EXTENSION

Evaluating Financial Performance and Position[1]

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Measures of financial performance reduce a large amount of information into a convenient form for analysis. No single measure of financial performance is adequate for evaluating a farm business. Evaluation of several financial measures may be more useful in directing the manager to ask the right questions than in providing solutions to the financial problems of the business. Both the magnitude of the measure and its relationship to other measures should be evaluated.

Decisions made in developing the balance sheet, cash flow statement, and income statement have important impacts on the financial measures discussed in this OSU Extension Fact Sheet. Some of those decisions include using cost or market values in preparing the balance sheet; determining a specific value for each asset and liability on the balance sheet; including or excluding accrued expenses, deferred taxes, and personal assets and liabilities from the balance sheet; estimating net income on a cash, accrual, or accrual adjusted basis; and deciding if income should be before or after taxes. Each of these decisions affects key relationships in the financial statements and impacts the financial measures used to evaluate financial performance and position.

The overall performance and position of the business should be evaluated based on a set of criteria that includes liquidity, solvency, profitability, financial efficiency, and repayment capacity. Each of these criteria measures a different aspect of financial performance and/or position.

Liquidity indicates the ability of the business to meet financial obligations when they come due. Timely payment of the obligations of the business, including principal and interest on debt without disrupting the normal operation, is an indication the business is liquid.

Solvency measures the ability of the firm to pay all debts if the assets of the business are sold. Generally, if the market value of total assets exceeds existing debt obligations against those assets, the business is solvent.

Profitability is an indication of the level of income produced by the farm business and is measured in terms of rates of return produced by the labor, management, and capital of the business.

Financial efficiency measures the degree of efficiency with which labor, management, and capital are used in thebusiness. Efficiency indicates the relationship between inputs and outputs and can be measured in physical or financial terms.

Repayment capacity measures the ability of the business to repay existing debt commitments from farm and nonfarm income, and it is closely related to the concept of liquidity.

Each of these criteria plays an important role in the analysis of financial performance and position of a business, and each has alternative measures that are discussed in this OSU Fact Sheet.

Measuring Liquidity

Liquidity is the ability to generate cash to meet cash demands as they occur during the year and to provide for unanticipated events. Cash is needed to pay for the usual expenses of the business, including operating expenses, capital items, and scheduled debt payments, and provide for personal transactions, such as family living expenses. Unanticipated events, such as adverse weather or price conditions, which produce economic losses, or new investment opportunities, may make it difficult to meet cash demands.

Current Ratio

The two balance sheet measures most often used to evaluate liquidity are the current ratio and working capital. The current ratio is used to evaluate liquidity through the relationship between current farm assets and current farm liabilities. However, the current ratio is a relative measure rather than an absolute dollar measure. It is calculated as follows:

Total current farm assets ÷ Total current farm liabilities

Current farm assets normally include cash, marketable securities, accounts receivable, and inventories. Current farm liabilities include accounts and short-term notes payable, interest and principal payments on long-term debt, accrued income taxes, and other accrued expenses. The ratio indicates the extent to which current farm assets, if liquidated, would cover current farm liabilities. If the ratio is greater than 1.0, the farm is considered liquid. The higher the ratio, the greater the liquidity. If less than 1.0, the farm is considered not liquid, indicating some degree of cash flow risk. A more careful evaluation of the cash flow statement would be appropriate, given this indication of a possible liquidity problem. A ratio between 1.0-2.0 should trigger further investigation and would be considered cautionary under the farm and ranch stress

[1] Based on an earlier version by Damona Doye.

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Based on data from the Madison's market-based balance sheet which includes deferred taxes, the current ratio as of March 1 is:

341,536 ÷ 237,250=1.439

Including deferred taxes is a conservative approach to calculating the current ratio; however, it recognizes that if all current farm assets are sold during the next year, the deferred taxes would be owed. It is better for the producer and lender to be aware of the contingent liability and to determine its potential impact, than to ignore the tax implications of selling assets. Generally, lenders and analysts like to see a current ratio of 1.5 to 2.0, when using the market value approach, excluding deferred taxes. The Madison's current ratio is lower than desired by lenders in an evaluation of short-term or operating credit needs. If deferred taxes (63,817) were excluded in calculating the Madison's current farm liabilities, the current ratio would be 1.969. The current ratio may register higher and lower, at different times during the year, for good reason.

