

equity infusion cut back

total farm assets

investment credit high

return years farm size

specialization vs

diversification asset

liquidation farm crises

machinery investment

current prices interest

rates forced to sell

two-enterprise returns

income fluctuation

commodity sales family

consumption patterns net

cash flow liability

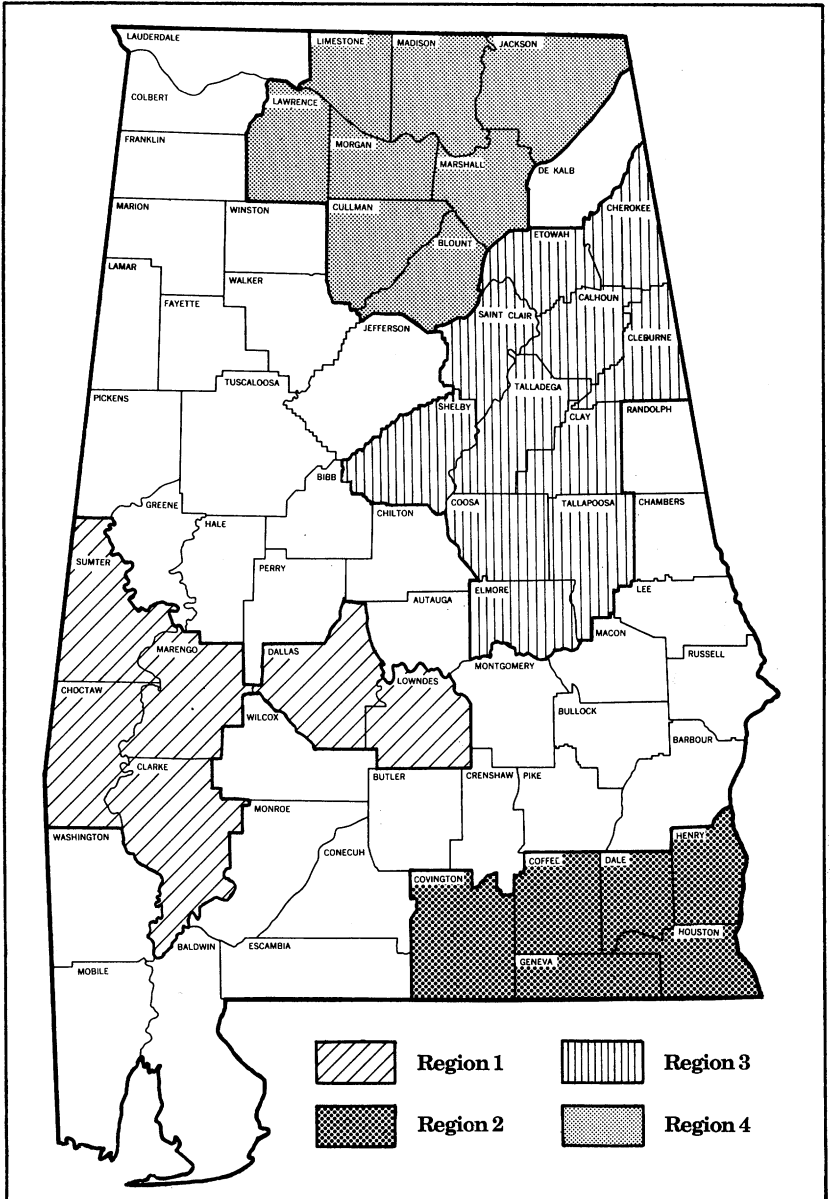


CIRCULAR 290 JUNE 1987

ALABAMA AGRICULTURAL EXPERIMENT STATION  
AUBURN UNIVERSITY

LOWELL T. FROBISH, DIRECTOR AUBURN UNIVERSITY, ALABAMA





Farm level data were collected from these four geographical regions of Alabama.

## SUMMARY AND IMPLICATIONS

Income, expense, investment, finance, and consumption trends in the data of 65 ongoing Alabama farms during 1978-82 indicate deepening financial stress.

- Analysis of income stability and enterprise earnings reveals cash rates of return to assets that tended to be quite variable and for most farm types averaged less than 4 percent.

- Negative economic income, for the study period as a whole, occurred for several one- and two-enterprise farm types.

- Debt management factors of particular interest that are positively related to increases in reliance on debt include machinery investment rates, interest expense, sales per dollar of farm assets, cash withdrawals for personal use, and labor expense.

- Factors related to lower farmer reliance on debt include improved profitability, increases in sales of commodities covered by government programs, increases in the share of expense of custom machinery expense, and increases in the share of expense for purchase of fertilizer, fuel, chemicals, and other operating inputs.

The relationship of the statistical results to investment and expense decisions during the study period points out elements of both effective management and limitations on the part of management to control the growth of debt. Percent response analyses of the debt-to-asset ratio indicate marked sensitivity to the ratio of sales to farm assets, enterprise specialization, government program participation, and profitability. Critical level/benchmark analyses point out the "ceiling" and "floor" effects of important management factors on debt management.

Up-to-date, comprehensive data from ongoing farms are especially useful in a time of marked turbulence and change in the agricultural sector. Alabama farmers are particularly encouraged to compare their experience with the key economic factors identified in this study: machinery investment rates, profitability, turnover of farm resources into commodity sales, enterprise specialization, participation in farm programs, and control of labor and custom expenses. Finally, farmers are encouraged to develop their own investment, profitability, and cost-control management goals.

