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AN EVALUATION OF FINANCIAL STRESS ABATEMENTS FOR AN OKLAHOMA FARM SITUATION

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Financial stress in the U.S. farm sector is widely recognized and well documented. The incidence of insufficient cash flows, credit problems, loan delinquencies, foreclosures, and bankruptcies in agriculture reached significant levels during the 1980's. In 1986, survey results indicated that most farmers earned enough to make principal and interest payments, reduce debt outstanding and meet other financial commitments. However, data varied widely by farm size, type and region as continued foreclosures and debt restructuring by lenders indicated that not all farmers were sharing equally in the recovery. Highly leveraged farmers still held roughly 66 percent of all debt suggesting a continued need for research on possible abatements to financial stress (USDA).

Recent research on farm financial stress is primarily of three types. One group of studies provides a perspective on the financial condition of agriculture, discusses the severity of the farm financial crisis, and suggests possible abatements to financial stress (Chicoine; Ginder; Melichar; Harshbarger and Chite). A second group of studies employs statistical techniques to identify the extent of farm financial stress by location, size, and type of farming enterprise (USDA; Lines and Morehart; Choat and Plaxico). A third group of studies investigates the merits of proposed farm-level abatements to financial stress using farm simulation modeling techniques (Perry, Rister, Richardson, and Leatham; Mapp and Walker; Al-Abdali; Barry). Throughout the literature, there is widespread agreement that the farm credit crisis is not a temporary, short-term phenomenon. Instead, it is a long-run adjustment to secular trends that calls for further restructuring of the agricultural industry at all levels. Numerous policy options have been suggested to help alleviate the burdens associated with this massive restructuring. Suggestions include restructuring debts through interest write downs, debt write downs, or combinations of both. Other suggestions focus on debt forgiveness, moratoriums on debt repayment and attracting additional equity capital into the farm sector. Selling farm assets and either leasing them back or adjusting to a downsized farming operation are additional possibilities.

The purpose of this study is to evaluate the impacts of selected financial stress abatement options on the overall performance of a financially stressed Northcentral Oklahoma wheat and livestock farm. The initial farm situation is specified to represent a high level of financial stress. The initial debt to asset ratio is 50 percent. This base farm situation is first simulated over a 5-year-period using the Integrated Farm Financial Statements (IFFS) model [Mapp, Love and Hesser; Love, Mapp, Haefner, and Richardson]. IFFS is a set of Lotus 1-2-3 spreadsheets integrated through the use of menus and macros. Key components include net worth, cash flow and income statements, and a debt worksheet. The model is used to measure liquidity, solvency, and profitability for the base case.

A conceptual model is presented and used to specify financial abatements to be included in the analysis. Financial abatements evaluated include a reduction in interest rates, an infusion of equity, an equity infusion/interest rate reduction combination, debt reduction, and sale of assets without a lease back provision. The abatements are evaluated in terms of their impacts on net farm income, net cash flow, changes in equity, rate of return on equity and rate of return on assets.

BASE FARM ANALYSIS

A base wheat and livestock farm for Northcentral Oklahoma is constructed using county census data. The typical farm consists of 1,280 acres and has an established wheat

crop base of 1,080 acres, of which 720 acres are owned and 360 acres are rented on a 1/3-2/3 crop share basis. Other crops consists of 80 acres of grain sorghum and 120 acres of lovegrass pasture for hay and grazing. The farm participates fully in government programs for wheat and grain sorghum. Other farm enterprises include 211 head of winter stocker steers and 79 head of summer stocker steers on lovegrass pasture annually. The base case farm initially controls 50 percent of the $818,096 of total assets. Wallace presents a detailed description of the assets, liabilities and farm plan for the base farm analysis. The assets are distributed as follows: current assets of $16,966, intermediate assets of $162,830 and long term assets of $518,300. There are total claims of $413,919 against the assets distributed as follows: current liabilities of $101,775, $62,470 of intermediate liabilities and long term liabilities of $249,674. The beginning equity position for the base farm situation is $397,816.

Based on 1987 cost/price relationships and enterprise budgets for the crop and livestock enterprises, gross farm receipts for the base case farm are $258,805 and cash operating expenses total $237,392, of which interest on debt accounts for $40,966. This interest expense if almost double any other single expense item except for livestock purchases. Gross farm sales minus operating expenses leaves net cash income from operations of $21,413 to cover family living expenses and capital reinvestment. Living expenses are excluded from the net farm income calculation but capital reinvestment is not. Because of the interest expense incurred on previously acquired debt and new capital purchases, net farm income in 1987 is a negative $7,498.

