ALLOCATION OF FARM FINANCIAL STRESS AMONG INCOME, LEVERAGE, AND INTEREST RATE COMPONENTS: A KANSAS EXAMPLE

Allen M. Featherstone, Ted C. Schroeder, and Robert O. Burton, Jr.

Abstract

Suggested methods to reduce farm financial stress have included interest rate buy-downs and debt forgiveness. This study develops a method to estimate the proportion of individual farm financial stress attributable to an income problem, a leverage problem, and an interest rate problem. Of the Kansas Farm Management Association farms with a financial problem, 30 percent of the total financial problem is caused by an interest rate problem, 28 percent by a leverage problem, and 42 percent by an income problem. A reduction of leverage or interest rate to the level attained by the average nonstressed farms would make 31 percent and 32 percent of the stressed farms profitable, respectively. Therefore, in the short run, an interest rate buy-down or a debt reduction would be equally effective.

Key words: financial stress, allocation, income, debt.

From January 1, 1985, to January 1, 1986, the percentage of U.S. farms with debt-to-asset ratios greater than 0.40 increased from 18.9 percent to 21.3 percent (Johnson et al., 1986). In addition, almost 48 percent of these farms had household returns to equity of less than −20 percent. From January 1, 1986, to January 1, 1987, farms with greater than a 0.40 debt-to-asset ratio increased further to 21.6 percent (Johnson et al., 1987b). Of these farms, 46 percent had returns to equity of less than −20 percent. Thus, farms with high leverage ratios were losing equity at a rapid rate. Several policies have been proposed to try to reduce the severity of financial stress, including income enhancements, welfare payments, debt restructuring, and interest rate reductions or buy-downs (Brake and Boehlje; Barry).

Analyses of farm financial stress and proposed solutions suggest that financial stress is composed of an income problem, a debt problem, or a combination of income and debt problems. The seriousness of the debt problem is determined by the leverage ratio[1] and the interest rate relative to the rate of return on assets. Recent literature emphasizes the debt problem. Brake and Boehlje assert that "the common element in farm financial problems ... is unserviceable debt" and "an interest buy-down speaks directly to the basic problem facing financially stressed farmers—too much debt service" (pp. 1123, 1126). However, Reinsel and Joseph conclude that net farm operating margins in 1984 were not highly correlated with leverage ratios. Thus, financial stress is not solely a function of debt; income and balance sheet measures must be used to quantify financial stress. Several other studies support this argument (e.g., Melichar, 1985; Johnson et al., 1985).

These studies raise basic questions about farms experiencing financial stress. For instance, what proportion of the problem may be attributed to business management (i.e., income) and what proportion to financial management (i.e., debt)? Further, if a farm has a debt problem, what proportion of the debt problem may be attributed to the degree of leverage and what proportion to the cost of

Allen Featherstone and Ted Schroeder are Assistant Professors and Robert Burton is an Associate Professor in the Department of Agricultural Economics, Kansas State University, Manhattan, Kansas.

The authors would like to acknowledge the helpful suggestions of Art Barnaby, Tim Baker, Stephen Miller, Bryan Schurle, and three anonymous reviewers.

[1]More than one ratio can be used to measure leverage. Debt-to-assets is used in this paper as the measure of leverage.

borrowed capital?

The objective of this paper is to examine the financial performances of individual farms and to allocate poor financial performance between income, leverage, and interest rate components. The results provide insights into the potential effectiveness and implications for the study set of farms of farm policies promoting income supports, interest rate buydowns, or debt forgiveness.

METHODS

Decomposing economic concepts into component parts is not new. For example, Farrell and numerous others (e.g., Lovell and Sickles; Taylor et al.) developed methods to decompose production efficiency into its principal components, technical and allocative (or price) efficiencies. They argue that firms using more factors of production for a given output than the most efficient firm are technically inefficient. If firms can use a cheaper input mix, given their degree of technical efficiency, then they are also allocatively inefficient. This efficiency can be measured as an envelope of the most efficient firms (Bressler and King).

Financial stress has been measured by examining a farm's profitability, liquidity, solvency, and risk-bearing ability (Jolly et al.) Many studies have used one or a combination of these measures (Johnson et al., 1985, 1986, 1987a, 1987b; Lines and Morehart; Melichar, 1984). Lins et al. argue that single financial stress classifications based on the debt-to-asset ratio do not adequately reflect the financial position of farms. Lins et al. also conclude that accrual-based measures of income are superior to cash-based measures of income for classifying farms as stressed or nonstressed.