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FIRST PRINTING 3M, JUNE 1987

*Results reported herein are available to all without regard to race, color, sex, or national origin.*

# **Financial Stress, Debt Use, and Cost Control Among Sample Alabama Farms**

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## **INTRODUCTION**

**D**EPRESSED INCOME, high expense levels, and price and income variability continue to be major concerns in U.S. agriculture. Extensive research efforts have focused on these issues in attempts to find possible solutions to the financial problems of farmers. Some general research conclusions identifying problems and management alternatives have gained considerable acceptance.

One such problem is farm income fluctuations, which may substantially alter desired investment schedules. Farmers may cut back on purchases of assets or disinvest following one or more low return years. A series of high return years, as experienced in the mid-1970's, may lead farmers to drive up input prices as they compete for limited short run supplies.

Farm income variability often interferes with desired product marketing schedules, and this represents another problem. Farmers postpone crop and livestock sales because of low current prices and the expectation of improved future prices. However, they may be forced to sell before an optimal price is reached to cover current debt obligations.

Family consumption patterns are often adversely affected by farm income fluctuations, thereby creating another problem.

Results of specific studies have suggested various solutions to financial problems. Hanson and Thompson (2), in a study of members of farm management associations in southern Minnesota, found debt-carrying capacity increased substantially with:

1. Flexible default arrangements (permitting recovery from worst case years).
2. Farm size increases (unless small farms earned above average rate of returns).

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3. Diversification into labor intensive operations (primarily relying on operator and family labor).
4. Diversification with equal asset shares in two enterprises.
5. Two to 3 percent increases in rate of return to assets.
6. Increase of real estate mortgage term from 20 to 30 years.
7. Decreases in interest rates of 4 or more percentage points.

In a similar study of low equity farmers in Wisconsin, Harris and Saupe (3) found that many of these farmers had debt burdens almost as large as the value of the farms they operated. They typically did not generate enough revenue to cover family living expenses, farm operating expenses, interest costs, principal payments on their farm debts, and replacement of capital items. Their conclusion is that several potential solutions lie in the market place. These include (1) using contracts to purchase land or other farm resources, with the seller providing credit and loan supervision; (2) renting instead of purchasing farmland; and (3) making loans through financial markets for operations with the greatest chance of success.

An analysis of debt payment ability and debt carrying capacity of New York dairy farms by Knoblauch (4) found that debt carrying capacity is largely determined by profitability of the farm business, the ratio of long term to short term debt, and interest rate and term of loan. As would be expected, profitability of the farm business was the most dominant factor. The level of short term debt and the interest rate were also important.

Concerning alternatives to debt financing, Penson and Duncan (5) state that increased capital needs projected for the farm sector during the 1980's will place increased pressures on farmers' credit reserves. They emphasized that farmers can lease farmland, tractors, trucks, combines, irrigation equipment, silos, and even cows. Among the advantages of leasing are acquiring the use of an asset without making sizable initial outlays of equity capital and reducing income tax liabilities by deducting the lease payment as an expense. Leasing also has some serious disadvantages. The interest rate on financial leases can be 3 or more points higher than the interest rate on debt financing. Also, any residual value of the asset at the conclusion of the lease period may belong to the lessor and not the farmer.

Other alternatives to debt financing are limited partnerships, venture companies, joint ventures, and incorporation. Farmers generally welcome new sources of capital, but have viewed outside equity capital with distrust.

Boehjle and Eidman (1) indicate that traditional approaches to risk reduction and farm survival have concentrated on production or marketing strategies to restructure debt and reduce leverage. They list

four options to explore for farm survival during periods of cash flow shortfalls.

1. Asset liquidation is a viable alternative since most farmers have real and personal property which could be sold if necessary. At least six factors warrant consideration if this option is to be implemented.

a. The net cash generated by the sale may be reduced substantially or even completely eliminated and deficiency judgements filed if the proceeds are less than the secured debt.

b. The property may have to be sold at a discount because of the forced sale. The amount of the loss is a function of the selling method, timing of sale, financing terms, asset quality, and local market conditions.

c. The type of return the asset earns is critical. Inventories and equipment generate higher cash rates of return than farm real estate.

d. Unique and favorable financing terms may be given up as well as the asset.

e. The extent to which proceeds from the sale will be taxed is important.

f. Assets which are encumbered with mechanics liens and other security interests may be difficult to sell because of title problems.

2. Sale-leaseback options may be good for farm operations which can efficiently utilize the resources but cannot handle the cash flow costs of ownership. For example, real estate cash flow requirements can frequently be reduced from 10 to 15 percent for annual debt servicing to 6 to 8 percent for cash rents.

3. Equity infusion can be used in businesses with financial problems by bringing in equity capital from outside the business. Several sources are available for this capital—a family member, a non-family investor, or a present lender who may incur a loss if the note is called.

4. Bankruptcy may involve immediate liquidation of assets and discharging of the debt obligation. It can also involve rehabilitating the business under Chapter 11 or 13 of the bankruptcy law.

The increased financial difficulties of the 1980's have required many farmers to carefully re-examine debt management and other financial practices, focusing on the options described above. Close cooperation between the farmer and the farm lender (whether a commercial bank, a member of the Farm Credit System, the Farmers Home Administration, or an individual) is essential in this difficult process. The results reported herein may contribute to knowledge of both financial difficulties and options to improve returns to farming by presenting statistical evidence of cost control strategies.

## **DESCRIPTION OF STUDY**

This study examined the inter-relationship between financial stress and debt management in a sample of ongoing Alabama farms during 1978-82. The deepening financial difficulties experienced by the sample farmers were identified. In addition, expense, earnings, farm size, and other management factors relating to debt usage were analyzed. Research results were also compared to farm performance in a Southern region, including Alabama, during 1984.

