FINANCIAL VIABILITY AND PROFITABILITY OF COTTON FARMS IN THE TEXAS HIGH PLAINS REGION AFTER THE FAIR ACT OF 1996

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Abstract

Recent policy changes in United States agriculture have brought added importance to risk management for farms. The 1995 Federal Agricultural Improvement and Reform (FAIR) Act has set forth legislation which gradually reduces government payments to farms through 2002, exposing farmers to increasing levels of risk. This study analyzed the financial and production results for two cotton farms in the Texas High Plains, then projected the future viability of each farm as its level of risk increased. The simulation results indicated that Farm 1 could remain profitable despite rising levels of debt and uncertainty, as shown by a probability of survival of 100%. Farm 2's probability of survival was only 60%, with the difference between producers primarily due to a difference in the cash cost to receipts ratio, which is a measure of operating efficiency.

General Problem

Risk is one of the many challenges confronting any business manager. Agribusiness firms, however, face an inordinate amount and variety of risks. Crop and livestock performance depends on biological processes which are affected by weather, diseases, insects, weeds, feed conversion, and soil fertility (Kay and Edwards, 1994). The uncertainty associated with these biological processes is referred to in agriculture as production uncertainty (Lee et al, 1988). Agriculturalists are also subject to higher levels of market risk than are producers in other industries. Since the demand for agricultural products is relatively inelastic, small changes in supply result in disproportionally larger changes in prices. Farmers, unlike most industrial producers, are price takers. Therefore, farmers are forced to accept these large price fluctuations, resulting in high farm income variability (Browne et al, 1992).

Recent policy changes in United States agriculture have increased the importance of risk evaluation. Low farm income traditionally has been the major justification for programs that support farm prices. U.S. agricultural policy finds its origins primarily in the New Deal legislation enacted in response to the economic maladjustments of the Great Depression (Meyer et al, 1985). The Agricultural Adjustment Act of 1938 introduced price supports for all major agricultural commodities. Although these price support policies have undergone various transformations over the last half-century, they have continued to serve as a stabilizing agent for farm income (Meyer et al, 1985). However, the 1995 Federal Agriculture Improvement and Reform Act (FAIR Act) sets forth legislation which gradually reduce government payments to farmers and ends these in 2002, thus exposing farmers to increasing levels of risk. Total risk can be separated into two major components--business risk and financial risk. Business risk is the risk derived from the uncertainty due to the nature of the enterprise. Business risk in agriculture is influenced by price variability, production variability, and various internal factors. Financial risk is the added variability of net cash flows to owner's equity resulting from the financial obligations associated with debt financing. Therefore, a computation of total risk to returns to equity capital can be achieved by adding business and financial risk. Farmers must possess an acute awareness of their individual risk levels in order to determine the amount of financed capital to employ.

Specific Problem

As the FAIR Act increases farm income volatility, farmers may find it necessary to alter the financial structure of their farms to maintain an acceptable level of total risk. Farmers must be aware of their farms' ability to survive given their current debt structures as risk increases in order to make informed decisions concerning changes in debt structures.

Objectives

The general objective of this study was to aid Texas High Plains cotton farmers in evaluating their ability to accommodate the increasing levels of risk associated with the enactment of the FAIR Act. The specific objectives were: (1) to select specific farms and analyze their financial structure; (2) to estimate the additional risk as the farm's dependence upon price supports decreases; (3) to apply the financial structure of the farm to a simulation model that incorporates the increasing level of risk; and (4) to analyze the farm's financial viability and profitability based on the simulation.

Farm Economic Outlook Reports

Smith, et al. (1996) reported on the farm level economic impacts of implementing the FAIR Act over the 1996-2002 planning horizon using the Farm Level Income and Policy Simulation Model (FLIPSIM). Producer panels were assembled to construct the representative farms. Seventy-one representative farms were analyzed. The analysis found that seven of the ten upland cotton farms experienced growth in real equity over the study period. A large Texas Southern Plains operation exhibited 76% real growth in equity, the highest among all cotton farms. The report also projected a 13 percent increase in variable cash expenses for cotton production over the 1996-2002 period, subjecting

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cotton farms to more of a price-cost squeeze than other crops simulated.

Haynes (1996) evaluated the economic impact of plant stress on crops grown in the Texas High Plains Region (THPR) and the impact of biotechnological advances relating to plant stress reduction on farm profitability and financial viability. He reached several conclusions regarding the use of debt in THPR cotton farms. He found that the representative farms were only profitable and viable at lower levels of debt. He also found that the return on assets for the farms was less than the cost of debt. He concluded that the use of debt is not profitable for THPR cotton farms, implying that the optimal level of debt for these farms is zero. In the context of this research, these findings suggests that the optimal amount of financial risk for a farmer to assume is zero.