The above studies measure financial performance in a static context. Lins et al. recognize that financial stress has a time dimension. Leathers considers the time dimension by examining a "snapshot" of a firm's productive efficiency and debt in 1960 as a basis to determine the probability of farm survival in 1975.

In this study, a farm's financial performance is measured by the farm's geometric mean real rate of return to equity. In corporate finance (and many firm growth models), the objective of the firm is to maximize shareholders' wealth or net worth (e.g., Brigham; Lowenberg-DeBoer). The real rate of return to equity is the rate of increase or decrease in the firm's net worth over time.

The rate of return to equity is an accrual measure composed of both income and balance sheet information; it measures the rate of increase or decrease in equity due to earnings and changes in the value of assets and liabilities. A negative rate of return to equity is the rate at which the firm's capital stock is being depleted. The real rate of return to equity (R_E) can be defined as

$$(1)\quad R_E = \frac{R_A - K\delta}{(1 - \delta)},$$

where R_A is the real rate of return to assets, K is the real interest rate, and δ is the leverage ratio (Barry et al., p. 59).[2]

Several studies have used measures of liquidity and leverage in addition to profitability to determine whether a farm is financially stressed (e.g., Lines and Morehart; Johnson et al., 1985, 1986). Perhaps the major reason for using the measures of liquidity and leverage to classify farms is the lack of time series data. With only a single year's data, it is necessary to include liquidity and leverage in the classification of a farm's financial performance because they provide information, not provided by profitability measures, about the risk of financial problems. However with time series data, liquidity and leverage can be considered in the context of their effect on net worth. As can be seen from equation (1), leverage has an explicit effect on financial performance. In equation (1), liquidity does not have an explicit effect on financial performance but may have an implicit effect through its impact on the return to assets, leverage, and/or the interest rate. For example, the implicit effect may cause the rate of return on assets to be low if a farm was forced to liquidate assets to maintain cash flow. Most farms that have a long-term record of successful equity management should be able to use accumulated or borrowed capital to avoid liquidity crises. Because the rate of return to equity is defined as a function of the rate of return to assets, the interest rate, and the leverage ratio, it is possi-

[2] $R_A = R_E\,(E/A) + K\delta$ = equation 4.6 from Barry et al.
$R_E\,(E/A) = R_A - K\delta$
$R_E = \frac{R_A - K\delta}{1 - \delta}$, $E/A = 1 - \delta$.

ble to allocate financial performance into component causes.

Definition of Unacceptable Financial Performance

A rate of return comparable to alternative investments can be used as the partition for classifying farms as being successful or unsuccessful. This criterion represents the case where a farmer voluntarily chooses to exit agriculture. For this study, farms are classified as financially unsuccessful if their geometric mean real rate of return to equity from 1973 to 1985 is negative. The geometric real rate of return on treasury bills from 1926 to 1984 was 0.2 percent (Moss et al.). Thus, using zero as the partition for successful and unsuccessful performance approximates the use of a risk-free alternative investment. If a farmer earns a positive rate of return to equity on average in the long run, the farmer should be able to continue farming.

Financial problems of any farmer can be alleviated by sufficiently increasing returns to assets, decreasing interest rates, or both. However, these should not be arbitrarily adjusted without regard to a reference group or market conditions. Comparing the rates of return to assets, leverage ratios, and interest rates from farms which are not experiencing financial stress with those that are experiencing financial stress (comparative financial analysis) is one method to systematically analyze the components of financial stress. Comparative financial analysis is commonly used to identify possible causes of financial difficulties (Barry et al.; Brigham; Osburn and Schneeberger). This paper quantifies the proportion of poor performance due to the use of excess leverage, high interest rates, or low rates of return to assets by identifying an average (target) leverage ratio and interest rate for those farms which have been financially successful.