At the beginning of this project, empirical data were collected for the development of practical research information that can be utilized by farmers, lenders, and other researchers. The broad objective of this study was to examine the financial condition of selected Alabama farm producers and to analyze management strategies to improve returns. Specific objectives were to (1) explore income variability effects on selected Alabama farms, (2) develop a series of indices relating levels of debt usage to general financial, expense, and investment ratios, and (3) present ideas for alleviation of short term cash flow difficulties.

### **Data Collection**

The farm level data are largely from the four geographical regions in Alabama identified by the map (page 2). Data sources include Production Credit Association financial records, Tennessee Valley Authority/Alabama Cooperative Extension Service farm management records service, and a mail survey in one region. The sample contains 65 farms; 47 had data from 1978 through 1982 and 18 had records from 1979 through 1982, providing 292 useable observations.

Farm income, expense, liability, and asset data and selected personal information, including consumption expense (for 115 observations) and number of dependents, were collected. The sample farms are larger and more representative of "commercial" size agriculture than the typical Alabama farm in the 1982 Census of Agriculture. Primary enterprises include peanuts, cotton, soybeans, poultry, and beef cattle.<sup>1</sup>

## **RESULTS**

### **Evidence of Economic Stress**

Annual changes in several income, expense, investment, consumption, and finance measures are presented in tables 1 and 2. Ev-

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<sup>1</sup>The representativeness of the farm sample cannot be readily determined.



TABLE 1. DEFLATED MEASURES OF INCOME AND EXPENSE, ALABAMA FARM SAMPLE, 1978-82

Year	Unit of measure	Section A: selected measures of income <sup>1</sup>				Section B: selected expenses				
		Gross farm income	Cash operating income	Farm net cash flow	Farm income	Operating expense (excluding livestock purchases) <sup>2</sup>	Rent expense	Labor expense	Machine work hired	Interest expense
1978	\$, 1972 <sup>3</sup>	83,465	13,357	-18,003	565	67,146	4,530	7,174	1,924	7,252
1979	Pct. change	-5.0	28.5	89	1,343.9	-7.4	7.3	-18.5	12.2	-10.6
1980	Pct. change	-13.9	-78.7	-461	-165.1	4.0	-7.5	4.2	-16.9	21.4
1981	Pct. change	23.4	181.8	96	145.9	14.4	7.9	-1.9	31.8	43.2
1982	Pct. change	-11.0	-66.7	-1,440	-281.2	-3.3	24.1	0.1	-15.3	-1.4
	\$, 1972	74,984	3,423	-6,793	-4,423	71,561	6,024	5,988	2,000	11,109
	Percent change, 1978-82	-10.1	-74.3	62.2	-882.4	6.5	32.9	-16.5	4.0	53.1

<sup>1</sup>Not all income and expense components are listed in this table. Income and expense measures are defined as follows: gross farm income: the sum of crop and livestock sales; cash operating income: gross farm income less operating expense less nonbreeding livestock purchases plus miscellaneous farm income; farm net cash flow: cash operating income less expenditures for breeding and nonbreeding livestock, buildings, machinery and land; farm income: cash operating income less depreciation.

<sup>2</sup>Operating expense other than rent, labor, machine work, and interest increased from \$46,266 to \$46,439 between 1978 and 1982. Depreciation is not included in this expense measure.

<sup>3</sup>Deflated by the Net National Product Implicit Deflator. Percent change is from the previous year.

TABLE 2. DEFLATED MEASURES OF INVESTMENT, CONSUMPTION, ASSETS, DEBT, AND NET WORTH, ALABAMA FARM SAMPLE, 1978-82

Year	Unit of measure	Section A: investment and consumption				Section B: assets, debt, and net worth				
		Machinery purchases	Building purchases	Livestock purchases	Family living expenses	Average farm assets	Farm debt	Sample debt ratio <sup>1</sup>	Average farm debt ratio <sup>2</sup>	Farm net worth
1978	\$, 1972 <sup>3</sup>	17,733	5,112	3,917	8,197	289,726	116,678	40.3	40.2	173,048
1979	Pct. change	-37.8	-65.4	-11.2	1.02	-16.2	-21	-11.6	-6.0	-13
1980	Pct. change	-26.5	-39.5	-11.1	-4.6	0.0	14	13.2	14.5	-9
1981	Pct. change	-27	-39.2	-55.1	-3.5	-1.0	3	15.2	3.7	-4
1982	Pct. change	-9.2	-28.3	-29.8	-9.4	-2.3	1	-10.9	3.5	-5
	\$, 1972	5,365	466	1,800	6,901	234,035	108,916	41.1	46.5	125,118
	Percent change, 1978-82	-69.7	-90.9	-54	-15.8	-19.2	-6.6	2.6	15.6	-27.7

<sup>1</sup>Total farm debt divided by total farm assets for the entire sample.

<sup>2</sup>The average of individual farm debt ratios observed in the sample.

<sup>3</sup>Deflated by the Net National Product Implicit Deflator. Percent change is from the previous year.

