COMPONENT CAUSES OF FARM FINANCIAL STRESS

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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 financially stressed farms, 33.5% suffered most from an interest rate problem, and 23.4% suffered most from a leverage problem. A reduction of leverage or interest rate to the level attained by the average nonstressed farms would make 31% and 32% of the stressed farms profitable, respectively. Therefore, in the short-run, an interest rate buy-down or a debt reduction would be equally effective.
COMPONENT CAUSES OF FARM FINANCIAL STRESS

From January 1, 1985 to January 1, 1986, the percentage of U.S. farms with
debt to asset ratios greater than .40 increased from 18.9% to 21.3% (Johnson et
al., 1986). In addition, almost 48% of these farms had household returns to
equity of less than -20%. From January 1, 1986 to January 1, 1987, farms with
greater than a .40 debt to asset ratio increased further to 21.6% (Johnson et
al., 1987b). Of these farms, 46% had returns to equity of less than -20%.
Thus, farms with high leverage ratios were losing their equity at a rapid rate.
Several polices have been proposed to try to reduce the severity of financial
stress, including income enhancements, welfare payments, debt restructuring or
reductions, 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 (debt divided by assets) and the interest
rate relative to the rate of return on assets.¹ 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 and 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

¹Debt structure (principle repayment schedule) is not addressed here
because, depending on the leverage and return to assets, debt may be
restructured.
balance sheet measures must be used to quantify financial stress. Several other studies support this idea (e.g., Melichar 1985; Johnson, Baum, and Prescott).

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 borrowed capital (interest rate)?

The objective of this paper is to allocate the financial stress of individual farms between income, leverage, and interest rate components. The results provide insights into the potential effectiveness and implications of farm policies promoting income supports, interest rate buy-downs, or debt forgiveness.

Decomposing economic concepts into component parts has been done in previous studies. For example, Farrell and numerous others (e.g., Lovell and Sickles; Taylor et al.) have 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,
Lins et al. conclude that single classifications based on the debt to asset ratio do not adequately reflect the financial position of farms. They also conclude that accrual-based measures of income are superior to cash-based measures of income for classifying farms as stressed or nonstressed. In this study, the measure of financial performance, rate of return to equity, is decomposed into income, leverage, and interest rate components. 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. A negative rate of return to equity is a measure of financial stress, which indicates the rate at which the firm's capital stock is being depleted.

The usefulness of decomposition of economic concepts, the appropriateness of the rate of return to equity as a measure of financial stress, and the impacts of increasing leverage ratios and interest rates are all recognized in the literature. However, allocation of negative returns to earnings, leverage, and interest rate problems has not been addressed previously.

Theory and Methodology

Many previous studies measure financial stress in a static context. Lins et al. recognize that financial stress has a time dimension. Leathers considers the time dimension by using a "snapshot" of a firm in 1960 as the basis to determine the potential of survival in 1975. He examines the effect of efficiency and debt on survivability. In this study, a single classification longitudinal measure of stress is used. In corporate finance and farm firm growth models, the performance of a firm is often measured by net worth at some point in time. The real rate of return to equity is the rate of increase or decrease in the firm's net worth over time. A leverage ratio of
.40 is not preferred to a leverage ratio of .60 unless it is associated with a larger expected utility of future net worth. Therefore, when analyzing the performance of a firm, the most appropriate single variable to be included in the utility function is a measure of change in net worth. Liquidity and leverage should be considered in the context of their effect on future net worth.

Assuming that farmers maximize expected utility subject to consideration of survival, a farmer's objective can be formulated as:

(1) Maximize \( E[U(R_E)] \)
    Subject to \( Pr(R_E < R_E^*) \leq \alpha \)

where \( R_E \) is the real rate of return to equity, \( R_E^* \) is a critical level of \( R_E \) associated with farm survival, and \( \alpha \) is the minimum acceptable probability of survival. It is assumed that the farmer is risk averse. The real rate of return to equity is defined as:

(2) \[ R_E = \frac{R_A - K\delta}{1 - \delta} \]

where \( R_A \) is the real rate of return to assets, \( K \) is the real interest rate, and \( \delta \) is the leverage ratio. As can be seen from equation 2, leverage has an explicit effect on financial performance. In equation 2, 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. Because the rate of return to equity is a function of the rate of return to assets, the interest rate, and the leverage ratio, it is possible to allocate financial performance into component causes.