The method used in this study to determine a target leverage ratio and interest rate is to use an average leverage ratio and interest rate for farmers with positive mean rates of return to equity. For farms with a positive geometric mean[3] rate of return to equity, equation (2) is estimated to determine the target K and δ.

$$(2)\ R_{Ei} = a\,R_{Ai} + b + e_i, \text{ for all } R_{Ei} > 0,$$

where R_{Ei} is the real geometric mean rate of return to equity for the ith farm with a positive mean rate of return to equity, R_{Ai} is the real geometric mean rate of return to assets for the ith farm with a positive mean rate of return to equity, and e_i is a random error term. The parameter a is equal to $1/(1-\delta)$, and the parameter b is equal to $-K\delta/(1-\delta)$. Thus, equation (2) can be used to estimate a target interest rate and target leverage ratio.[4]

Equation (3) is estimated for each farm to approximate each individual farm's K and δ.

$$(3)\ R_{Eij} = c_j R_{Aij} + d_j + e_{ij} \text{ for all i farms,}$$

where R_{Eij} is the actual real rate of return to equity for the ith farm in the jth year, R_{Aij} is the actual real rate of return to assets for the ith farm in the jth year, and e_{ij} is a random error term. The average interest rate and the average leverage ratio for each farm can be determined from the estimated parameters c_j and d_j.

For farms with a negative real geometric mean rate of return to equity, the target interest rate, the target leverage ratio, the farm's estimated leverage ratio, and the farm's estimated interest rate can be used to decompose the farm's financial problem into component parts. The first step in decomposi-

[3]The geometric mean is used instead of the arithmetic mean because the geometric mean accounts for the effect of compounding. The geometric mean is equal to $\left[\prod_{i=1}^{n}(1+r_i)\right]^{1/n}-1$, where r_i is the rate of return for the ith period. For farms with the same arithmetic mean, a farm with more variable returns will have a smaller geometric mean.

[4]There are two reasons for calculating the target leverage ratio and target interest rate using equation (2) instead of using simple arithmetic means. First, the observations on debt occur as of January 1st each year, while the interest payments are for the year. Operating debt that is borrowed and retired within the year would not be included in the calculation of the leverage ratio, while the interest paid on the operating debt would be included in the calculation of the interest rate. Hence, the leverage ratio for those farms which use operating debt would be understated and the interest rate would be overstated. Also, using equation (2) to econometrically estimate the target leverage ratio and interest rate simultaneously minimizes the squared error. The arithmetic mean of the farms with a positive rate of return to equity would minimize the absolute error of the interest rate and the leverage ratio independently. Estimating the target leverage ratio and interest rate simultaneously is more desirable.

tion is to estimate the percentage of the farm's total problem due to a low rate of return on assets. Define the rate of return to equity (R^{A}_{Ei}) for the farm with financial difficulties ($R_{Ei}<0$), assuming it has the target leverage ratio and target interest rate as:

$$(4)\quad R^{A}_{Ei} = \frac{R_{Ai} - \hat{K}\hat{\delta}}{1-\hat{\delta}}.$$

where R_{Ai} is the farm's observed real geometric mean rate of return on assets, $\hat{\delta}$ is the target leverage ratio, and $\hat{K}$ is the target interest rate estimated in equation (2). Since $\hat{K}$ and $\hat{\delta}$ are the estimated interest rate and leverage ratio for farms that do not have financial problems, R^{A}_{Ei} is the rate of return to equity for a farm that is financially stressed, but the parts of the problem due to K and δ have been removed. Thus, any remaining financial problem is attributable to R_{Ai}. To estimate the portion of the farm's total financial problem due to low returns to assets, divide R^{A}_{Ei} by the farm's observed real geometric mean rate of return to equity, R_{Ei}. The ratio R^{A}_{Ei}/R_{Ei} may be greater than one, between zero and one, or less than zero. A negative ratio implies that if the farm had the target interest rate and target leverage ratio, the farm would have realized a positive rate of return to equity. Thus, none of the problem of negative rate of return to equity is attributed to a rate of return to assets problem. If R^{A}_{Ei}/R_{Ei} is greater than one, this suggests that the farm has a better leverage and interest rate combination than the target interest rate and target leverage ratio. Thus, the total financial problem can be attributed to a return to assets problem. If the ratio is between zero and one, the proportion of the financial problem attributed to a return to assets problem is equal to the ratio.