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TABLE 3. AVERAGE ANNUAL RATES OF RETURN AND VARIABILITY OF DOMINANT ENTERPRISES, ALABAMA FARM SAMPLE, 1978-82

Farm type	Total sales due to dominant enterprises	Cash income				Economic income			
		Mean sample rate of return (ROR)	Coefficient of variability	Range of the annual mean ROR	Average annual change in the mean ROR	Mean sample rate of return (ROR)	Coefficient of variability	Range of the annual mean ROR	Average annual change in the mean ROR
		<i>Pct.</i> (1)	<i>Pct.</i> (2)	<i>Pct.</i> (3)	<i>Pct.</i> (4)	<i>Pct.</i> (5)	<i>Pct.</i> (6)	<i>Pct.</i> (7)	<i>Pct.</i> (8)
Cotton	61.5	27.5	105.1	37.9	19.3	18.1	159.5	42.3	21.2
Poultry	70.9	12.0	37.3	3.5	1.8	2.9	186.5	4.2	2.3
Swine	67.3	10.2	166.0	23.6	9.7	3.3	523.7	20.6	8.8
Peanuts	54.5	9.8	87.2	9.3	2.2	3.5	212.0	10.3	4.7
Soybeans	63.0	9.8	166.9	17.3	8.4	1.9	857.9	18.0	7.9
Dairy	82.2	4.9	83.6	4.0	2.3	-1.5	-298.4	6.6	2.5
Beef	61.4	4.2	156.0	4.5	1.6	-1.5	-359.2	4.0	1.3

ident in section A of table 1 are strong downward trends for cash operating income and farm income, and moderate downward trends in real farm sales. Farm net cash flow, which consists of cash operating income (excluding livestock purchase expense) plus cash flow relating to farm investment and family consumption, increased from a negative \$18,003 in 1978 to a negative \$6,793 in 1982. This reflects cost control behavior relating to reductions in real consumption and especially investment, table 2, section A. Among the expense categories shown in section B of table 1, a decline occurs only for labor costs. In view of the large increases in rent (33 percent) and interest (53 percent), the 6.5 percent increase in deflated total farm expense is relatively moderate.

Investment and consumption measures, shown in the first section of table 2, declined without exception between 1980 and 1982. The one annual increase occurred for consumption in 1979, the highest real income year for both Alabama and U.S. agriculture during the study period.

Financial effects of the 1980-82 recessionary period are evident in section B of table 2. Although farm debt declined 6.6 percent in real terms between 1978 and 1982, this was entirely due to relatively high 1979 income. While the 2.6 percent increase in the debt ratio (total debt divided by total assets) for the combined sample is minimal, average debt ratios increased nearly 16 percent on a per farm basis. It is apparent from positive trends in land values in the data that the large reduction in deflated net worth from \$173,048 to \$125,118 does not reflect declines in land values observed in U.S. agriculture since 1981.

An overview of the income, expense, investment, and finance trends of tables 1 and 2 indicates increasing financial difficulties for the sample farmers. Real income levels tended to be negative or fluctuated in the vicinity of zero. There were substantial increases in several expense categories. Marked declines in real investment occurred, while average ratios of debt to assets increased. The bottom line was a clear erosion of the financial well-being of the sample farms.

### **Enterprise Income and Variability**

Rates of return for farms dominated by the sales of one enterprise are shown in table 3. The enterprise that contributed the large percentage of total sales was defined as "dominant." A minimum of 20 observations was required for each dominant enterprise. The large variability values for cash rates of return, shown in column 3 of table 3, indicate that considerable income variability occurred in the sam-

ple. (The variability measures need to be cautiously interpreted when the rate of return is close to zero.) Rates of return (ROR) are calculated as follows:<sup>2</sup>

Cash rate of return =	cash farm income to total farm assets, where
Cash farm income =	summation of crop sales, livestock sales, and miscellaneous farm income, less cash production expense, purchases of non-breeding livestock, and interest expense;
Total farm assets =	summation of year-end market value of land, buildings, improvements, machinery, equipment, livestock, crop, seed, and feed;
Economic rate of return =	adjusted farm income to total farm assets; where,
Adjusted farm income =	cash farm income less depreciation of buildings and machinery.

### Single-Enterprise Returns

The largest cash and economic rates of return for a dominant enterprise were achieved by cotton, 27.5 and 18.1 percent, table 3. The second largest cash return was posted by poultry, 12 percent, followed by swine, peanuts, and soybeans with return rates of approximately 10 percent.<sup>3</sup> Dairy and beef exhibited cash returns between 4 and 5 percent, and negative economic rates of return.

The measure of income variability ranged from 37.3 to 166.9 for poultry and soybean cash rates of return, respectively. There is no clear trade-off between level of returns and income variability. However, beef, soybeans, and swine had much higher relative variability than dairy, peanuts, and poultry.

The estimated rates of return include interest expense. Thus, farms with little or no interest expense would tend to have higher

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<sup>2</sup>The income concepts in table 1, as well as the enterprise rates of returns in tables 3 and 4, include interest expense. To the extent that debt ratios tended to differ substantially between farm types, this may introduce a bias in results. (Inclusion of interest expense paid is also consistent with USDA cost of production budgets and published returns to operators series for farm management associations in many states.)

<sup>3</sup>Inventory and income tax effects were estimated to change the economic rate of return between 0.0005 and 0.0146 for beef, dairy, peanuts, and soybeans, to lower cotton and soybeans by 0.026 and 0.089, respectively, and to raise swine by 0.062. The average combined effect of inventory and income taxes was estimated to be a decline of 0.0102 in the economic rates of return for the seven dominant enterprises. These factors were not included in the economic rates of return because personal deductions, off-farm income, and investment behavior were not indicated in most records.

rates of return than the sample average. The general lack of profitability of beef cows is often observed with the suggestion that beef is profitable no more than 2 or 3 years in 10. The only year exhibiting a positive economic rate of return for beef in the sample was 1979. Correspondingly, USDA enterprise budgets for cow-calf herds in the Southeast indicate negative returns for 1978 and 1980-82 and positive cash returns for 1979. The current decline of the dairy sector in Alabama is consistent with the low level of profits shown in table 3. The strong profitability shown for cotton and swine is primarily due to a single year of high returns for each (cotton, 1979; swine, 1981).