Standardized Performance Analysis

Clark and Johnson (1997) define Standardized Performance Analysis (SPA) as a management tool designed to assist producers with farm and ranch financial and production analysis. The SPA methodology consolidates farm financial statements and production information into a performance analysis of a total farming operation. Standardized Performance Analysis-Multiple Enterprise (SPA-ME) performs a single analysis on a farming operation containing both crop and livestock enterprises (McGrann and Michalke). The SPA-ME program also facilitates the development of accrual adjusted farm financial statements following the recommendations of the Farm Financial Standards Council. The program's analysis consists of a summary table of investment, financial, and economic information for each enterprise and sub-enterprise. The investment information is broken down into balance sheet formats for both a cost and market valuation. The financial and economic performance of the farm enterprises are described in dollars per pound and dollars per acre. The SPA report also calculates the return on equity and the equity-to-asset ratios on both a cost and market basis.

Field tests of the SPA-ME program on cotton farms in the Texas High Plains Region for the 1997 crop year have yielded several findings applicable to this research. The studies have shown that government payments represent 7.4% and 7.6% of the gross accrual revenue to dryland and irrigated cotton farms, respectively. Clark and Johnson propose that farmers who rely heavily on government payments as a source of income may need to adjust some management and marketing practices as farm program payments are reduced under the FAIR Act. Preliminary financial ratio analyses show that the equity-to-asset ratio is 53.14% for irrigated cotton farms and 47.09% for dryland cotton farms. A comparison of the return on assets (ROA) ratios and the return on equity (ROE) ratios show that ROE is less than ROA for both irrigated and dryland farms, indicating that these farms are paying more interest on borrowed money than the returns they are earning by borrowing this money. Clark and Johnson suggest that producers may need to reconsider the use of debt to finance their operations. This finding is consistent with Haynes' findings.

Methods and Procedures

The cotton farms analyzed in this research were taken from the Texas High Plains Region (THPR). Two farms with varying amounts of debt were used in the simulation program to facilitate meaningful comparisons. The simulations were then altered to reflect a high, medium, and low debt level between which further comparisons were made.

The first farm chosen for the simulation (hereinafter referred to as "Farm 1") is located in Lubbock county and consists of 743 acres of dryland cotton, 743 acres of irrigated cotton, 303 acres of milo, and 137 acres of dryland wheat. Of the 1,926 total acres, 253 acres are owned by the sole proprietor and 1,673 acres are crop-share leased. The baseline debt structure (long-term debt to long-term assets) is 27%. For the purposes of simulation, family living withdrawals are estimated to be a minimum of $40,000 per year while miscellaneous machinery purchases are estimated to be $5,000 per year.

The second farm chosen for the simulation (hereinafter referred to as "Farm 2") is also located in Lubbock county and consists of 360 acres of irrigated cotton, 157 acres of irrigated milo, and 34 acres of dryland wheat. All of the 551 total acres are leased with a 75% crop-share agreement. The baseline debt structure is 38%. Family living withdrawals and miscellaneous machinery purchases are estimated to be equal to those of Farm 1.

The financial structure of the chosen farms was analyzed by entering the financial information regarding those farms into the SPA-ME computer program. Financial information was derived from the balance sheets, income statements, and cash flow statements completed by the producer. SPA-ME generated the financial ratios of the farm based on the information from the financial statements. These financial ratios were the measures used to evaluate the financial structure of each farm (Clark and Johnson, 1996). A measure of dispersion was applied to the price of cotton to reflect an increase in risk. The level of risk is assumed to increase incrementally each year as the price supports are phased out. This increase in risk was reflected by an increase of 25 percent in the variability of the price of cotton.

The simulation method used in this research was the Farm Level Income and Policy Simulation Model (FLIPSIM). Input for FLIPSIM includes the financial, production, farm program history, and enterprise budget information for each case study farm, as well as projected market prices and

market price variability. The model consists of a complex set of generally accepted accounting equations to keep track of the annual production and marketing activities for each crop produced on a farm. The simulation plants and harvests the crops using each crop's budget information and the farm's crop mix. Once a crop is produced and marketed, the program calculates variable expenses such as the production, harvesting, and marketing costs for each crop based on acres planted and harvested, crop yield, and inflation rates. Fixed cash costs are computed based on their initial values, then adjusted for inflation. Cash receipts for selling each crop are adjusted for share rental arrangements and then added to the operator's share of deficiency payments to calculate total receipts.

The annual financial activities for a farm are simulated using standard financial equations to amortize simple interest loans. Net cash farm income is obtained by subtracting all cash expenses from all cash receipts. Farm machinery is updated annually by calculating each item's depreciation and replacing items that have outlived their specified economic life. The farm's ending cash balance for each year is obtained by subtracting principal payments, family living withdrawals, income taxes, and self-employment taxes from net cash farm income and the beginning cash balance.