Debt payments of $58,305 plus interest on the operating note of $3,777 results in cash available for new investment and risk of $2,878. The $2,878 is insufficient to cover a downpayment on capital purchases of $6,929 and results in a negative net cash flow of $4,050. During the initial year, net worth declines by $4,916 or 1.2 percent. The decline in equity is primarily due to an increase in notes payable because of insufficient cash flows to cover interest, principal and downpayments on capital reinvestment expenditures.

The base farm situation is simulated over 5 years assuming no major changes in cost and price relationships, but with debt payments and capital replacement investments made each year. This base case simulation results in economic deterioration over the analysis period (Table 1). Net farm income becomes slightly more negative over the period, as does the change in equity. Net cash flow is increasingly negative over the five years.

FINANCIAL ABATEMENTS ANALYSIS

Conceptualizing Adjustments To Financial Stress

A simple conceptual framework may be used to analyze the relationships between financial stress and financial structure, and to suggest relevant financial abatements. If a firm's rate of return on equity capital (Re) is expressed as a weighted average of the difference between its return on assets (Ra) and its cost of debt (i), where the weighs are the ratios of assets to equity (A/E) and debt to equity (D/E), respectively, and the profit measure is net of withdrawals for taxation (t) and family living (c), the rate of return on equity can be expressed as

$$(1) \qquad Re = [(Ra)\ A/E - (i)\ D/E]\ (k)$$

where $k = (1-t)(1-c)$ (Barry, Ellinger, and Eidman). Financial stress has been defined by combinations of those values which yield a zero rate of return to equity (Barry, Ellinger and

TABLE 1. A COMPARISON OF FINANCIAL PERFORMANCE CRITERIA

	BASE CASE FARM	INTEREST RATE REDUCT.	EQUITY INFUSION	COMBINAT. INT. RED. EQU. INF.	DEBT REDUCTION	ASSET SALE NO LEASE BACK
NET FARM INCOME						
1987	-7498	12599	15883	13232	15804	6594
1988	-7456	12780	15581	12981	16087	17996
1989	-7565	13062	15016	12834	16205	18238
1990	-7949	13425	14827	13125	16660	18875
1991	-8484	13766	15191	13992	17748	18989
NET CASH FLOW						
1987	-4051	9456	36683	27540	32650	73633
1988	-9713	4958	32639	22268	28682	25327
1989	-16945	-655	27139	16724	23291	21743
1990	-25205	-6706	21515	11100	17668	18158
1991	-34451	-13349	15891	5476	12044	22580
CHANGE IN EQUITY						
1987	-4916	15180	18464	15903	18358	10647
1988	-4875	15361	18162	15563	18669	22050
1989	-4974	15644	17597	15415	18786	22293
1990	-5369	16005	17408	15706	19268	22928
1991	-5902	16348	17772	16572	20330	23043
5-YEAR AVERAGES*						
Ra	0.0269	0.0253	0.0027	0.0233	0.0237	0.0155
A/E	2.0846	1.8038	1.2552	1.4588	1.2462	1.2422
i	0.1099	0.0621	0.11	0.0793	0.1097	0.0996
D/E	1.0846	0.0804	0.11	0.0793	0.1097	0.2422
Re	-0.0631	-0.0042	0.005	-0.0025	0.0021	-0.0049

*Ra = rate of return to assets; A/E = assets to equity ratio; i = average interest rate on debt; D/E = debt to asset ratio; and Re = rate of return to equity.

Eidman; Melichar; USDA). If so expression (1) can be solved for the debt to equity ratio for which the rate of return on equity is zero, and results in:

(2) $$D/E = -Ra / (Ra - i)$$

The expression holds as long as the rates of taxation and consumption are less than 100 percent and (Ra) is less than (i). Leverage will be higher as the rate of return on assets is lower and/or the rate of interest is higher.

The model demonstrates that the rate of return to equity will increase as the rate of return on assets (Ra) is higher, the rates of interest (i), taxation (t), and consumption (c) are lower, and those effects increase as financial leverage (D/E) increases (Barry, Ellinger and Eidman). The rate of return to equity then can be increased through a reduction in interest rates, reduction of outstanding debts, asset sales, or equity infusions, or by increasing the current rate of return to assets.

An increase in the rate of return on assets (Ra) by one unit will increase the rate of return on equity (Re) by the product of net rate of savings (k) time the asset-to-equity ratio, as seen in (3).

