program provisions reduced the 1,280- and 1,920-acre farm's chances of survival to 48% and 32%, respectively, while reducing the 3,200-acre farms chance of survival to 92%.

- The percentage reduction in average net present value was similarly reduced more for the 1,280- and 1,920-acre farms than the 3,200-acre farm.

- In the absence of farm programs, all three farms continue to grow but at a much slower rate than under the Base program. The 3,200-acre farm grew about 17% less than the Base while the 1,280- and 1,920-acre farms grew 22 and 24%, respectively, less than the Base.
- The reduction in land values, due to removing farm program benefits, resulted in all three farms experiencing losses in net worth over the planning horizon.

More Restrictive Federal Income Tax Provisions

- More restrictive federal income tax provisions reduced the average annual rate of growth more for the two larger farms than for the 1,280-acre farm.
- Increasing the federal income tax burden on farmers reduced their propensity to grow through purchasing cropland relative to leasing.
- Probability of survival and probability of receiving a positive net present value were not affected by more restrictive income tax provisions.
- All three farms experienced reductions in average annual net farm income. The 3,200-acre farm experienced the greatest absolute reduction in net farm income $20,000, followed by the 1,920-acre farm.

Financial Bailout Strategies

- Restructuring debt for highly leveraged wheat farms provided a substantial benefit to the three farms. Average net present value and the probability of survival for all three farms was raised due to a debt restructuring program.
- An interest rate buy-down strategy increased the probability of survival more than the debt restructure strategy. For the most disadvantaged farm, this strategy doubled the probability of survival, going from 40 to 80%.

Impact of Technology

- Early adopters of new technology experienced greater annual growth rates than later adopters. New technology accounted for none of the 1,280-acre farm's growth while it accounted for 50% of the 3,200-acre farm's growth under the Base farm program.
- Farm programs had a greater effect on average ending farm size for the 1,280- and 1,920-acre farms than new technology. New technology accounted for 50% of 3,200-acre farm's growth under the Base program and 65% of the farm's growth under the no farm program scenario.

Literature Cited:

Gardner, B. L. "Public Policy and the Control of Agricultural Production." *Amer. J. Agr. Econ.,* 60(1978):836-843.

Gardner, B. D., and R. D. Pope. "How is Scale and Structure Determined in Agriculture?" *Amer. J. Agr. Econ.,* 60(1978):295-302.

Morton, A. S., S. Devadoss, and E. O. Heady. "Potential Grain Price Instability Under Alternative Farm Policies," The Iowa State University, Card Report 129, 1984.

Office of Technology Assessment. *Technology, Public Policy, and the Changing Structure of American Agriculture: A Special Report for the 1985 Farm Bill,* Congress of the United States, OTA, February, 1985.

Quance, L., and L. G. Tweeten. "Policies, 1930-1970." *Size, Structure and Future of Farms,* (eds., G. Ball and E. O. Heady), Ames: Iowa State University Press, 1972.

Richardson, J. W. and C. J. Nixon. "Description of FLIPSIM V: The General Firm Level Policy Simulator," Texas A&M University, Department of Agricultural Economics, mimeo, 1985.

Smith, E. G. "Economic Impact of Current and Alternative Farm Programs on Farm Structure in the Southern High Plains of Texas," Unpublished Ph.D. Dissertation, Texas A&M University, 1982.

U.S. Department of Agriculture. *Economic Indicators of the Farm Sector: Income and Balance Sheet Statistics,* ERS-ECIFS, 2-2, 1982.

U.S. Department of Agriculture. *Farm Real Estate Market Developments,* ESCS, CD-84, issues in 1970-1984.

U.S. Department of Agriculture. Unpublished data for the 1979 *Ag Finance Survey* were provided by USDA, July, 1984.

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