The year end cash balance is added to the updated value of land, machinery, and livestock to calculate the farm's total assets. The updated liabilities for the farm are calculated after making the annual payments for land and machinery loan payments. If the farm experienced a cash flow deficit, long-term liabilities are increased to refinance the deficit. The annual planning horizon is simulated recursively so that the ending financial situation for year one is the beginning situation for the next year (Richardson, Smith and Gray, 1995). The simulation model generates information relating to the viability of the farms at the end of a ten year period, such as the probability of survival, ending leverage ratio, ending net worth, ending farm size, total assets, total debt, net present value of the farm, whether the farm remained solvent based on its financial ratios, and an increasing variability of cotton prices (Haynes, 1996).

Analyzing the Farms' Financial Viability and Profitability

The FLIPSIM model generated six different measures of financial viability and profitability. These six variables were used in analyzing the farms.

1. **The probability of survival** is defined as the probability that a farm will remain solvent over the ten-year horizon. It is more specifically defined as the probability that the equity to assets ratio remains greater than 0.25 over the ten-year period.
2. **The probability of decreasing real equity** is the probability of the farm decreasing in equity over the ten-year horizon, after adjusting for inflation.
3. **Average annual net farm income** is defined as net cash farm income minus depreciation. Net cash farm income is defined as gross receipts minus all cash production cost, including interest. Net cash farm income is used to pay family living expenses, principal payments, income taxes, and machinery replacement costs.
4. **Average annual cash costs to receipts ratio** is defined as the ratio of cash costs to cash receipts.
5. **Return to assets** is defined as net income divided by average total assets.
6. **Return to equity** is defined as net income divided by average total equity.

For the purposes of this study, financial viability was measured primarily by the probability of survival, while profitability was measured by average annual net farm income.

Results

This section reports the results of a ten-year simulation for Farms 1 and 2, then compares the results of the two farms.

Farm 1 Results

The probability of survival for Farm 1 (the probability that the equity to assets ratio remains greater than 0.25 over the ten-year period) remains at 100 percent across the range of debt to asset ratios evaluated (0.2 to 0.7), as shown in Figure 1. The debt level of Farm 1 exhibits no substantial relationship to the long-term economic performance of the farm. The actual debt to assets ratio for Farm 1 is approximately 25 percent, indicating that the farm has a 100 percent probability of survival over a ten-year period.

The farm also experiences a very low probability of decreasing net worth as shown in Figure 2. The farm begins with a 5 percent probability of decreasing net worth from 1996 to 1997, lowers to 2 percent over the next year, and then lowers to 0 percent throughout the remainder of the planning horizon. This beginning probability of decreasing net worth can be explained by the amount of carryover crop held over after the first marketing year in the planning horizon. Carrying over crop receipts results in lower crop receipts in the beginning years of the ten-year period. Once a marketing pattern is established, accrual adjusted income is higher.

The average annual net farm income for Farm 1 is shown in Figure 3. The portion of the crop carried over results in a lower income over the beginning years of the planning horizon. Despite the sharp drop in net income realized after the year 2002, Farm 1 remains profitable over the ten-year

period. For each debt level, net profit decreases by over $20,000 between the years 2002 and 2003 as government payments end. Figure 3 also shows that the level of debt exerts only a slight influence on net income for Farm 1. Over the ten-year planning horizon the farm does not experience any probability of negative cash farm income.

The cash costs to receipts ratios are displayed in Figure 4. The ratios are relatively high at the beginning of the planning horizon because much of the first year's crop was carried over, lowering the cash receipts. The cash costs to receipts ratio jumps in 2002 when the government payments are terminated as mandated by the 1996 FAIR Act. The debt structure of the farm appears to exert minimal influence upon the cash cost to receipts ratio.

Figures 5 and 6 show the return to assets and return to equity for Farm 1. At the beginning of the planning horizon the farm yields a 45 percent return to assets, declining to 15 percent by the end of the ten-year period. The return to equity exhibits a similar behavior as it drops from approximately 50 percent to 15 percent throughout the planning horizon. Farm 1 experiences such a high level of profitability that the farm generates and accumulates excess cash in each year of the planning horizon. Therefore, the return to assets and return to equity figures are distorted as accumulating cash reserves inflate the level of assets and equity. The farmer may maintain the high returns by expanding the farming operation with the excess cash.

The financial measures shown in Figures 1 through 6 collectively demonstrate that the different levels of debt applied to the simulation of Farm 1 have a small affect upon the probability of survival, the probability of decreasing net worth, the level of cash farm income, or the cash costs to receipts ratio.