The preferred current ratio varies by type of business. If the objective of the business is to maximize profitability, a high current ratio might indicate the business is sacrificing income by emphasizing low-yielding current assets, such as cash or a savings account.

Working capital is calculated by subtracting total current liabilities from current farm assets and is expressed as an absolute dollar amount. It is the amount of cash left to purchase inputs and inventory items if the business sold all current assets and paid all current liabilities. Generally, working capital should be positive, but the amount needed depends upon the type and size of business. Seasonal borrowing and repayment of credit lines or operating notes will cause the measure to fluctuate in value during the year. Because current farm liabilities include liabilities due within the coming year, and some farms have relatively few current assets, operations generally can be maintained even with negative working capital. Nevertheless, negative working capital indicates a potential liquidity problem, which should be subject to further evaluation.

Balance sheet measures of liquidity, such as working capital and current ratio, cannot totally evaluate the ability of a business to meet cash commitments. To overcome the limitations associated with a liquidity measurement at a point in time, these ratios should be used with repayment capacity measures and the cash flow statement. This allows a more complete analysis of the liquidity position of the business.

Measuring Solvency

Solvency relates primarily to the firm's ability to meet long-term commitments as they come due. If the value of total farm assets exceeds total farm liabilities, the farm is said to be solvent; if the sale of all assets would not generate sufficient cash to pay off all liabilities, the farm is insolvent. The difference between the value of total assets and total liabilities, generally referred to as net worth or owner's equity, is the most often used measure of solvency. The most realistic approach to calculating owner equity is to use the market-based approach to value assets, including consideration of deferred taxes. Three ratios are used to measure financial solvency: the equity-to-asset ratio, the debt-to-asset ratio, and the debt-to-equity or leverage ratio.

Equity-to-Asset Ratio

The equity-to-asset ratio indicates the proportion of total farm assets owned or financed by the owner's equity capital. It is calculated by dividing total farm equity by total farm assets, as follows:

Total farm equity ÷ Total farm assets =
(Total farm assets - Total farm liabilities) ÷ Total farm assets

[(Total current farm assets + Total non current farm assets) + (Total current farm liabilities + Total non current farm liabilities) - Total farm liabilities] ÷ (Total current farm assests + Total non current farm assets)

The higher the equity-to-asset ratio, the more capital supplied by the farm owner and the less supplied by the creditors. There is no exact standard for the equity-to-asset ratio, which would apply to every farm business. However, as the percent equity increases above 50, the owner is supplying a greater percent of the total capital in the business than the creditors. With data from the Madison's balance sheet, estimated using the market-value approach and including deferred taxes, the equity-to-asset ratio as of March 1 is:

($3,124,095 - $835,556) ÷ $3,124,095 =
($341,536 + $2,782,559) - ($237,250 + $598,306) /
($341,536 + $2,782,559) = 0.73

$2,228,539 ÷ $3,124,095 = 0.73

With an equity-to-asset ratio substantially above 50 percent, the Madisons are in a strong equity position. Also, this ratio should increase over time if the owner retains farm profits and reduces debt obligations.

The equity-to-asset ratio is often converted to a percentage, by multiplying by 100, and referred to as the percent equity. Equity capital represents the owners' claims against the assets of the business. If the percent equity does not increase over time, the farm profits may be too low or family living expenses and other nonfarm withdrawals may be too high.

Debt-to-Asset Ratio

The debt-to-asset ratio measures the proportion of total farm assets owed to creditors. The higher the ratio, the greater the risk exposure for the business and those providing loan funds for the business and the less flexibility the operator has to respond to adverse natural or market phenomenon. The debt-to-asset ratio is calculated as follows:

Total farm liabilities ÷ Total farm assets =
(Total current farm liabilities + Total noncurrent farm liabilities) ÷ (Total current farm assets + Total noncurrent farm assets)

With data from the Madison's balance sheet, estimated using the market-value approach and including deferred taxes, the debt-to-asset ratio as of March 1 is:

($237,250 + $598,306) ÷ ($341,536 + $2,782,559) =
$835,556 ÷ $3,124,095 = .26

Although there is no exact standard for every farm business, a debt-to-asset ratio greater than .50 indicates that

less than 50 percent of the value of the farm's total assets is contributed by owners. Faced with this situation, the creditors are likely to be cautious in advancing additional funds. The Madison's debt-to-asset ratio of .26 indicates the creditors are contributing only about 26 percent of the farm assets.