The next step is to decompose the farm's debt problem (financial problem minus return to assets problem) into an interest rate problem and a leverage problem. For farms with a negative real geometric mean rate of return to equity, the actual rate of return to assets, estimated interest rate, and target leverage ratio are used to estimate the farm's rate of return to equity without a leverage problem,

$$R^{L}_{Ei} = \frac{R_{Ai} - K\hat{\delta}}{1-\hat{\delta}}.$$

Finally, the farm's rate of return to assets, leverage ratio, and target interest rate are used to estimate the rate of return to equity, assuming no interest rate problem,

$$R^{I}_{Ei} = \frac{R_{Ai} - \hat{K}\delta}{1-\delta}.$$

The percent of the farm's total financial stress not due to a rate of return to assets problem is then allocated to a leverage problem and an interest rate problem using equation (5). Farm i's leverage problem (L_i) is

$$(5)\quad L_i = \left[\frac{(R_{Ei} - R^{L}_{Ei})}{(R_{Ei} - R^{L}_{Ei}) + (R_{Ei} - R^{I}_{Ei})}\right] * \left[\frac{(R_{Ei} - R^{A}_{Ei})}{R_{Ei}}\right],$$

where the first term is the proportion of the debt problem due to leverage and the second term is the proportion of the farm's total financial problem due to the debt problem. The remaining portion of the negative R_E problem not allocated to a rate of return to assets or leverage problem is an interest rate problem.

THE DATA

Data on the rate of return to equity and rate of return to assets for this analysis originate from Kansas Farm Management Association records (Parker) and the Kansas Crop and Livestock Reporting Service (Pretzer). Data on 492 farms were available on an annual basis from 1973 through 1985. The farm enterprises include dairy, beef cattle, swine, dryland crop, and irrigated crops.

The Kansas Farm Management Association records include complete balance sheet data on a cost basis and income data on an accrual basis. Data on land values, obtained from the Kansas Crop and Livestock Reporting Service for different regions of the state, are used to adjust long-term assets to a market value basis and to calculate capital gains (losses). All variables were converted to real values (1985 dollars) using the annual personal consumption expenditures (PCE) index[5] (*Economic*

[5]The PCE index is the personal and consumption expenditures portion of the implicit GNP deflator.

Report of the President).

The real annual return to assets for each farm is calculated by adding interest paid and unrealized capital gains on land to net farm income and subtracting a labor charge of $15,000 for unpaid labor in 1985 dollars per operator and a management charge of 5 percent of gross farm income. The real return to equity is calculated by subtracting interest paid and adding capital gains on debt[6] to the real return to assets. The rate of return to equity and the rate of return to assets for each year are determined by dividing the real return to equity by real beginning equity and dividing the real return to assets by real beginning assets, respectively. The geometric mean rate of return to assets and equity are calculated using the annual rate of return to assets and equity for each farm.

RESULTS

In this section, estimates of the mean rate of return to equity, mean rate of return to assets, interest rate, and leverage ratio are discussed. Next, target interest rate and leverage ratio estimation results are examined. Finally, decomposition results are discussed.

Components of Financial Performance

The geometric mean real rate of return to equity for the farms studied varied from −37.1 percent to 30.4 percent. Of the 492 farms, 283 had a geometric mean real rate of return to equity greater than zero, while 209 had a rate of return to equity less than zero. These numbers may not be representative of the farm sector because the sample consisted of Kansas Farm Management Association farms that had useable data for all 13 years and therefore does not represent a random sample.

Summary statistics for the sample farms are presented in Table 1. The geometric mean real rate of return to assets ranged from −9.7 percent to 30.1 percent. Several farms with negative rates of return to equity had positive rates of return to assets. On average, farms that earned a higher rate of return to assets tended to have a higher rate of return to equity. For all farms, the leverage ratios estimated using equation (3) ranged from zero to 81.1 percent. Farms with a negative rate of return to equity tended to have a higher leverage ratio than farms with a positive rate of return to equity. The estimated real interest rates ranged from −10.0 percent to 9.9 percent. Farms with a negative rate of return to equity tended to have a higher interest rate estimate than farms with a positive rate of return to equity.