Farm 2 Results

Figure 7 presents the probability of survival for Farm 2 at varying levels of debt. The probability of survival for Farm 2 over the ten-year period demonstrates an inverse relationship to the beginning debt structure. At a relatively low debt structure of 25 percent debt to assets ratio, the farm's probability of survival is relatively high at 75 percent. However, as the debt to assets ratio increases to 70 percent, the probability of remaining solvent drops to 34 percent. The actual debt to assets ratio for Farm 2 is approximately 40 percent, indicating a probability of survival of slightly above 60 percent over the next ten years.

The probability of decreasing net worth over the planning horizon is shown at varying debt levels in Figure 8. The probability of decreasing net worth is relatively high in the beginning years of the planning horizon as the first year's crop receipts are carried over into subsequent years. A minimum probability is reached for all debt levels in the year 2000 and the subsequent upward trend increases after the year 2002 when government payments cease. Figure 8 also reveals a positive relationship between the probability of decreasing net worth and the debt level.

Figure 9 shows the probability of negative cash farm income over the planning horizon. A positive relationship between the probability of negative cash farm income and the debt level is expressed. A minimum probability is reached in the year 1999 followed by a steady increase throughout the remainder of the planning horizon.

Figure 10 shows the average annual net income over the ten-year period for Farm 2 at differing debt levels. Farm 2, as did Farm 1, exhibits a sharp decline in net farm income after the year 2002. An inverse relationship is shown between the debt level and level of net farm income. As the level of long term debt increases, the average annual profit declines.

The cash costs to receipts ratios for Farm 2 are shown in Figure 11. The cash costs to receipts ratios reach a minimum in the year 1999 and increase throughout the remainder of the planning horizon. The farm experiences a dramatic increase in the cash costs to receipts ratio after the year 2002. The figure displays a positive relationship between the cash costs to receipts ratio and the debt level.

Figure 12 shows the average annual rate of return to assets for Farm 2. The rate of return reaches a maximum of approximately 30 percent in the year 2002 and then decreases dramatically to approximately 18 percent by the year 2004 as government payments cease. Figure 12 shows that the debt level exhibits only a slight inverse relationship to the rate of return to assets.

Figures 7 through 12 suggest that Farm 2's performance as measured by the probability of survival, the probability of decreasing net worth, the net farm profit, and the cash costs to receipts ratio is greatly impacted by the farm's debt level. These figures also reveal the effects of the elimination of the transition payments on the farm's profitability.

Comparison of Farms 1 & 2

Although the level of performance for Farm 2 is highly contingent upon the debt structure of the farm, Farm 1 remains profitable regardless of the level of debt. A comparison of the simulation results of the two farms is needed in order to draw meaningful conclusions regarding the true relationship between debt structure and probability of survival.

A notable difference exists in the cash costs to receipts ratio for the two farms as shown by Figure 13. The average annual cash costs to receipts ratios are considerably lower for Farm 1 than for Farm 2, indicating that Farm 1 has a higher operating efficiency than Farm 2. The higher level of operating efficiency may allow Farm 1 to manage more profitability at higher levels of debt. Tables 1 and 2

summarize the financial viability and profitability measures of the Farms 1 and 2, respectively.

Summary

The general objective of this study was to aid Texas High Plains cotton farmers in evaluating their ability to accommodate the increasing levels of risk associated with the enactment of the FAIR Act. The specific objectives were to select specific farms and analyze their financial structure, to estimate the additional risk as the farm's dependence upon price supports decreases, to apply the financial structure of the farm to a simulation model that incorporates the increasing level of risk, and to analyze the farm's financial viability and profitability based on the simulation.

Two Texas High Plains cotton farms with varying debt levels were selected for the analysis. Farm 1 is located in Lubbock county and consists of 743 acres of dryland cotton, 743 acres of irrigated cotton, 303 acres of milo, and 137 acres of dryland wheat. The baseline debt structure is approximately 25%. Farm 2 is also located in Lubbock county and consists of 360 acres of irrigated cotton, 157 acres of irrigated milo, and 34 acres of dryland wheat. The baseline debt structure is 38%. Their financial structures were analyzed using Standardized Performance Analysis-Multiple Enterprise (SPA-ME), a prototype software package. SPA performs a single financial analysis on a farming operation containing both crop and livestock enterprises.

The level of risk for the farms is assumed to increase as the price supports are phased out. The increase in risk was reflected by a 25 percent increase in the variability of the price of cotton. The simulation method that was used in this research was the Farm Level Income and Policy Simulation Model (FLIPSIM). FLIPSIM is a recursive programming simulation model developed to describe and predict the effects of alternate agricultural policies and economic conditions on the income flows, resource use, and financial characteristics of a farm over a ten-year planning horizon. The increased variability of the price of cotton was incorporated into the FLIPSIM model.