For enterprises with cash or economic rates of return near zero, variability is perhaps more effectively portrayed by the measures in columns (4), (5), (8), and (9) of table 3. The range of the cotton mean rate of return is 37.9 and 42.3 percentage points, respectively, for cash and economic incomes. The comparable measures for beef are 4.5 and 4.0 percentage points, however, the absolute values of the measure of variability are higher for beef. In most cases, the range in column (8) slightly exceeds that of column (4). Returns for most crops were highly variable, poultry was relatively stable (with positive returns), and beef was also stable (with negative returns). The economic return appears to be "adequate" only for cotton, but both high income and variability shown for this crop were primarily due to strong returns in 1979. The return levels for dairy and beef were disturbingly low.

## **Two-Enterprise Returns**

Two-enterprise returns and variability results are shown for 11 farm types in table 4. The enterprises are the largest and next largest in terms of farm sales. Because fewer observations are available in the data for this additional level of farm type specification, increased caution is required in assessing the reliability of these findings. Compared to single enterprises, the two-enterprise combinations in table 4 exhibited less difference in levels and ranges of cash and economic rates of return.

Cotton/soybeans (the only combination with cotton) demonstrated the "diversification effect" of greater relative declines in variability than in returns. Soybeans in combination with swine, beef, or "miscellaneous" provided higher returns and generally lower variability than single enterprises, but there was a rapid fall-off in returns after cotton/soybeans. Economic income levels (including depreciation) were particularly low.

Examination of the diversification effects in table 4 raises the man-



TABLE 4. RATES OF RETURN AND VARIABILITY OF TWO-ENTERPRISE COMBINATIONS, ALABAMA FARM SAMPLE, 1978-82

Farm type	Total sales due to each enterprise		Cash income			Economic income		
	First	Second	Mean sample return (ROR)	Coefficient of variability	Range of the annual mean ROR	Mean sample rate of return (ROR)	Coefficient of variability	Range of the annual mean ROR
	<i>Pct.</i> (1)	<i>Pct.</i> (2)						
Cotton/soybeans	53.37	36.14	23.6	114.45	19.6	14.6	86.0	21.2
Soybeans/misc. <sup>1</sup>	64.84	24.35	14.6	155.63	32.0	5.5	403.75	26.4
Peanuts/soybeans	48.84	30.75	11.6	80.90	14.3	3.5	230.63	14.2
Soybeans/swine	44.80	43.83	10.7	175.66	34.0	4.5	419.07	31.1
Swine/broilers	53.61	42.39	10.5	69.39	7.5	1.2	772.95	6.0
Soybeans/beef	48.91	35.51	10.2	156.76	21.0	2.8	596.26	20.0
Swine/peanuts	46.07	35.91	8.7	76.44	9.4	4.3	170.38	12.4
Beef/broilers	48.57	41.34	7.4	33.42	4.6	-.3	-1,042.74	3.7
Soybeans/wheat	50.23	34.82	6.7	241.20	35.2	-3.8	-475.26	40.3
Peanuts/beef	47.85	35.04	5.7	114.27	14.6	1.5	452.73	15.3
Soybeans/corn	64.71	27.41	5.0	133.86	15.4	-1.0	-925.11	18.7

<sup>1</sup>Miscellaneous refers to sales from enterprises not included because of insufficient observations, e.g., vegetables. Certain combinations were not prevalent, such as corn/wheat or combinations with the dairy enterprise.

agement issue of specialization vs. diversification. This is one of the issues examined in the next section, which analyzes debt management in the sample and relates trends among the farms to levels of economic stress.

## **Debt Management**

Several management/cost control strategies were analyzed with statistical methods. Size, investment, specialization, profitability, and expense variables were analyzed because of their impacts on important economic, technical, and growth factors in farming. The statistical analysis is based on the economic relationships identified as follows:

### *Debt*

DEBTRTO-the ratio of total farm debt to total farm assets

### *Investment*

MCHINVRT-annual gross machinery investment divided by total assets

LSTINVRT-annual gross livestock investment divided by total assets

### *Size*

TASSET-total farm assets

GSALESRT-gross farm sales divided by total assets (the asset turnover ratio)

### *Finance, profitability, taxes*

INTPDRTO-interest expense divided by sales

FRMPFTRT-net profit divided by assets

WITHDRAW-this is a "disappearance" variable that is the net of cash farm income, off-farm income, operating expense, capital expense, and/or principal transactions. A primary component of withdrawals from the farm business would be family living expense.

TTAXCOVR-federal, state, and self-employment taxes on income (includes carry-overs of net operating losses and investment credits)

### *Expense*

LABHIRRT-labor expense paid divided by total sales

MACHIRRT-machinery lease or custom expense divided by total sales

OTHEXPRT-other cash expense (e.g. chemicals, fuels) divided by total sales

RTPDRTO-rent expense divided by total sales

## *Specialization*

CONINDEX-concentration index recognizing enterprises contributing more than 10 or more than 50 percent of sales<sup>4</sup>

TOTPCTGP-the percentage of total sales in commodities with strong government programs (dairy, peanuts, cotton, corn)

## **How Management Factors May Affect Debt Usage**

In developing this analysis, the debt-to-asset ratio was expected to be positively related to the following variables: TASSET, LSTINVRT, MCHINVRT, INTPDRTO, WITHDRAW, GSALESRT, AND LABHIRRT. That is, an increase in these factors was thought to be associated with increases in reliance on debt, as explained by the following statements:

- Asset, livestock, and machinery expansion are typically facilitated through an increase in financial leverage (i.e., use of debt).

- An increase in the ratio of interest expense to sales, e.g. due to increasing variable interest rates, was expected to result in increases in debt leverage. However, outstanding efficiency in production could result in a highly leveraged farm with a low interest-to-sales ratio.