A rate of return comparable to alternative investments can be used as the partition for classifying farms as being stressed or nonstressed. This
criterion represents the case in which a farmer voluntarily chooses to exit agriculture. For this study, farms are classified as financially stressed if their geometric mean real rate of return to equity from 1973 to 1985 is negative. Using zero as a partition instead of the rate that can be earned on an alternative investment, such as treasury bills, may not maximize ending net worth, but it captures the essence of the survivability constraint. In the long-run, if a farmer earns a positive rate of return on equity on average, he 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, it does not make sense to arbitrarily adjust these without regard to a reference group or market conditions. Using the leverage ratios and interest rates from farms that are not experiencing financial stress as targets is one method to systematically decompose financial stress.

The first step in decomposing financial stress into an income problem, a leverage problem, and an interest rate problem involves identifying a target leverage ratio and interest rate. Several alternatives exist for choosing a target interest rate and leverage ratio. One method is to use the interest rate and leverage ratio of the firm with the highest mean return to equity from 1973 to 1985. This method is undesirable because the firm with the highest rate of return to equity could be using leverage inefficiently. In fact, leverage could be working against this firm (the rate of return to assets could be greater than the rate of return to equity).

A second method is to identify those firms that have used leverage to the greatest advantage (the firms with the maximum \( R_E - R_A \) for different levels of \( R_A \)) and use the respective interest rates and leverage ratios as the target.
The idea would be similar to Farrell’s measurement of technical efficiency, identifying firms that have most efficiently used leverage to increase the rate of return to equity. However, Farrell’s method, which is based upon profit maximization, would produce an envelope for the most risk neutral individuals and as a result, would classify farmers that are more risk averse as being inefficient.

A third possible method of determining a target leverage ratio and interest rate, and the method used in this study, is to use an average leverage ratio and interest rate for farmers with a positive mean rate of return to equity. Because farmers are assumed to maximize expected utility (equation 1), each farm’s leverage ratio is assumed optimal, given an exogenous interest rate available to that farmer. Thus, using an average leverage ratio and interest rate instead of the leverage ratio and interest rate of the envelope of the most risk neutral farmers considers more risk averse farmers. This procedure provides a level of risk aversion closer to average.

For farms with a positive geometric\(^2\) mean rate of return to equity, equation 3 is estimated to determine the target \(K\) and \(\delta\).

\[
R_{Ei} = a \cdot R_{Ai} + b + e_i, \text{ for all } R_{Ei} > 0
\]

where \(R_{Ei}\) is the real geometric mean rate of return to equity for the \(i\)th farm with a positive mean rate of return to equity. \(R_{Ai}\) is the real geometric mean

\[2\] The geometric mean is used instead of the arithmetic mean in this study 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 \(i\)th period. For farms with the same arithmetic mean, a farm with more variable returns, will have a smaller 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 3 can
be used to estimate a target interest rate and target leverage ratio.$^3$

Equation 4 is estimated for each farm to approximate individual farm’s $K$
and $\delta$.

(4) $R_{Eij} = c_jR_{Aij} + d_j + e_{ij}$ for all j 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
decomposition is to estimate the percent of the farm’s total problem due to a

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$^3$ There are two reasons for calculating the target leverage ratio and
target interest rate using this equation instead of using the simple arithmetic
means. First, the observations on debt occur as of January 1st each year,
whereas 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, whereas the interest paid on the operating debt would be
included in the calculation of the interest rate. Hence, the leverage ratio
for those farms that use operating debt would be understated and the interest
rate would be overstated. Using equation 2 eliminates this bias. 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 dependently is more desirable.
low rate of return on assets. First, define the rate of return to equity ($R_{ei}^\hat{A}$) for the farm with financial difficulties ($RE_{i}<0$), assuming that it has the target leverage ratio and target interest rate:

\begin{equation}
R_{el}^A = \frac{RA_{i} - KE}{1 - \hat{\delta}}
\end{equation}

where $RA_{i}$ 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 3. To estimate the portion of the farm's total financial problem due to low returns to assets, divide $RE_{i}$ by the farm's observed return to equity, $RE_{i}$. If $RE_{i}/RE_{i}$ is 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 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 $RE_{i}/RE_{i}$ is greater than one, this suggests that the farm has a better leverage and interest rate position than the position associated with 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, $R^L_{EI}$. 4