The simulation results indicate that the debt level of Farm 1 exhibits no substantial relationship to the long-term economic performance of the farm. The farm also experiences a very low probability of decreasing net worth as farm income remains high throughout the 10-year planning horizon. The farm's ability to remain profitable even at high debt levels may be explained by its relatively low cash costs to receipts ratio, indicating that Farm 1 has a relatively high operating efficiency.

The simulation results for Farm 2 indicate that the probability of solvency for Farm 2 over the ten-year period demonstrates an inverse relationship to the beginning debt structure. The probability of survival for Farm 2 over the ten-year period at its actual structure is slightly above 60 percent. The simulation further reveals a positive relationship between the probability of decreasing net worth and the debt level as well as a persisting probability of negative cash farm income. Farm 2 also demonstrates an inverse relationship between the debt level and the level of net farm income as well as a positive relationship between the debt level and the cash costs to receipts ratio. The farm's inability to remain profitable at high debt levels may be explained by its relatively high cash costs to receipts ratio, indicating that the farm has a weaker operating efficiency.

Farms 1 and 2 were impacted by the termination of the government payments. Farms 1 and 2 realize a sharp decline in net income and an increase in the cash costs to receipts ratio after the year 2002 when government payments end. Farm 2 also experiences an abrupt decline in its rate of return to assets after the year 2002. The elimination of the transition payments adversely affected profitability on both farms. In particular, the effects of elimination of transition payments increased the probability of negative net income for Farm 2.

Conclusions

The results of this study show that a profitable farm, primarily due to a high operating efficiency, can continue to perform profitably while assuming higher levels of debt, while an unprofitable farm, due to a weaker operating efficiency, significantly decreases its probability of survival as the debt level increases. The implication derived from this finding is that the level of both farm profitability and debt contribute significantly in determining the farm's probability of survival. A positive relationship between farm profitability and the probability of survival is expressed, while an inverse relationship between the debt level and the probability of survival is shown. Therefore, the risk constraint for a highly profitable farm allows a significant increase in the financial risk to the farm without adversely affecting the farm's probability of survival. However, the risk constraint for a marginally profitable farm requires that the farm minimize its financial risk by minimizing its use of financed capital.

Economies of size of the farm may be the primary factor affecting the farm's level of operating efficiency, concluding that small farms may need to expand. In this study Farm 1, with a higher operating efficiency, farms 1,926 acres, while Farm 2, with a lower operating efficiency, farms only 551 acres. However, if the expansion requires assuming a significant amount of additional debt, the effects of altering the debt structure must also be considered. If the increase in profitability increases the total risk constraint enough to compensate for the added financial risk associated with the additional debt, the farm should expand. However, if the increase in profitability does not

increase the total risk constraint enough to compensate for the additional financial risk, the farm should not expand.

This study also revealed the effects of the elimination of the government payments upon Texas High Plains cotton farms. The farms in this study realized adverse trends in various profitability measures such as a decrease in net farm income and an increase in the cash costs to receipts ratio after the year 2002. This increase in government payments represents an exogenous shock increasing the business risk to the farm. As the business risk to the farm increases, farmers will need to decrease the financial risk to the farm by lowering their debt levels to comply with the farm's total risk constraint.

Implications

This study has concluded that the risk constraint for a highly profitable farm allows a significant increase in the financial risk to the farm without adversely affecting the farm's probability of survival, while the risk constraint for a marginally profitable farm requires that the farm minimize its financial risk by minimizing its use of financed capital. Further studies should seek to define the level of profitability necessary for THPR cotton farms to assume additional risk without adversely affecting the probability of survival. This will allow THPR cotton farms with various levels of profitability to ration their capital in such a way as to maximize their probability of survival.

Limitations

Two major limitations are evident in this research study. First, the assumption for each farm that a portion of the cotton crop is carried over into the next year results in lower crop receipts in the beginning years of the ten-year period. Accrual adjusted income is not accurately reflected until a marketing pattern is established, creating difficulty in analyzing trends throughout the planning horizon. Second, limiting the number of farms in the THPR to only two farms creates a likelihood that this study does not adequately represent the majority of farms in the region.