High debt-to-asset ratios have been interpreted as an indication of "farm financial stress." In 1988, the U.S. Department of Agriculture indicated those farms with a debt-to-asset ratio between 40 to 70 percent were likely to experience a high level of financial stress, while those with debt-to-asset ratios above 70 percent were likely to experience very high financial stress. Farms experiencing high financial stress may have to consider restructuring or refinancing debt. Farms experiencing very high financial stress may have to liquidate certain assets in order to improve their farm financial position. By these standards, the Madison's debt-to-asset ratio is below the farm financial stress level.

In comparisons between businesses, the debt-to-asset ratio is most meaningful when the market value approach is used to value farm assets. When evaluating the performance of an individual business overtime, the cost approach to valuing assets may provide more meaningful estimates of the debt-to-asset ratio. With the cost approach, the cost of farm assets will not be influenced by fluctuations in market prices that create annualized, but unrealized, capital gains or losses.

Debt-to-Equity Ratio

The debt-to-equity ratio is a third measure of solvency, and indicates the relative proportion of funds invested by creditors versus the farm owners. The higher the value of the debt-to-equity ratio, the more total capital supplied by the creditors relative to the farm owner. The debt-to-equity ratio is calculated by dividing total farm liabilities by total farm equity, as follows:

Total farm liabilities ÷ Total farm equity =

(Total current farm liabilities + Total noncurrent farm liabilities) ÷ (Total farm assets - Total farm liabilities)

This ratio is also referred to as the leverage ratio. Leverage refers to increasing the use of debt relative to equity as a means of financing the business. The higher the leverage ratio, the more total capital supplied by the creditors and the less by the farm owner. Lenders are particularly interested in this ratio because it shows the proportion of the risk they are taking in comparison to the owner. Many lenders prefer the debt-to-equity ratio to be less than 1.0, with requirements varying depending on whether the liabilities are secured by current, intermediate, or long-term assets. In general, the greater the loan risk and longer the loan terms, the lower the ratio desired by the lender.

Using data from the Madison's balance sheet, estimated using the market-value approach and including deferred taxes, the debt-to-equity ratio as of March 1 is:

($237,250 + 598,306) / ($3,124,095 - $835,556)
$835,556 ÷ $2,288,539 = 0.36

The Madison's debt-to-equity ratio is substantially less than 1.0 and indicates that considerably more capital is being supplied by the owners than the creditors. With equity nearly three times as great as debt, the Madison's equity position would be viewed favorably by owner and lender.

Influence of Asset Valuation Method

All three ratios are influenced by the value placed on farm assets. Market value more accurately represents the realizable value owners can receive for their assets. However, deferred taxes that would result from the sale of assets should be considered as liabilities (both current and noncurrent) in developing the solvency ratios. Using current market value without considering deferred taxes might suggest more "comfort" than exists. Also, when only the market-value approach to valuing assets is used, those evaluating solvency ratios need to consider the source(s) of the owner equity and identify how much came from contributed capital, changes in asset values, and retained earnings. It is important over time for equity to be earned through the operation and success of the business rather than from appreciation in asset values.

Also, increasing the proportion of debt relative to equity in financing the business should not be viewed as necessarily good or bad without additional information regarding the profitability of the business. Increasing leverage can be either favorable or unfavorable, depending on the rate of return, which the additional debt can earn relative to the cost of the debt capital. If the business is profitable, the rate of return on the assets of the business is greater than the cost of capital. Increasing leverage increases equity and the rate of growth in equity. If the business is not profitable, increasing leverage reduces equity. Borrowing more money to expand a business increases financial risk and exposes the business to a greater negative impact from adverse outcomes.