Table 2 contains the correlation coefficients

TABLE 1. MEAN AND STANDARD DEVIATIONS OF THE RATE OF RETURN TO EQUITY, RATE OF RETURN TO ASSETS, LEVERAGE RATIO, AND INTEREST RATE FOR KANSAS FARMS, 1973-1985

Variable[a]	Observations[b]	Mean	Standard Deviation
	All Farms		
R_E	492	0.37%	8.38%
R_A	492	2.32	4.12
δ	492	30.20	19.57
K	461	1.25	3.92
	Farms with $R_E \geq 0$		
R_E	283	5.35	4.79
R_A	283	4.57	3.54
δ	283	25.45	17.27
K	268	0.67	3.69
	Farms with $R_E < 0$		
R_E	209	−6.36	7.43
R_A	209	−0.72	2.62
δ	209	36.62	20.67
K	193	2.03	4.09

[a]R_E = real geometric mean rate of return to equity, R_A = real geometric mean rate of return to assets, δ = debt to asset ratio, and K = real interest rate.

[b]Estimates of K on those farms with no debt were not possible.

[6]Capital gains on debt occur during periods of inflation because principal is paid back in cheaper dollars.

TABLE 2. CORRELATION BETWEEN THE RATE OF RETURN TO EQUITY, RATE OF RETURN TO ASSETS, LEVERAGE RATIO, AND INTEREST RATE FOR KANSAS FARMS, 1973-1985

	R_E[a]	R_A	δ	K
R_E	1.000	0.740*	−0.348*	−0.279*
R_A		1.000	0.092*	−0.015
δ			1.000	0.432*
K				1.000

[a]R_E = real geometric mean rate of return to equity, R_A = real geometric mean rate of return to assets, δ = debt to asset ratio, and K = real interest rate.
*—Significant at α = .05.

between the real rate of return to equity, the real rate of return to assets, the leverage ratio, and the interest rate. As would be expected from equation (2), the rate of return to equity is positively correlated with the rate of return to assets and negatively correlated with the leverage ratio and interest rate. The interest rate and leverage ratio are positively correlated, possibly indicating some differentiation in the cost of debt for firms which are higher risk to the lending institution.

Financial Structure of Successful Farms

The target leverage ratio and the target real interest rate for farms with a positive rate of return to equity can be estimated using equation (2). Equation 2, estimated using ordinary least squares (OLS), suggested a target leverage ratio of 19.0 percent and a target real interest rate of 1.22 percent.

$$(6)\ R_{Ei} = \underset{(37.21)}{1.2341}\ R_{Ai} - \underset{(-1.50)}{0.0029} + e_i,$$

where the values in parentheses are the t statistics. The overall F for the equation is 1384.68, which is significant at the 5 percent level. The R-square for the equation is .83, and the root mean squared error is .0197.

The sensitivity of the estimated target leverage ratio and interest rate to the choice of the minimum R_E for a farm to be classified as successful is found in Table 3. The leverage ratio is not sensitive to changes in the cut-off R_E. As the minimum cut-off increases, the target interest rate decreases. However, a change in the cut-off rate of one percent changes the target interest rate estimate by less than 1/2 of one percent.

Decomposition of the Financial Problem

In this section, the target leverage ratio and interest rate estimates are used to decompose each farm's financial problem into a rate of return to assets problem, a leverage problem, and an interest rate problem. The average importance of the leverage, interest rate, and income problems for farms in selected rate of return to equity categories is reported in Table 4. The most significant problems for the most severely stressed farms are the interest rate and leverage problems (each contributing more than 40 percent of the total financial problem). For farms with greater than −10 percent returns to equity, the relative importance of leverage and interest rate problems decline relative to an income problem. However, for all but one of the categories reported the total debt problem (interest rate plus leverage problem) remains more important than the income problem.

In Table 4, it appears as though the rate of

TABLE 3. SENSITIVITY OF THE TARGET LEVERAGE RATIO AND INTEREST RATE TO THE DEFINITION OF SUCCESSFUL AND UNSUCCESSFUL KANSAS FARMS

Minimum R_E of Successful Farms[a]	Number of Successful Farms	R-square	Target δ	Target K
			Percent	
−2%	350	.83	18.6	2.09
−1%	321	.82	18.6	1.87
0%	283	.83	19.0	1.22
1%	245	.83	18.4	.43
2%	206	.81	18.0	−.13

[a]R_E = rate of return to equity, δ = debt to asset ratio, and K = the real interest rate.