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Table 1. Summarization of Financial Viability and Farm Profitability Measures for Farm 1

	Long-Term Debt Structure		
	0.25	0.55	0.75
Prob. of Survival	100	100	100
Prob. of Decreasing Real Net Worth	0	0	0
Avg. Annual Net Farm Income (1996-2005)	$212,200	$209,787	$208,569
Avg. Annual Cash Costs to Receipts Ratio (1996-2005)	54.96	55.50	55.77
Avg. Annual Return to Assets Ratio (1996-2005)	29.65	30.33	30.69
Avg. Annual Return to Equity Ratio (1996-2005)	30.40	32.89	34.35

Table 2. Summarization of Financial Viability and Farm Profitability Measures for Farm 2

	Long-term Debt Structure		
	0.25	0.55	0.75
Prob. of Survival	75	49	34
Prob. of Decreasing Real Net Worth	60	68	74
Avg. Annual Net Farm Income (1996-2005)	$36,178	$29,765	$26,374
Avg. Annual Cash Costs to Receipts Ratio (1996-2005)7	74.64	78.46	80.47
Avg. Annual Return to Assets Ratio (1996-2005)	29.65	30.33	30.69
Avg. Annual Return to Equity Ratio (1996-2005)	22.45	23.64	23.93

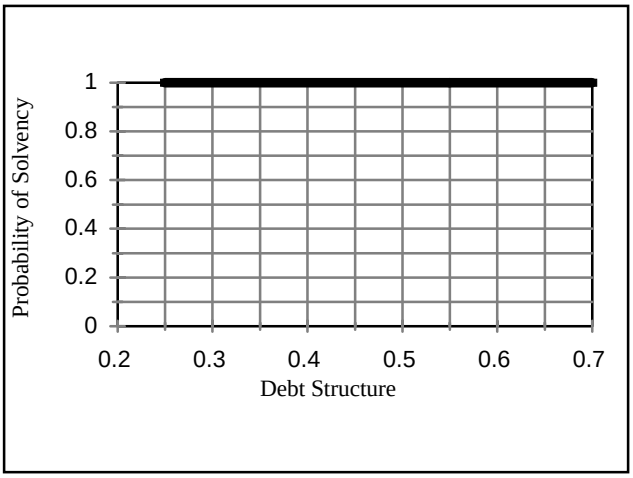

Figure 1. Probability of Survival for Farm 1.

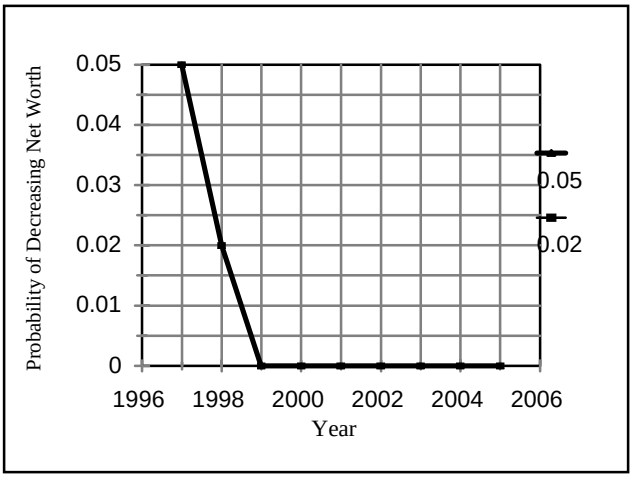

Figure 2. Probability of Decreasing Net Worth for Farm 1.

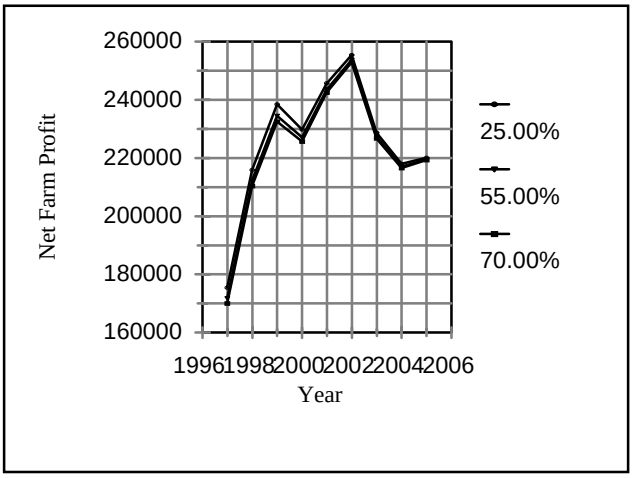

Figure 3. Average Annual Net Farm Income for Farm 1.

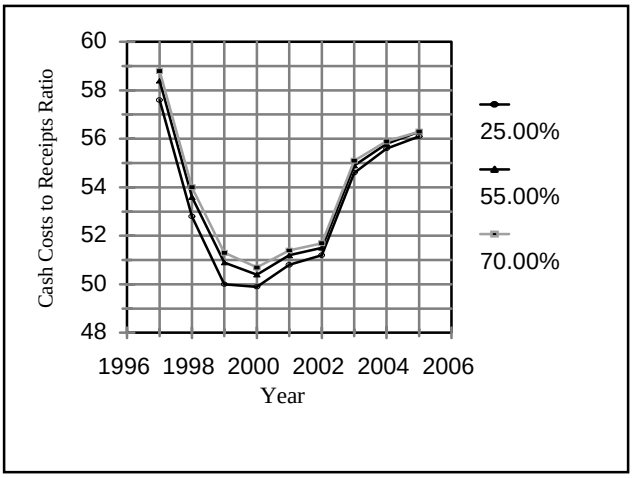

Figure 4. Average Annual Cash Costs to Receipts Ratios for Farm 1.