- The “disappearances” variable (WITHDRAW) was formulated because of the often cited phenomenon of “vanishing” loan funds that were used for family expense rather than farm expense. Damage to a farm’s debt position can become substantial if such “disappearances” continue to be large.

- Increases in the turnover ratio of sales to assets, especially if due to capital investment in highly specialized facilities, were expected to be associated with increased debt-to-asset ratios.

- Increases in the ratio of labor expense to farm sales were also expected to increase debt usage.

Increases in TTAXCOVR, MACHIRRT, TOTPCTGP, FRMPFTRT, CONINDEX, OTHEXPRT, and RTPDRTO were expected to lower the debt-to-asset ratio, in accordance with the following:

- Management strategies to lower tax liabilities, e.g., generation of investment credit and depreciation deductions, were expected to lower debt usage.

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<sup>4</sup>For example, a farm with enterprise sales of 15, 25, and 60 percent of total sales would have an index value of  $[(15 + 25 + 60)/3 + (60 - 50)] = 43.3$ . A single-enterprise farm would be given an index of 150  $[100 + (100 - 50)]$ . This measure does recognize and differentiate between what were viewed to be critical levels of enterprise contributions. While many other formulations are possible, this is the only one examined in this study.

- Leased machinery can substitute for owned machinery of which much can be expected to be debt financed.

- Commodity programs are believed to reduce downward price variability and increase farm income levels. Over the long run, one would expect government program participation to lower debt financing requirements.

- Increased profitability would be expected to lessen debt financing requirements.

- Efficiency gains due to enterprise specialization are expected to increase profitability, and thus decrease the use of debt financing.

- Increases in other expense, such as chemicals and fertilizer, may result in lower debt usage through increased production efficiency of operating inputs.

- Increases in rental expense, compared to land ownership costs, would be associated with decreasing debt-to-asset ratios.

## **Results of Analysis**

The results in table 5 indicate that the following 10 factors were statistically important (1-6 relate to general production, investment, and financial factors and 7-10 to input costs):

1. Machinery investment rates.
2. Profitability.
3. Sales compared to farm asset value.
4. Enterprise specialization.
5. Participation in government commodity programs.
6. Withdrawals from the firm for personal/family uses.
7. Interest.
8. Labor.
9. Custom machinery expense.
10. Other expense (fertilizer, chemicals, fuel, etc.).

Several statistically important relationships are of particular interest to management. Higher rates of machinery custom expense and other expenses, such as fertilizer and chemicals, were associated with lower debt usage. Relatively high labor expenses were related to high debt usage. High firm withdrawals for personal uses tended to be associated with high debt usage. Strong farm profitability and participation in government commodity programs fostered low debt usage. Enterprise specialization promoted better control of debt loads.

Comparison of the statistical results in table 5 with the trends in investment, expense, and earnings in tables 1 and 3 provides an in-

TABLE 5. STATISTICALLY IMPORTANT ECONOMIC FACTORS INFLUENCING DEBT USAGE

Variable name	Description	Level of statistical significance	Effect on debt usage
(1)	(2)	(3)	(4)
MCHINVRT (machinery investment)	Machinery investment to assets ratio	2.62	increase
INTPDRTO (interest paid)	Interest paid to sales ratio	4.19	increase
FRMPFTRT (profitability)	Net profit to assets ratio	-7.38	decrease
GSALESRT (asset turnover)	Gross farm sales to assets ratio	7.90	increase
CONINDEX (enterprise concentration index)	An index of farm enterprise specialization	-3.56	decrease
TOTPCTGP (government program sales)	Government commodity program participation	-4.31	decrease
LABHIRRT (labor expense)	Hired labor expense to sales ratio	2.15	increase
MACHIRRT (custom machinery expense)	Hired machinery expense to sales ratio	-2.04	decrease
OTHEXPRT (other expense)	Other farm expense to sales ratio	-2.48	decrease
WITHDRAW (firm withdrawals)	Cash withdrawals for consumption or other purposes	4.61	increase

<sup>a</sup>T-value, significant at the .05 level.

dication of the latitude of farmers to respond to worsening financial conditions.

Lowering interest expense would be anticipated to lower the debt ratio. Considering that average effective Production Credit Association interest rates in Alabama increased from 9.7 percent in 1978 to an average of 16.2 percent during 1980-82, the imperative to reduce debt was evident. Because interest expense increased in real terms from \$7,252 to \$11,109 between 1978 and 1982, table 1, management of interest cost in the farm sample was not effective. Obviously this cost is difficult to control for many farmers, a fact that farmers and lenders need to bear in mind when they enter agreements to increase debt.

Response to interest rate increases would be expected to occur through investment behavior and the growth or decline in total farm assets. Both investment and asset data in table 2 indicate substantial declines in these trends. Thus, the response of farmers to decrease investment was consistent with the statistical finding that this results in lower debt usage.

The debt management model also found lowering the labor share of expense reduced the need for debt. Farmers lowered labor expense from \$7,174 to \$5,988 (in real terms) between 1978 and 1982, table 1, while the other expense categories were not reduced.

The statistical results in table 5 point out the importance of investment, interest costs, profitability, sales levels, enterprise spe-



cialization, participation in government programs, and the control of labor, machinery, and other expenses for effective debt management.

### Response and Critical Levels

The sensitivity of the debt ratio to a 1 percent increase in labor usage, investment, etc. can be called a “percentage response” measure. Percentage response results for variables found to be statistically important are provided in column 3 of table 6.