Table 4. Relative Importance of Return to Assets, Interest Rate, and Leverage Problems for Financially Stressed Kansas Farms

Rate of Return to Equity	Leverage Problem	Interest Rate Problem	Return to Assets Problem
	percent of total problems		
$R_E < -25\%$	42.7%	46.9%	10.4%
$-25\% \leq R_E < -10\%$	43.5	40.8	15.7
$-10\% \leq R_E < -5\%$	29.5	32.5	38.0
$-5\% \leq R_E < -2.5\%$	21.6	20.6	57.8
$-2.5\% \leq R_E < 0\%$	22.3	29.3	48.4
All farms with $R_E < 0\%$	27.6	30.4	42.0

return to assets problem relative to the farm's total financial problem decreases as the rate of return to equity decreases. This hypothesis can be tested by regressing the proportion of the total financial problem due to the rate of return to assets for each farm on the rate of return to equity. The hypothesis is tested by the following equation estimated using OLS.

$$(7) \quad \frac{R^A_{Ei}}{R_{Ei}} = \underset{(5.33)}{0.8132}\, R_{Ei} + \underset{(9.37)}{0.3448} + e_i,$$

where R^A_{Ei}/R_{Ei} is the proportion of the total problem due to the rate of return to assets for the ith farm, and t values are in parentheses. The R-square for the estimated equation is .43 with an F value of 76.39. Because the slope coefficient is significantly greater than zero, the hypothesis is not rejected. Furthermore, it appears as though on average for a 10 percent decline in the rate of return to equity, the marginal percentage of the problem due to rate of return to assets increases by 8 percent. Thus, those farms with a progressively more negative rate of return to equity increasingly face more of a debt problem than an income problem.

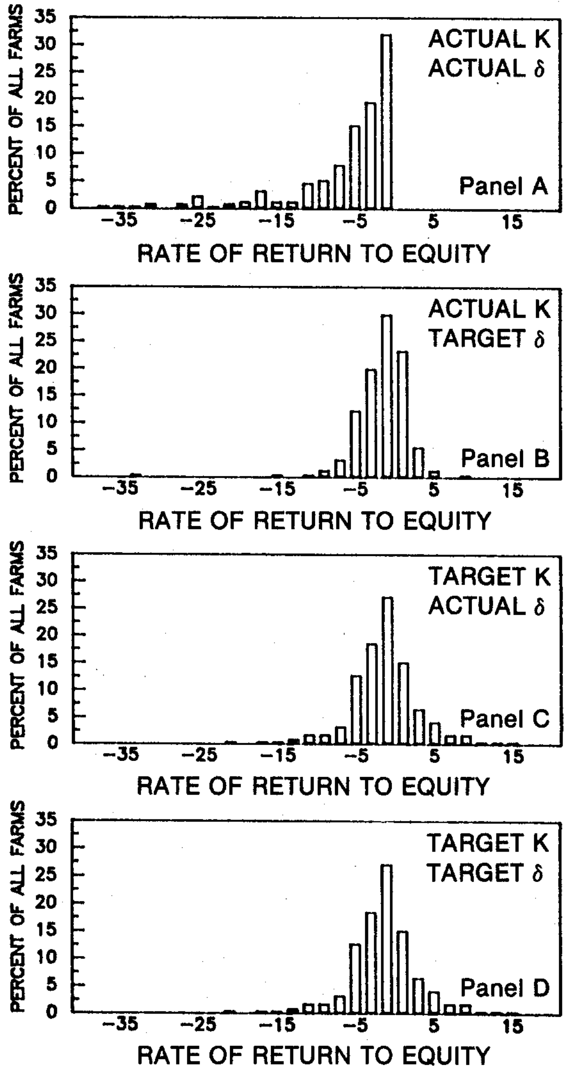

Figure 1. Distribution on Real Rate of Return to Equity with Target and Actual Leverage Ratios (δ) and Interest Rates (K) for Kansas Farms with Negative Rates of Return to Equity.

Policy Implications

Several proposals such as debt forgiveness and interest rate buy-downs have been suggested to alleviate financial stress. Figure 1, Panel A shows the distribution of the real geometric mean rate of return to equity for farms which had a negative real geometric mean rate of return to equity from 1973 to 1985. Figure 1 also shows the distribution of the rate of return to equity with the target leverage substituted for the farms' actual leverage (Panel B), the distribution of the rate of return to equity with the target interest rate (Panel C), and the distribution of the rate of return to equity with the target leverage ratio and target interest rate substituted for the actuals (Panel D).