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, $R^T_{EI}$. 5 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 6. Farm i's leverage ($L_i$) problem is

$$L_i = \frac{(R_{Ei} - R^L_{EI}) \cdot (R_{Ei} - R^A_{EI})}{(R_{Ei} - R^L_{EI}) + (R_{Ei} - R^I_{EI})} \cdot R_{EI}$$

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

The Data

Data on the rate of return to equity and rate of return to assets originate from Kansas Farm Management Association records (Parker) and the Kansas Crop and Livestock Reporting Service. Data on 492 farms were available on an annual basis from 1973 through 1985. The farms are a cross section of Kansas agriculture including dairy, beef cattle, swine, dryland crop, and irrigated crop enterprises.

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4 $R^L_{EI} = R_{Ai} - \frac{1}{1-\delta}$

5 $R^T_{EI} = R_{Ai} - \frac{1}{1-\delta}$
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 using the annual personal consumption expenditures (PCE) index.

The real annual return to assets (1985 dollars) for each farm are calculated by adding interest paid and unrealized capital gains on land to net farm income and subtracting a labor charge of $15,000 in 1985 dollars per operator and a management charge of 5% of gross farm income. The real return to equity is calculated by subtracting interest paid and adding capital gains on debt to the real return to assets. The rate of return to equity and the rate of return to assets for each year are then 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.

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6Capital gains on debt occur during periods of inflation because principal is paid back in cheaper dollars.
Components of Financial Performance

The rate of return to equity is used as the measure of financial performance. A farm is defined as financially successful from 1973 to 1985, if the real geometric mean rate of return to equity is positive. The geometric mean real rate of return to equity varied from approximately -37.1% to 30.4% (figure 1). Of the 492 farms, 283 had a geometric mean real rate of return to equity greater than zero, whereas 209 had a rate of return to equity less than zero. These numbers may not be representative of the farm sector because farms that went bankrupt before 1985 are not included in the analysis.

The geometric mean real rate of return to assets varied from -9.7% to 30.1% (figure 2). 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.

Figures 3 and 4 illustrate the distribution of estimated leverage ratios and real interest rates, respectively, for the individual farms (estimated using equation 4). For all farms, the estimated leverage ratios ranged from zero to 81.1% (figure 3). Farms with a negative rate of return to equity tend to have a higher leverage ratio than farms with a positive rate of return to equity. The estimated interest rates ranged from -10.0% to 9.9% (figure 4). 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.

The mean and the standard deviations (across farms) of the geometric mean real rate of return to equity, geometric mean real rate of return to assets, estimated leverage ratio, and the estimated interest rate are reported in table 1. As suggested previously, the mean rate of return to assets is higher for
farms with positive rates of return to equity, whereas the leverage ratios and the interest rates are lower.

Table 2 contains the correlation 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 that 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 3. Equation 3, estimated using ordinary least squares (OLS), suggested a target leverage ratio of 19.0% and a target real interest rate of 1.22%.

\[
\begin{align*}
    R_{ei} &= 1.2341 R_{Ai} - 0.0029 + e_i \\
    (37.21) & \quad (-1.50)
\end{align*}
\]

where the values in parenthesis are the t statistics. The overall F for the equation is 1384.68, which is significant at the 5% level. The R-square for the equation is .831, and the root mean squared error is .0197.

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. Also, the hypothesis is tested that, as the rate of return to equity becomes more negative, the percent of the problem due to low rate of return to assets decreases.
Table 3 presents the percent of financially stressed farms for which either the return to assets or debt problem dominates. The debt problem is defined as one minus the return to assets problem. For 58.85% of farms, the debt problem is larger than the return to assets problem. When the mean rate of return to equity is greater than -5%, the percent of farms suffering from a return to assets problem is greater than the percent of farms facing a debt problem. When the mean rate of return to equity is less than -5%, the debt problem becomes more significant. From table 3, it can be hypothesized that the rate of return to assets problem relative to the farm's total financial problem decreases as the rate of return to equity decreases.