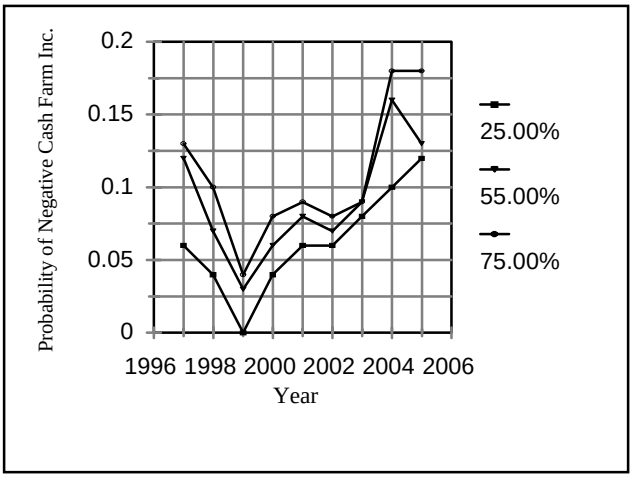

Figure 7. Probability of Negative Cash Farm Income for Farm 2.

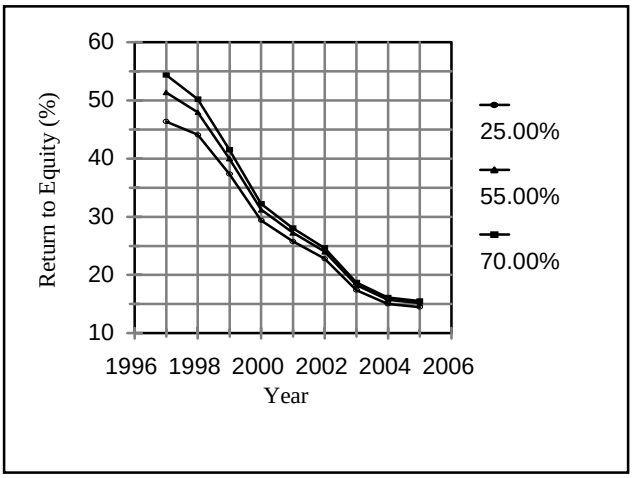

Figure 5. Average Annual rate of Return to Equity for Farm 1.

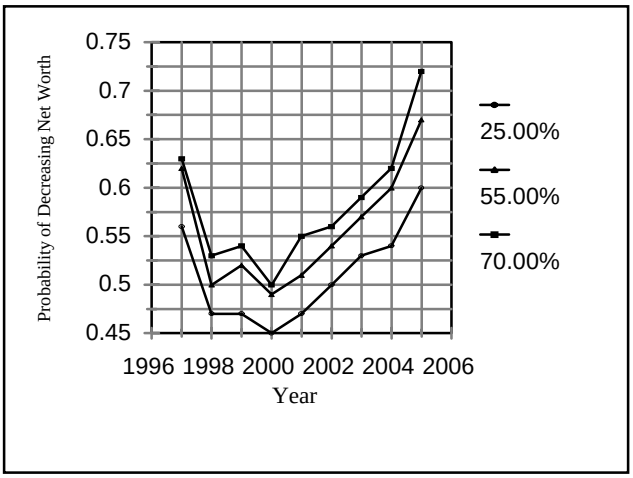

Figure 8. Probability of Decreasing Net Worth for Farm 2.

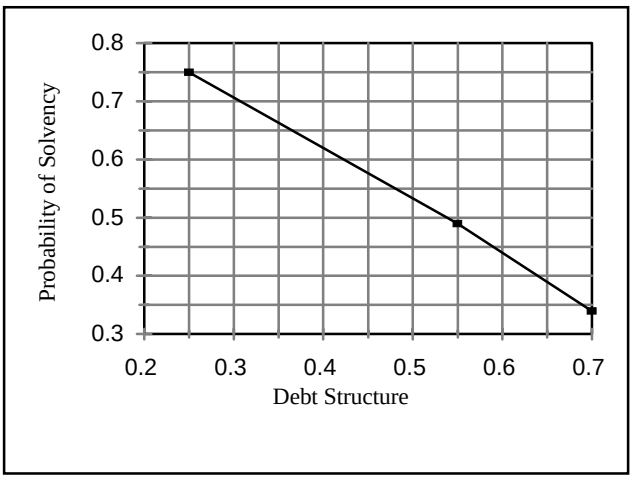

Figure 6. Probability of Survival for Farm 2.