Of the 209 Kansas farms that exhibited a negative real geometric mean rate of return to equity from 1973 to 1985, 31.1 percent would have realized a positive rate of return to equity if the leverage ratio were reduced to the target leverage ratio (Panel B). Sixty-one percent of these farms would have a rate of return to equity of greater than −2 percent with a reduction to the target leverage ratio. But only 32.1 percent of these farms actually had a rate of return to equity of greater than −2 percent (Panel A).

If the farms which lost equity had an interest rate reduced to the target, then 31.6 percent would have a positive rate of return to equity (Panel C). About 58.9 percent of these farms would have a mean rate of return to equity greater than −2 percent. Thus, a small percentage of Kansas Farm Management Association farms would have been in a relatively better financial situation if the leverage ratio had been reduced as opposed to having the interest rate reduced. However, because of the high debt, some farms were able to obtain a greater rate of return to equity with the interest rate reduction.

With target leverage ratios and target interest rates, 36.4 percent of the financially stressed farms have a positive rate of return to equity (Panel D). About 67.9 percent of the farms have a return to equity greater than −2 percent. A reduction in the leverage ratio without a corresponding reduction in the interest rate or a reduction of the interest rate without a corresponding reduction in the leverage ratio improves the financial situation of the farms by nearly as much as reducing both the leverage ratio and the interest rate. This suggests little added benefit to reducing both the interest rate and the leverage ratio simultaneously. Although most financially stressed farmers would have been in a much better financial situation (about 60 percent with a mean rate of return to equity greater than −2 percent) with a reduction in the interest rate or leverage ratio, all of the financial problems ($R_E > 0$) would not be solved for about 70 percent of the farmers. These results may not be representative of the farm sector because the sample consisted of Kansas Farm Management Association farms that had useable data for all 13 years and therefore does not represent a random sample.

SUMMARY AND CONCLUDING COMMENTS

This study investigated the components of long-term farm financial stress as indicated by a long-term negative real geometric mean rate of return to equity. A method was developed to allocate the financial stress into two component parts: 1) stress attributable to an income problem as measured by low rates of return to assets, and 2) stress associated with a debt problem as measured by debt-to-asset ratio and interest rate. This method was based on the accounting identity that expresses the rate of return to assets as a weighted average of rate of return to equity and cost of debt. The allocation procedure involved estimation of the debt-to-asset ratio and interest rate for farms not experiencing financial stress and measuring the proportion of financially stressed farms that would not have been stressed if they had the target debt-to-asset ratio and interest rate. A debt problem accounts for about 58 percent of financial stress on Kansas Farm Management Association farms that were on average losing equity over the 1973 to 1985 period. The most severely stressed farms were facing a proportionately larger debt problem.

The debt problem was further allocated into a leverage problem and an interest rate problem. Leverage accounted for 28 percent of the financially stressed farms' problems, while the interest rate was 30 percent of the total financial problem. In addition, a reduction of leverage to the level attained by the average nonstressed farms would have made 31 percent of the stressed farms profitable. Similarly, a reduction of the interest rate would have made 32 percent of the stressed farms profitable. The proportion of stressed farms made profitable by reducing both leverage and the interest rate simultaneously was 36 percent.

Recent farm policy discussions center on leverage reduction and/or interest rate buy-downs as a means to reduce farm financial stress. This study estimates the proportion of financially stressed farms that would be categorized as not stressed as a result of different types of policy options. Issues such as the costs of such policies and which groups of farms would benefit most were not addressed. Results suggest that 42 percent of the financially stressed Kansas Farm Management Association farms would not benefit much from debt (interest or leverage) buy-downs since their most significant problem is low rates of return to assets. Of the 58 percent of financially stressed farms that could benefit most from these policies, it was evident that interest buy-downs and debt reductions to levels associated with nonstressed farms would be roughly equally effective.

REFERENCES

Barry, P.J. *Financial Stress in Agriculture: Policy and Financial Consequences For Farmers*. AE-4621, University of Illinois at Urbana-Champaign, Nov. 1986.

Barry, P.J., J.A. Hopkin, and C.B. Baker. *Financial Management in Agriculture*. Third Edition. Danville, Illinois: Interstate Printers & Publishers, 1983.