The hypothesis that the rate of return to assets problem relative to the total problem decreases as the rate of return to equity decreases is not rejected. The hypothesis is tested by estimating the following equation using OLS.

\[
\frac{R_{ei}}{R_{ei}} = 0.8132 R_{ei} + 0.3448 + e_i
\]

where \( R_{ei}/R_{ei} \) is the proportion of the total problem due to the rate of return to assets for the ith farm. The t values are in parentheses. Because the slope coefficient is significantly greater than zero, the hypothesis is not rejected. The R-square for the estimated equation is .425 with an F value of 76.39. Thus, those farms with a more negative rate of return to equity face more of a debt problem than an income problem.

The debt problem is further proportioned into a leverage problem and an interest rate problem. Table 4 assesses the most important problem facing the financially stressed farm. Farms with the lowest rates of return to equity most often have a leverage problem. Farms with higher rates of return to equity most often face a rate of return to assets problem. Overall, the
largest proportion of financial stress is allocated to a leverage problem on 23.4% of farms, an interest rate problem on 33.5% of farms, and an income problem on 43.1% of farms.

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 5. The most significant problems for the most severely stressed farms are the interest rate and leverage problems (each contributing more than 40% of the total financial problem). For farms with greater than -10% returns to equity, the importance of leverage and interest rate problems decline relative to an income problem; however, the total debt problem (interest rate plus leverage problem) generally remains more important than the income problem.

Several proposals such as debt forgiveness and interest rate buy-downs have been suggested to alleviate financial stress. Figure 5 shows the distribution of the real geometric mean rate of return to equity for farms that had a negative real geometric mean rate of return to equity from 1973 to 1985. Figure 5 also shows the distribution of the rate of return to equity with the target leverage substituted for the farms actual leverage, the distribution of the rate of return to equity with the target interest rate, and the distribution of the rate of return to equity with the target leverage ratio and target interest rate substituted for the actuals.

Of the 209 farms that exhibited a negative real geometric mean rate of return to equity from 1973 to 1985, 31.1% would have realized a positive rate of return to equity if the leverage ratio were reduced to the target leverage ratio. Sixty-one percent of the farms would have a rate of return to equity of greater than -2% with a reduction to the target leverage ratio. But only 32.1%
of the farms actually had a rate of return to equity of greater than -2% (figure 1).

If the farms that lost equity had an interest rate reduced to the target, then 31.6% would have a positive rate of return to equity. About 58.9% of the farms would have a mean rate of return to equity greater than -2%. Thus, more farms would have been in a relatively better financial situation if the leverage ratio had been reduced rather than the interest rate. 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 interest rates, 36.4% of the financially stressed farms have a positive rate of return to equity. About 67.9% of the farms have a return to equity greater than -2%. 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 in 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% with a mean rate of return to equity greater than -2%) with a reduction in the interest rate or leverage ratio, all of the financial problems \( R_E > 0 \) would not have been solved for about 70% of the farmers.

**Conclusions**

This study investigated the components of recent farm financial stress. A method was developed to allocate the financial stress into two component parts: 1) stress attributable to low rates of return to assets and 2) stress
associated with debt. A debt problem was the primary contributor to financial stress for about 60% of the farms that on average were 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 was the most significant problem for 23% of the financially stressed farms, whereas the interest rate was the most severe problem for 33% of the farms. In addition, a reduction of leverage to the level attained by the average nonstressed farms would have made 31% of the stressed farms profitable. Similarly, a reduction of the interest rate would have made 32% of the stressed farms profitable. The proportion of stressed farms made profitable by reducing both leverage and the interest rate simultaneously would have been 36%.

Recent farm policy discussions center on leverage reduction and/or interest rate buy-downs as a means of reducing farm financial stress. The results of this study suggest that 40% of the financially stressed 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 60% of financially stressed farms that could benefit most from these policies, it was evident that in the short-run, interest buy-downs and debt reductions to levels associated with nonstressed farms would be roughly equally effective, although the cost of the policies would be different. Also, the primary benefits may accrue to different groups of farms under each scenario.
Table 1. Mean and Standard Deviations of the Rate of Return to Equity, Rate of Return to Assets, Leverage Ratio, and Interest Rate.