A 1 percent increase in the machinery investment-to-asset ratio was estimated to result in 0.06 percent increase in debt-to-asset ratio. Similarly, a 1 percent increase in sales to assets was estimated to result in nearly 0.6 percent increase in the debt ratio.

The relatively high percentage response for the sales-to-assets ratio is difficult to interpret. If firms with large sales-to-assets ratios tend to be capital intensive, purchasing expensive production facilities or farm land should be carefully evaluated with respect to financial risk. Also, the high percentage responses of the concentration index, government program usage, and profitability indicate the sensitivity of debt usage to these key management variables.

An alternative, “benchmark” model relationship can be calculated with “critical levels” of management variables. A positive relation-

TABLE 6. CALCULATED DEBT RATIO “PERCENTAGE RESPONSE” AND CRITICAL LEVELS FOR SIGNIFICANT VARIABLES AT THE MEAN DEBT RATIO

Variable name	Description	Percent response level	Critical value	Ceiling effect (+) <sup>1</sup> floor effect (-)
(1)	(2)	(3)	(4)	(5)
MCHINVRT (machinery investment)	Machinery investment to assets ratio	0.06	0.0431	(+)
INTPDRTO (interest paid)	Interest paid to sales ratio	.10	.1731	(+)
FRMPFTRT (profitability)	Net profit to assets ratio	-.17	.06	(-)
GSALESRT (asset turnover)	Gross farm sales to assets ratio	.56	.3868	(-)
CONINDEX (enterprise concentration index)	An index of farm enterprise specialization	-.33	56.81	(-)
LABHIRRT (labor expense)	Hired labor expense to sales ratio	.08	.0788	(+)
OTHEXPRT (other expense)	Other farm expense to sales ratio	-.12	.6431	(-)
TOTPCTGP (government program sales)	Government commodity program participation	-.26	.08	(-)
MACHIRRT (custom machinery expense)	Hired machinery expense to sales ratio	-.04	.0264	(-)

<sup>1</sup>The “ceiling” indicates that values above the critical level are related to higher than average levels of debt to assets. The “floor” indicates that values below the critical level are related to higher than average debt burdens.

ship indicates a “ceiling” or maximum amount. This suggests that if the critical level is exceeded, an increase in the debt ratio is anticipated. A negative relationship indicates a “floor” or minimum value. If the variable in question falls below the critical level, an increase in the debt-to-asset ratio will occur.

Ratios of annual machinery investment to assets exceeding 0.04 are associated with debt ratios greater than the sample average of 40 percent. Ratios of interest paid to sales exceeding 0.17 are associated with above average debt ratios. Profitability rates above 6 percent are indicative of debt ratios below the average. While this rate of return may appear modest, only the cotton and cotton/soybeans enterprises exceeded this level for the sample period, tables 3 and 4. From a managerial perspective, the labor hired to sales critical value of 0.08 provides a “benchmark,” or goal, that many farmers may try not to exceed to limit the growth of debt. Large cash withdrawals not accounted for in the records are also associated with high debt ratios.

The importance of percentage response estimates and critical values is that they aid the formulation of financial and business management objectives based on empirical evidence. They also indicate the latitude available in working towards attainment of objectives.

### **Study Update and Validation**

A comparison of the critical values derived from the sample of Alabama farms with mean values of the variables from a larger sample of farms points out the continued importance of investment, interest, and profitability in debt management in 1984. While the mean values from the 1984 USDA Farm Cost and Returns Survey (FCRS) regional data are not directly comparable to “critical” values, they illustrate major financial and investment behavior differences by debt level.

Definitions of factors vary slightly between the two sources of farm level data, particularly with respect to government program participation. Factors not shown were not comparable between the two data sources. The FCRS results available for analysis had 371 and 760 observations in, respectively, the Southeast and Delta regions with sales of \$20,000 or more and assets of \$10,000 or more. To provide a more consistent comparison with the Alabama commercial farms in the study sample, farms with sales exceeding \$1 million or assets exceeding \$5 million were not included. The FCRS survey is probabilistically based and represented approximately 8,000 high debt and 2,800 low debt commercial size farms in the Southeast. Similar projections are for 12,000 high and 21,000 low debt farms in the Delta. Both critical and mean values are shown in table 7. The mean debt ratio of the Alabama sample is 0.4.

TABLE 7. COMPARISON OF 1978-82 CRITICAL VALUES WITH MEANS OF DEBT MANAGEMENT FACTORS

Factor	1978-82 Alabama farm record data		1984 FCRS survey data <sup>1</sup>			
	Critical value	Effect, ceiling (+) floor (-)	Southeast Region		Delta Region	
			High debt (D/A > .4)	Low debt (D/A < .4)	High debt (D/A > .4)	Low debt (D/A < .4)
1. Machinery investment	0.04	+	0.06	0.02	0.15	0.04
2. Interest paid	.17	+	.2	.09	.22	.09
3. Profitability	.06	-	.02	.06	.10	.17
4. Asset turnover	.39	+	.73	.57	.83	.54
5. Labor expense	.08	+	.07	.08	.07	.06
6. Other expense	.64	-	.8	.74	.73	.66
7. Government programs participation	.08	-	.44	.23	.32	.20
8. Custom machinery expense	.03	-	.01	.02	.02	.02

<sup>1</sup>Southeastern States are South Carolina, Georgia, Florida, and Alabama. Delta States are Mississippi, Arkansas, and Louisiana. Definitions of factors vary slightly between the two sources of farm level data, particularly with respect to government program participation. Factors not shown were not comparable between the two data sources. The USDA Farm Costs and Returns Survey (FCRS) results made available for analysis had 371 and 760 observations in, respectively, the Southeast and Delta regions with sales of \$20,000 or more and assets of \$10,000 or more. To provide a more consistent comparison with the Alabama commercial farms in the study sample, large farms with sales exceeding \$1,000,000 or assets exceeding \$5,000,000 were not included. The FCRS survey is probabilistically based and represented approximately 8,000 high debt and 2,800 low debt commercial size farms in the Southeast. Similar projections are for, respectively, 12,000 and 21,000 high and low debt farms in the Delta.