Measuring Profitability

Profitability measures the financial performance of the farm over a period of time, usually one year, as a result of decisions regarding use of land, labor, capital, and management resources. The five measures used to assess profitability are net farm income, net farm income from operations, rate of return on farm assets, rate of return on farm equity, and operating profit margin ratio.

Net Farm Income from Operations

Net farm income from operations represents the return to unpaid operator and family labor and management, and the owner's equity capital from the normal operation of the business. Net farm income from operations comes directly from the income statement, and is calculated by subtracting all farm operating expenses incurred to create those revenues. Changes in the values of inventories and capital items are reflected in net farm income from operations, but not the gain or loss resulting from the sale of farm capital items and marketable securities.

The calculation of net farm income from operations is influenced by the decisions regarding use of the market-value or cost approach to value farm assets. The Madison's net farm income from operations, calculated using the accrual adjustments approach with market values for assets, is $31,546.

Net farm income from operations is a dollar amount and not a financial ratio. Thus, no one standard is appropriate for all farm operations or to make comparisons with other agricultural businesses. Net farm income from operations should

be positive and sufficiently large to compensate the owner for utilizing his/her labor, management, and equity capital in the farming operation. Over time, profits should increase so funds can be allocated to farm capital replacement, nonfarm expenses, and retained earnings.

Net Farm Income

Net farm income is net farm income from operations adjusted for the gain/loss resulting from the sale of farm capital items and marketable securities. The Madison's net farm income, using the market-value approach, is $31,546. Again, since net farm income is a dollar amount, it is difficult to establish a standard for comparison across farm operations.

Net farm income from operations and net farm income are generally calculated as "before-tax" amounts. The form of business organization can affect interpretation of this before-tax amount of income. A corporation, for example, will include payments for owner and family labor and management as expenses in calculating net farm income, and a sole proprietorship will usually not include these as expenses.

Rate of Return on Farm Assets (ROA)

The rate of return on farm assets (ROA) measures the relative income generated by the assets of the farm business, and is often used as an overall index of profitability. The rate of return on farm assets is calculated as follows:

(Net farm income from operations + Farm interest expense - Value of unpaid operator and family labor and management)
÷
Average total farm assets

Once the income statement has been developed, net farm income from operations and farm interest expense can be taken directly from the statement. The value of unpaid operator and family labor and management and the value of average total farm assets must be estimated. Because costs typically vary widely across farms, ROA is most meaningful for comparisons between farm businesses when the market-value approach is used to value farm assets. When evaluating the performance of an individual farm business over time, meaningful comparisons can also be made if assets are valued using the cost approach. In either case, the higher the ROA, the more profitable the operation.

The rate of return on farm assets uses net farm income from operations in its calculation because ROA is calculated for the purpose of evaluating the profitability of the business that results from the normal, routine agricultural operation. Including gains/ losses resulting from the sale of capital assets that are not part of the normal operation could cause misleading results. Farm business interest expense is included because ROA measures the return on all farm assets, those assets financed by creditors as well as by owner equity. In calculating net farm income from operations, the interest expense was subtracted from gross farm receipts. Now, the interest expense must be added back to net farm income from operations to calculate ROA.

For agricultural businesses that are incorporated, or in which those involved in the operation take a salary withdrawal, wages would have been paid to the operator and family members employed by the business. For agricultural businesses that are not incorporated, a return to unpaid labor and management has not been subtracted as an expense. Because ROA measures the return to only the assets, a charge must be made for unpaid operator and family labor and management. Thus, a value for unpaid operator and family labor and management is subtracted. In estimating the dollar return to assets, the operator could subtract a return for his/her labor and management valued at what they could earn in alternative employment. This return is often referred to as the "opportunity return to labor and management," and varies for different individuals depending on their opportunities for alternative employment. However, because this opportunity return does vary by individual, precise estimates of alternative earnings are difficult to obtain.

A proxy for unpaid operator and family labor and management is the amount of withdrawals from the business or the amount listed as family living expense. If withdrawals are used, consistency across firms may be a problem. For example, family housing costs may be included in the withdrawal figure for some agricultural businesses, but they may be part of the farm mortgage interest expense for other agricultural businesses. Also, the withdrawal figure is sometimes higher or lower than the market opportunity cost of these resources, and it is often difficult to determine the market opportunity cost. If possible, however, one should compare the amount of family living expense with the opportunity cost of the labor and management resources to assess the realism of family living expenses as a proxy for unpaid operator and family labor and management. For this example, we used the family living expense as a proxy. This was found on the cash flow statement line 45.