<table>
<thead>
<tr>
<th>Variable (^a)</th>
<th>Observations (^b)</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>(R_E)</td>
<td>492</td>
<td>0.37%</td>
<td>8.38%</td>
</tr>
<tr>
<td>(R_A)</td>
<td>492</td>
<td>2.32</td>
<td>4.12</td>
</tr>
<tr>
<td>(\delta)</td>
<td>492</td>
<td>30.20</td>
<td>19.57</td>
</tr>
<tr>
<td>(K)</td>
<td>461</td>
<td>1.25</td>
<td>3.92</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td><strong>-All Farms-</strong></td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(R_E)</td>
<td>283</td>
<td>5.35</td>
<td>4.79</td>
</tr>
<tr>
<td>(R_A)</td>
<td>283</td>
<td>4.57</td>
<td>3.54</td>
</tr>
<tr>
<td>(\delta)</td>
<td>283</td>
<td>25.45</td>
<td>17.27</td>
</tr>
<tr>
<td>(K)</td>
<td>268</td>
<td>0.67</td>
<td>3.69</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>-Farms with (R_E \geq 0)-</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(R_E)</td>
<td>209</td>
<td>-6.36</td>
<td>7.43</td>
</tr>
<tr>
<td>(R_A)</td>
<td>209</td>
<td>-0.72</td>
<td>2.62</td>
</tr>
<tr>
<td>(\delta)</td>
<td>209</td>
<td>36.62</td>
<td>20.67</td>
</tr>
<tr>
<td>(K)</td>
<td>193</td>
<td>2.03</td>
<td>4.09</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
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<tr>
<td><strong>-Farms with (R_E &lt; 0)-</strong></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

\(^a\) \(R_E\) = real geometric mean rate of return to equity, \(R_A\) = real geometric mean rate of return to assets, \(\delta\) = debt to asset ratio, and \(K\) = real interest rate.

\(^b\) Estimates of \(K\) on those farms with no debt were not possible.
Table 2. Correlation between the Rate of Return to Equity, Rate of Return to Assets, Leverage Ratio and Interest Rate.

<table>
<thead>
<tr>
<th></th>
<th>$R_E^a$</th>
<th>$R_A$</th>
<th>$\delta$</th>
<th>$K$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$R_E$</td>
<td>1.000</td>
<td></td>
<td>-0.348*</td>
<td>-0.279*</td>
</tr>
<tr>
<td>$R_A$</td>
<td></td>
<td>1.000</td>
<td>0.092*</td>
<td>-0.015</td>
</tr>
<tr>
<td>$\delta$</td>
<td></td>
<td>1.000</td>
<td></td>
<td>0.432*</td>
</tr>
<tr>
<td>$K$</td>
<td></td>
<td></td>
<td></td>
<td>1.000</td>
</tr>
</tbody>
</table>

$R_E^a$ = real geometric mean rate of return to equity, $R_A$ = real geometric mean rate of return to assets, $\delta$ = debt to asset ratio, and $K$ = real interest rate.

* - Significant at $\alpha = .05$. 

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18
Table 3. Percent of Financially Stressed Farms for which either the Returns to Assets or Debt Problem Dominate.

<table>
<thead>
<tr>
<th>Rate of Return to Equity</th>
<th>n</th>
<th>Debt Problem</th>
<th>Return to Assets Problem</th>
<th>Return to Equity Problem</th>
</tr>
</thead>
<tbody>
<tr>
<td>( R_E &lt; -25% )</td>
<td>10</td>
<td>4.78</td>
<td>0.00</td>
<td>4.78</td>
</tr>
<tr>
<td>(-25% \leq R_E &lt; -10%)</td>
<td>31</td>
<td>13.40</td>
<td>1.44</td>
<td>14.84</td>
</tr>
<tr>
<td>(-10% \leq R_E &lt; -5% )</td>
<td>39</td>
<td>11.48</td>
<td>7.18</td>
<td>18.66</td>
</tr>
<tr>
<td>(-5% \leq R_E &lt; -2.5% )</td>
<td>49</td>
<td>9.57</td>
<td>13.88</td>
<td>23.44</td>
</tr>
<tr>
<td>(-2.5% \leq R_E &lt; 0% )</td>
<td>80</td>
<td>19.62</td>
<td>18.66</td>
<td>28.28</td>
</tr>
<tr>
<td>Column Sum</td>
<td>209</td>
<td>58.85</td>
<td>41.15</td>
<td>100.00</td>
</tr>
</tbody>
</table>