Brake, J. R., and M.D. Boehlje. "Solutions of Financial Stress Problems from the Private and Public Sectors." *Amer. J. Agr. Econ.*, 67(1985):1123-28.

Bressler, R.G., Jr., and R.A. King. *Markets, Prices and Interregional Trade*. New York: John Wiley and Sons, 1970.

Brigham, E.F. *Financial Management: Theory and Practice*. Third Edition. Chicago: Dryden Press, 1982.

Economic Report of the President, Washington, D.C.: U.S. Government Printing Office, 1987.

Farrell, M.J. "The Measurement of Productive Efficiency." *J. Royal Statist. Soc.*, Series A, 120(1957):253-81.

Johnson, J.D., K. Baum, and R. Prescott. *Financial Characteristics of U.S. Farms, January 1985*. AIB-495, USDA ERS, July 1985.

Johnson, J.D., R. Prescott, D. Banker, and M.J. Morehart. *Financial Characteristics of U.S. Farms, January 1, 1986*. AIB 500, USDA, ERS, Aug. 1986.

Johnson, J.D., M.J. Morehart, and K. Erickson. "Financial Conditions of the Farm Sector and Farm Operators." *Agr. Fin. Rev.*, 47, Special Issue (1987a): 1-18.

Johnson, J.D., M.J. Morehart, L. Nielson, D. Banker, and J. Ryan. *Financial Characteristics of U.S. Farms, January 1, 1987*. AIB 525, USDA/ERS, August 1987b.

Jolly, R.W., A. Paulsen, J.D. Johnson, K.H. Baum, and R. Prescott. "Incidence, Intensity, and Duration of Financial Stress among Farm Firms." *Amer. J. Agr. Econ.*, 67(1985):1108-15.

Leathers, H.D. "Debt and Efficiency as Determinants of Farm Survival: An Empirical Approach." Selected paper presented at AAEA meeting, East Lansing, Michigan, 1987.

Lines, A.E., and M.J. Morehart. "Financial Health of U.S. Farm Financial Businesses in 1984: A Region, Type, and Size Analysis." *Agr. Fin. Rev.*, 47(1987):43-52.

Lins, D.A., P.N. Ellinger, and D.H. Latz. "Measurement of Financial Stress in Agriculture." *Agr. Fin. Rev.*, 47(1987):53-61.

Lovell, C.A.K., and R.C. Sickles. "Testing Efficiency Hypotheses in Joint Production: A Parametric Approach." *Rev. Econ. Stat.*, 65(1983):51-58.

Lowenberg-DeBoer, J. *The Microeconomic Roots of the Farm Crisis*. New York: Praeger Publishers, 1986.

Melichar, E. "A Financial Perspective on Agriculture." *Fed. Res. Bul.*, Jan. 1984.

Melichar, E. "Farm Financial Experience and Agricultural Banking Experience." Statement before the U.S. House of Representatives, Committee on Banking, Finance, and Urban Affairs, Subcommittee on Economic Stabilization, Oct. 23, 1985.

Moss, C.B., A.M. Featherstone, and T.G. Baker. "Agricultural Assets in an Efficient Multiperiod Investment Portfolio." *Agr. Fin. Rev.*, 47(1987):82-94.

Osburn, D.D., and K.C. Schneeberger. *Modern Agricultural Management: A Systems Approach to Farming*. Second Edition. Reston, Virginia: Reston Publishing Company, Inc., 1983.

Parker, L.C. *Extension Farm Management Assoications —A Model for Kansas Agriculture*. Cooperative Extension Service, Manhattan, Kansas, 1982.

Pretzer, D.D. *Kansas Land Prices—Cash Rental Rates and Associated Data*. Cooperative Extension Service, Manhattan, Kansas, 1987.

Reinsel, R.D., and A. Joseph. *The Financial Condition of Agriculture: An Income Analysis*. USDA ERS Staff Rep. AGES860710, Aug. 1986.

Taylor, T.G., H.E. Drummond, and A.T. Gomes. "Agricultural Credit Programs and Production Efficiency: An Analysis of Traditional Farming in Southeastern Minas Gerais, Brazil." *Amer. J. Agr. Econ.*, 68(1986):110-18.