(3) $$f'(Re)/Ra = (k)\ A/E$$

An increase in the cost of debt (i) by one unit will decrease the rate of return on equity (Re) by the product of the net rate of savings and the debt-to-equity ratio (D/E), as in (4).

(4) $$f'(Re)/(i) = -(k)\ D/E$$

Finally, the effect of a change in leverage on profitability, with (Re) and (i) held constant is

(5) $$f'(Re)/(D/E) = (k)\ (Ra-i)$$

That is, an increase in the leverage ratio (D/E) by one unit will increase the rate of return on equity (Re) by the product of the net rate of savings and the rate of return on assets (Ra) minus the interest rate (i). If (Ra) is less than (i), the effect on profitability is negative one, and reductions in leverage will increase profitability by the difference between (Ra) and (i) multiplied by the net rate of savings (Barry, Ellinger and Eidman).

The model used for conceptualizing adjustments to financial stress is used to determine specific assumptions regarding the level of interest rate reduction, equity infusion, combination interest rate reduction/equity infusion, debt reduction, and asset sale with no leaseback analyzed in this study (Wallace). For example, as prescribed by the conceptual model, interest rates on existing debts are reduced from an average of 11 percent to 4.76 percent to yield a zero rate of return to equity. The interest rate reduction results in cutting interest expense by more than half, which should almost double net farm income. In a like manner, reducing interest rates should improve the liquidity position of the farm business. Because the liquidity and profitability positions of the business are expected to improve, there should be a corresponding increase in equity as long as net farm income (NFI) and net cash flow (NCF) are greater than zero.

The second abatement investigated is an equity infusion which is assumed used to reduce existing debts by $227,220. Reducing total farm debt by 54 percent decreases interest expense and total debt payments resulting in improved NFI and NCF. In addition,

since the level of assets remains the same as in the base case, reducing debts by over half should increase proprietor's equity.

The combination equity infusion - interest rate reduction abatement considers the possibility of obtaining assistance both from lenders and individual sources. In this abatement both the cost of debt and the magnitude of debt are reduced. Interest rates are reduced to 7.4 percent and debts are reduced by $135,832 through the equity infusion. Reducing interest expense should increase NFI and NCF. In addition the equity position of the business should improve because the lower debt repayment costs are below cash available to service debts.

To implement the debt reduction abatement, the conceptual model suggests debts be reduced by $227,220. In percentage terms this is a reduction of 54 percent, the same as in the equity infusion abatement. A reduction in debt of this magnitude significantly decreases debt repayment commitments. By reducing outstanding debt the interest expense is decreased even more than in the interest reduction case. The decrease in interest expense should increase NFI and by reducing total debt payments should improve NCF. Since debts are reduced there should be a corresponding increase in equity and the rate of return to equity.

The asset sale no leaseback abatement assumes that the operator will reduce the size of the farming operation. Based on the conceptual model, assets worth $295,091 are sold, with land representing over $220,000 of that amount. Appropriate adjustments are made in the farming operation. Of the abatements considered, the asset sale no lease back abatement results in the largest decrease in debts and should produce substantial improvement in financial performance.

Analysis and Results of Abatements

Interest Rate Reduction

The interest reduction abatement improves the NFI, NCF, and equity positions of the farm over the base case (Table 1). However, the average NFI of $13,126 barely covers the annual family living expense of $12,950 leaving only $176 as a return to land and risk. The interest rate reduction abatement provides less improvement in farm profitability than the other abatements. One possible explanation is that the interest rate reduction reduces the cost of debt while the other abatements reduce the amount of outstanding debt. As demonstrated by the expression $f'(Re)/(i) = (k)(D/E)$, the effect on the rate of return to equity of a one unit change in interest rates is dependent upon the magnitude of the leverage ratio. Because the relationship between the leverage ratio and the interest rate is positive , as the leverage ratio increases the effect of a one unit change in the interest rate on the rate of return to equity also increases proportionally.

Since new borrowing occurs at current interest rates the average cost of debt increases over the analysis period. By the third year of the analysis interest expense causes debt payments to exceed the cash available for debt service. Therefore, the interest rate reduction abatement results in the farm continuing to have liquidity problems although less than those experienced by the base case farm.

Equity Infusion:

The equity infusion abatement improves average NFI by more than $2,000 over the previous abatement (Table 1). The $2,000 comes from the reduction in interest expense accompanying the reduced debts. However this improvement assumes that the equity capital injected into the farm business is provided by a family member or friend who does not require an immediate return on that capital. It is unlikely that anyone could part with $227,220 and not expect to receive some kind of return on their investment. If measured in terms of an opportunity return on equity capital of 6 percent or $13,633, then the return to equity would be reduced to a negative 1.25 to 1.5 percent.