Since real estate asset values declined markedly and the “farm crisis” became more severe between the study period and 1984, differences between the two surveys can be anticipated. Sales-to-turnover ratios are higher from FCRS data reflecting the decline in asset values by 1984 (the denominator of the asset turnover ratio fell). Compared to the critical values, mean profitability decreased in the Southeast among high debt farms.

The high debt farms tend to participate more in government programs. This large difference compared to the critical value may reflect sampling differences relating to the distinct time periods or a weakening of commodity program effects. The differences in mean values of factors between high and low debt farms in the Southeast suggest quite contrasting behavior. Farmers need to recognize the requirement for higher sales (asset turnover) that is associated with high debt usage. On the other hand, low debt usage may require (or force) low machinery investment rates. Results for the Delta region show similar relative values but different absolute values of management factors. These results indicate benchmark or critical levels based on performance ratio analysis may vary by region, enterprise type, and farm size.

## Suggestions for Farm Management

Several of this study's specific findings can be summarized into general suggestions or "benchmarks." Farmers and farm lenders are cautioned that these benchmarks need to be viewed as general trends and cannot be applied strictly to any specific farm situation. These results vary by enterprise type, farm size, operator and family goals, and management approach.

The guidelines shown below were estimated based on average farm characteristics. Particular strengths of a farm operation, e.g., increased efficiency of labor, can compensate for the cost of higher interest expense. Thus, the guidelines can be viewed to be "flags" that may caution the manager, although the guideline "flagged" may not apply to the farm situation.

<i>Factor</i>	<i>Guideline</i>
1. Profitability	Low debt usage was supported by rates of return on assets of 6 percent or higher after payment of all cash expense including interest.
2. Sales-to-assets	Go for "quality" sales. The study suggests that high sales rates that are accompanied with heavy expense burdens can cause debt to increase. Maximizing sales (by itself) may not strengthen a firm's financial position without strong management.
3. Interest expense	Interest levels of 10-17 percent (or less) of sales were associated with low debt burdens.
4. Labor expense	When limited to 6-8 percent of sales, debt levels tended to be low.
5. Custom machinery expense	Levels of 2-3 percent or more of sales, if accompanied by lowered machinery investment and ownership costs, were consistent with low debt usage.
6. Machinery investment	When limited to 4 percent or less of sales annually, debt use was low.

7. Other expenses                      Levels of 65-75 percent of sales were associated with low debt usage. Concentrate on highly productive inputs such as fertilizer, pesticides, and fuels.
8. Specialization                      Enterprise specialization in two main enterprises may improve efficiency levels while not substantially increasing the risk of "over-specialization." Specialization that fully utilizes available labor is also suggested.
9. Farm program participation      Participation was associated with lower debt in the sample. However, low debt farms participated less than high debt farms in the last year studied, 1984. Consider each program carefully and participate when returns are improved.
10. Firm withdrawals                Cost control and family budgeting tools are recommended. Study results suggest either poor accounting of expenses and other withdrawals or else a spending "discipline" problem on many farms. This factor is significantly related to high debt burdens.

An additional factor of consideration is that certain expense categories appear to have more "slack" and are prime candidates for cost reduction. These include custom machine work, labor, investment, and family consumption. Other categories of expense, especially interest, appear to have little "slack." The need is to develop cost reduction strategies that recognize where cost-cutting is possible without reducing productivity and profit.



## BIBLIOGRAPHY

- (1) BOEHLJE, M. AND V. EIDMAN. 1983. Financial Stress in Agriculture: Implications for Producers. *Amer. J. Agr. Econ.* 65:937-944.
- (2) HANSON, G.D. AND J.L. THOMPSON. 1980. A Simulation Study of Maximum Feasible Farm Debt Burdens by Farm Type. *Amer. J. Agr. Econ.* 62:727-733.
- (3) HARRIS P.E. AND W.E. SAUPE. 1981. Debt Repayment Capacity of Low-Equity Farms. Univ. of Wisconsin-Madison, Dept. of Agr. Econ, No. 62.
- (4) KNOBLAUCH, W.A. 1979. Debt Payment Ability and Debt Carrying Capacity of New York Dairy Farms. *J. Amer. Soc. Farm Managers and Rur. Appraisers.* 43:29-34.
- (5) PENSON, JOHN B., JR. AND MARVIN DUNCAN. 1981. Farmers: Alternatives to Debt Financing. *Agr. Fin. Rev.* 41:83-90.
- (6) U.S. DEPARTMENT OF AGRICULTURE. 1980 and 1983. Economic Indicators of the Farm Sector: Costs of Production. *Nat. Econ. Div., Econ. Res. Serv., ECIFS 3-1.*
- (7) \_\_\_\_\_ . 1983. Economic Indicators of the Farm Sector and Review. *Nat. Econ. Div., Econ. Res. Serv., ECIFS 3-2.*
- (8) \_\_\_\_\_ . 1983. Economic Indicators of the Farm Sector: State Income and Balance Sheet Statistics. *Nat. Econ. Div., Res. Serv., ECIFS 3-4.*
- (9) \_\_\_\_\_ . 1985. The Current Financial Condition of Farmers and Farm Lenders. *Nat. Econ. Div., Econ. Res. Serv., Ag Info. Bull.* 490.