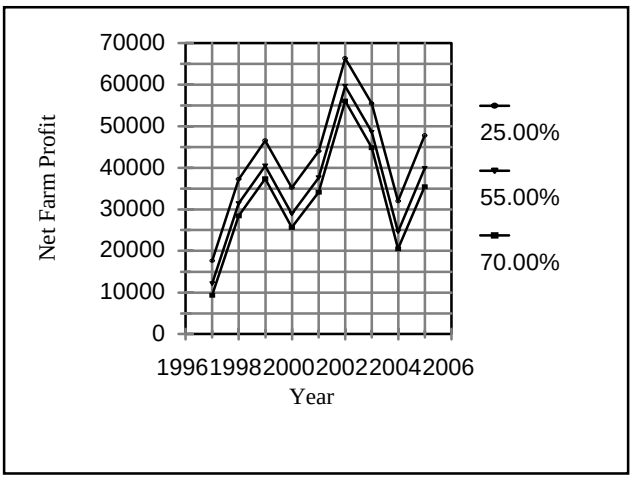

Figure 9. Average Annual Net Farm Income for Farm 2.

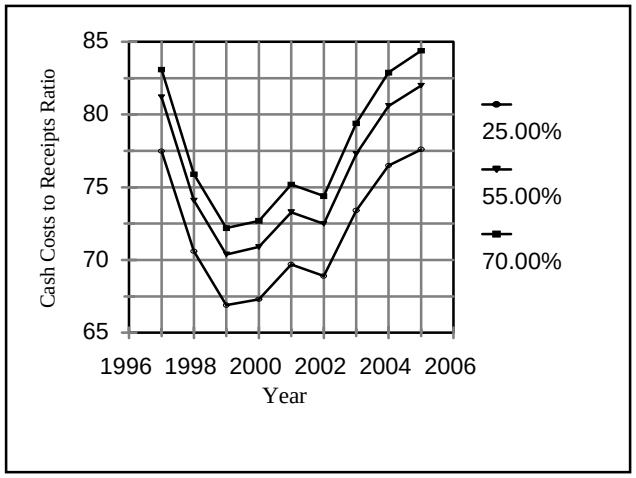

Figure 10. Average Annual Cash Costs to Receipts Ratio for Farm 2.

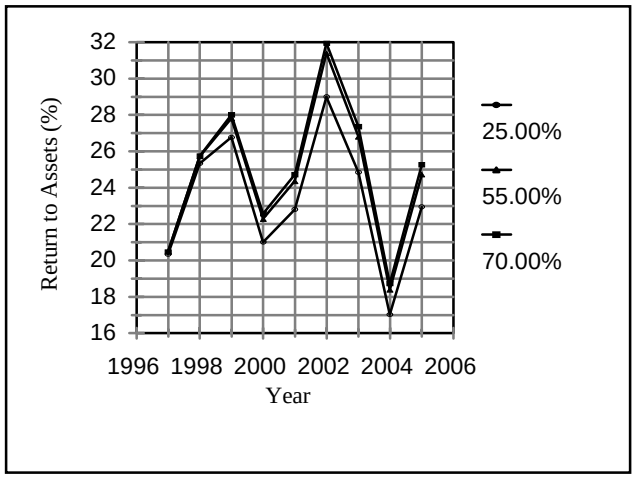

Figure 11. Average Annual Rate of Return to Assets for Farm 2.

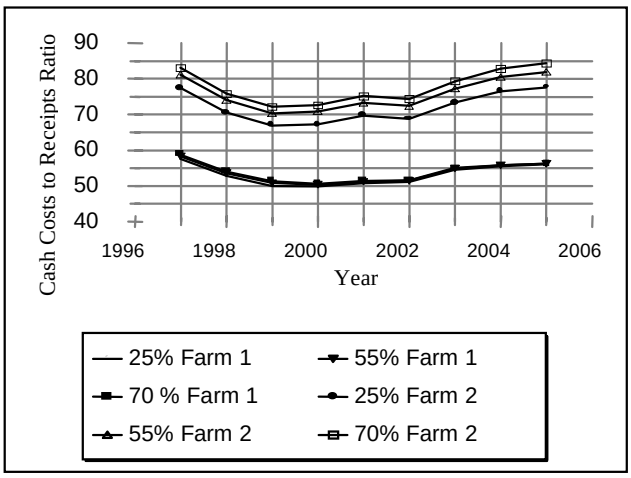

Figure 12. Comparison of Average Annual Cash Costs to Receipts Ratio.