\( ^a \) % of farms where the returns to asset problem is less than one-half.
### Table 4. Percent of Financially Stressed Farms for which either the Returns to Assets, Interest Rate, or Leverage Problem Dominate.

<table>
<thead>
<tr>
<th>Rate of Return to Equity</th>
<th>Leverage Problem</th>
<th>Interest Rate Problem</th>
<th>Returns to Assets Problem</th>
<th>Return to Equity Problem</th>
</tr>
</thead>
<tbody>
<tr>
<td>RE &lt; -25%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.35</td>
<td>1.44</td>
<td>0.00</td>
<td>4.78</td>
</tr>
<tr>
<td>-25% ≤ RE &lt; -10%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>8.13</td>
<td>5.26</td>
<td>1.44</td>
<td>14.84</td>
</tr>
<tr>
<td>-10% ≤ RE &lt; -5%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.83</td>
<td>6.70</td>
<td>8.13</td>
<td>18.66</td>
</tr>
<tr>
<td>-5% ≤ RE &lt; -2.5%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.87</td>
<td>5.74</td>
<td>14.83</td>
<td>23.44</td>
</tr>
<tr>
<td>-2.5% ≤ RE &lt; 0%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>5.26</td>
<td>14.35</td>
<td>18.66</td>
<td>38.28</td>
</tr>
<tr>
<td>Column Sum</td>
<td>23.44</td>
<td>33.49</td>
<td>43.06</td>
<td>100.00</td>
</tr>
</tbody>
</table>

a% of farms where the leverage problem is greater than both the interest rate problem and return to assets problem.
Table 5. Relative Importance of Return to Assets, Interest Rate, and Leverage Problems for Financially Stressed Farms.

<table>
<thead>
<tr>
<th>Rate of Return to Equity</th>
<th>Leverage&lt;sup&gt;a&lt;/sup&gt; Problem</th>
<th>Interest Rate Problem</th>
<th>Returns to Assets Problem</th>
</tr>
</thead>
<tbody>
<tr>
<td>RE &lt; - 25%</td>
<td>42.7%</td>
<td>46.9%</td>
<td>10.4%</td>
</tr>
<tr>
<td>-25% ≤ RE &lt; - 10%</td>
<td>43.5</td>
<td>40.8</td>
<td>15.7</td>
</tr>
<tr>
<td>-10% ≤ RE &lt; - 5%</td>
<td>29.5</td>
<td>32.5</td>
<td>38.0</td>
</tr>
<tr>
<td>-5% ≤ RE &lt; - 2.5%</td>
<td>21.6</td>
<td>20.6</td>
<td>57.8</td>
</tr>
<tr>
<td>-2.5% ≤ RE &lt; 0%</td>
<td>22.3</td>
<td>29.3</td>
<td>48.4</td>
</tr>
<tr>
<td>All farms with RE &lt; 0%</td>
<td>27.6</td>
<td>30.4</td>
<td>42.0</td>
</tr>
</tbody>
</table>

<sup>a</sup>The mean leverage problem for farms in each RE classification, 
\[ \frac{1}{n} \sum_{i=1}^{n} L_i. \]
Figure 1. Distribution of Real Geometric Mean Rate of Return to Equity, 1973-1985.
Figure 2. Distribution of Real Geometric Mean Rate of Return to Assets, 1973-1985.
Figure 3. Distribution of Real Average Debt to Assets Ratio, 1973-1985.
Figure 4. Distribution of Real Interest Rate, 1973-1985.
Figure 5. Distribution of Real Rate of Return of Equity with Target Leverage and Target Interest Rate for Farms with Negative Rates of Return to Equity.
References