The equity infusion abatement (without charging the opportunity return) brings large gains to NCF and improves liquidity. The improvement in liquidity results from the operator being able to selectively reduce the farm's debt by retiring those with the highest payments first. The selection of which debts to retire might not be left up to the operator in a debt reduction agreement. Such an agreement likely would require reducing specific notes by specific amounts resulting in a different payout structure than that attained in this example of an equity infusion.

Combination Abatement:

The combination equity infusion - interest rate reduction abatement improves the financial performance of the farm over the base case. The impacts on NFI, NCF and change in equity are slightly more favorable than the interest rate reduction and slightly less favorable that the reduction in indebtedness (Table 1). The equity infusion - interest rate reduction case addresses both the cost of debt and the magnitude of existing debts. By assumption the amount of equity infusion and interest rate reduction are chosen such that the of return to equity is zero. The effect on interest expense is similar to the reduction in interest rates and the equity infusion cases. However, because this abatement reduces both the magnitude of debt and the interest rate, the total debt payments are lower than for the reduction in interest rates case, but not as low as for the equity infusion case.

Debt Reduction

The debt reduction abatement results in the largest increase in NFI of any of the abatements examined thus far (Table 1), and NFI increases throughout the analysis period. In addition, the debt reduction abatement has the second highest return to assets, the fourth lowest average interest rate and the second lowest A/E and D/E ratios. These variables combine to produce the best calculated return to equity of any of the abatements.

Depending on the tax structure of the farm in question debt reductions may be treated as taxable income. As tax liabilities increase the gains in NFI and NCF would be offset in the second year of the plan by the amount of the tax liability. Since there may be large variations in tax structures across farms, we are merely suggesting taxes would likely affect this abatement more than most others. Of course, the asset sale no lease back option has definite tax consequences due to taxable capital gains. As described in the conceptual model, the relationship between tax rates and financial performance is an inverse one implying that increasing the net marginal tax rate diminishes the return to equity by one minus the appropriate tax rate.

One other possible drawback to the debt reduction abatement is the effect it may have on the credit reserve of the farm business. Lenders will be unwilling or hesitant to provide

loans in situations where other lenders or themselves have absorbed loan losses. A borrower in this situation would likely be considered a higher risk and might be required to pay an additional risk premium for the borrowed capital. The additional risk premium could be difficult for farms unable to service debts at existing interest rates.

Asset Sale No Leaseback:

The asset sale no lease back option results in the greatest average improvement to NFI, NCF and change in equity (Table 1). Although, NFI, NCF and change in equity all improve over the base case the average rate of return to equity calculated from the conceptual model is the lowest of all the abatements (Table 1). The decrease in the calculated rate of return to equity is explained by the components of the conceptual model. In the previous abatements the rate of return to assets ranged between 2.3 and 2.7 percent. However, in this abatement the percentage decline in the value of assets is less than the percentage increase in NFI earned by those assets. Therefore, the rate of return to those assets declines compared to the other abatements. In addition, although the average interest rate remains close to 10 percent and the leverage ratio is the lowest of all the abatements at 24.2 percent, the decrease in the weighted return to equity is greater than the decrease in the weighted cost of debt. These factors combine to produce the lower calculated rate of return to equity. These figures possibly reflect a less efficient combination of assets, leverage and interest expense than reflected under the base case farm assumptions that are consistent across the other abatements.

Summary and Conclusions

This study simulates the performance of a financially stressed crop and livestock farm in Oklahoma over five years using the Integrated Farm Financial Statements (IFFS) model. Based on a beginning debt to asset ratio of 50 percent and cost and price relationships which existed during the 1987 base year, the financial condition of the farm deteriorated over the period of the analysis. In this study, machinery and equipment is assumed replaced at the end of its useful life. This assumption contributes to the liquidity problem of the base farm. A number of other financial stress studies have ignored capital replacement over extended periods of analysis. However, if financial stress abatements are to be effective, they must provide sufficient improvement to permit the capital replacement necessary if the farm is to operate efficiently.

A simple conceptual model relating financial stress to financial structure of the farm is used to develop and implement a set of financial abatements. The potential impacts of six financial abatements, including a reduction in interest rates, an infusion of equity capital, a combination of equity infusion and interest rate reduction, debt set-aside or reduction, and the sale of assets without a provision for those assets to be leased back, are evaluated. Impacts of the financial abatements are evaluated in terms of their impacts on net farm income, net cash flow, and the change in equity, in addition to rates of returns to assets and equity.

The six financial stress abatements analyzed improve the farm's economic viability and financial performance over the five year planning horizon relative to the base farm analysis. However, the financial abatements have differential impacts on profitability, liquidity, and solvency. As the conceptual model suggests, the impacts of the options varies with the asset base, debt structure, rate of returns to assets and average interest rate.

Interestingly, the asset sale without leaseback provision generates the greatest improvement in NFI, NCF, and change in equity. The reduction in debt and interest expenses, and use of excess labor in other farm income generating activities, contributes to this result. The relatively low level of profitability which existed at the time of the analyses is also important. The equity infusion and debt reduction were similar in their effects on farm financial performance. If the person or organization providing the equity infusion requires a competitive return on that capital, it is much less attractive to the farm operator. Most other studies have not addressed the competitive return possibility. The combination interest rate reduction and equity infusion is slightly less attractive to the farm operator, followed by the reduction in interest rates abatement.

There are a number of complex issues regarding implementation of the financial abatements, some of which we have addressed and others which we have not. Clearly, several of these financial abatements offer the opportunity to improve the financial position of financially stressed farms. Their relatively attractiveness will vary depending on the specific farm situation. Those who provide loan funds to farmers must be involved in implementing most of these abatements, and the lenders may well prefer specific abatements which are more attractive to them and less attractive to borrowers.

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THE RELATIVE RISKINESS OF FIXED VERSUS FLEXIBLE CROP ROTATIONS IN THE BROWN SOIL ZONE OF SOUTHWESTERN SASKATCHEWAN

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Summerfallow is a distinctive cropping practice in the southern Great Plains of western Canada. While summerfallow reduces the need for nitrogen applications through demineralization of organic matter, and improves weed and pest control, its primary purpose is to increase the amount of soil moisture available for growing next year's crop (Molberg et al.; Michalayna and Hedlin). In Saskatchewan, precipitation averages 12 to 18 inches per year. As a result, the province experiences an annual soil moisture deficit of 4 to 12 inches (Environment Canada). Thus, it is not surprising that summerfallow is a common practice in Saskatchewan, with the summerfallow (SF) ratio—the ratio of summerfallow to total tillable acreage—as high as 0.456 in parts of the province.[1] In 1981, the SF ratio was 0.456, 0.413, and 0.303 for the brown, dark brown and black soil zones, respectively.

By increasing the following year's soil moisture, summerfallow contributes to higher and more stable crop yields and, thereby, higher and more stable net returns (Zentner et al., 1979 and 1984). In contrast to the direct and immediate economic benefits, summerfallow has adverse effects on soil quality through lower soil organic matter content, increased soil salinity and increased soil erosion. Depleted soil organic matter levels directly affect future production through reduced tilth, moisture holding ability and available soil nitrogen (Rennie). However, the greatest and most immediate concern is its impact on soil erosion, since it generates soil losses five to ten times greater than those associated with cropped land.[2] Therefore, to maintain soil quality, it may be necessary to either increase cropping intensity or adopt other forms of soil conservation.

Traditionally, farm management extension specialists in Saskatchewan have based crop/fallow recommendations on static crop budgeting models and fixed crop rotations that generate break-even yields or yield ratios. For example, the break-even ratio between fallow and stubble wheat yields is between 0.72 and 0.82, depending upon price, yield and machinery assumptions (Schoney).[3] If spring soil moisture levels cannot generate expected yields above these ratios, fallowing is recommended over stubble cropping. Alternatively, the crop/fallow choice can be based on critical soil moisture thresholds where the decision to stubble crop varies according to actual spring soil moisture. Therefore, crop strategies are no longer fixed. In 1963, Burt and Allison employed Stochastic Dynamic Programming (SDP) to determine optimal critical soil moisture thresholds between crop and fallow alternatives. More recently, Young and Van Kooten have determined optimal flexcrop soil moisture thresholds for the Palouse region in the state of Washington, while Weisensel developed a similar flexcrop model for the brown

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[1] Summerfallow is a common practice in dryland agriculture. It involves keeping a field weed free through the use of cultivation to store two years of moisture for a single crop. It is also a useful weed control practice.

[2] Personal communication with soil scientists at the University of Saskatchewan.

[3] Stubble yields must be 72% to 82% of fallow yields to be profitable.

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