Finally, the ROA calculation is based on the average value of farm assets, rather than the beginning or ending asset values, because the return is generated for the entire year. Nonfarm assets should be excluded from the calculation of ROA for the agricultural business. Because the return is to farm assets, the denominator of the equation should only include farm assets.

Calculating the rate of return on farm assets for the Madisons, using the market-value approach to valuing assets, involves several steps:

Return to farm assets:

$31,546 Net farm income from operations
+$18,603 Farm interest expense
- $53,000 Opportunity return to labor and management
=$-2,851 Return to total farm assets

Average total farm assets = (beginning total farm asset values + ending total farm asset values) ÷ 2. For the Madisons, average total farm assets are:

[($2,738,440 + $307,842) + ($341,536 + $2,782,559)] / 2 = ($3,046,282 + $3,124,095) ÷ 2 = $6,170,377 ÷ 2 = $3,085,188.5

The calculation of rate of return on farm assets using the market-value approach to valuing assets involves dividing the return to total farm assets by average total farm assets, as follows:

$-2,851 ÷ $3,085,188.5 = -0.0924, or -9.24%

The rate of return on farm assets will vary by farm type, but the higher the ROA value, the more profitable the farming operation. ROA is often compared to the average interest rate on borrowed capital or to the cost of new borrowing. If the ROA exceeds the cost of borrowed capital, then the borrowed capital is being used profitably in the business and increasing leverage will contribute to additional firm growth. If, however, the ROA is less than the cost of borrowed capital, borrowed funds are not being used profitably and increasing debt will reduce growth in equity. So, the level of profitability is an important key to successful use of debt financing as a strategy to increase the equity of the business.

For the Madison's operation, the average interest rate on borrowed capital can be estimated as follows:

Farm interest expenses ÷ Average total farm liabilities =
$18,603 ÷ $813,857 = 0.0228

where average total farm liabilities =
(beginning total farm liabilities + ending total farm liabilities)
÷2 =

[($272,910 + $519,248) + ($237,250 + $598,306)] / 2 =
($792,158 +$835,556) ÷ 2 = $1,627,714 ÷ 2 = $813,857

For the Madison's operation, the rate of return on assets of -9.24 percent is much less than the average interest rate on borrowed capital of 2.28 percent. It may also be less than the interest rate charged on new borrowed capital. Expanding the operation using borrowed capital would not be considered a profitable alternative under these circumstances.

Comparisons to rates of return on other investments or to other agricultural businesses should be on the same basis if the comparison is to be meaningful. Finally, the rate of return on farm assets may seem low when compared to nonfarm investments such as stocks and bonds. In making comparisons, remember that realized and unrealized capital gains are not included in the return to farm assets. Also, the method used to value farm assets has a significant effect on ROA. If agricultural real estate is valued at a cost of $800 per acre versus a current market value of $2,500 per acre, the ratio will differ considerably.

Profitability also is important when evaluating any new business investment. Rather than considering overall level of profitability, however, the decision maker should compare the rate of return on the specific investment alternative with the cost of capital needed to finance the investment.

Rate of Return on Farm Equity (ROE)

Another measure of farm profitability is the rate of return on farm equity (ROE). It is calculated as follows:

(Net farm income from operations - Value of unpaid operator and family labor and management)
÷
Average total farm equity

Net farm income from operations can directly be taken from the completed income statement, while the value of unpaid operator and family labor and management and average total farm equity must be estimated. The earlier discussion of issues surrounding estimation of the value of unpaid operator and family labor and management is still appropriate. Average total farm equity is used since profitability is being measured for the year, rather than at the beginning or end of the year. The ROE measures the rate of return on only the owner's equity capital that is employed in the farm business, rather than on both owned and borrowed capital as in the calculation of ROA. Thus, in calculating ROE, the interest expense is not added back into the numerator as it was in the calculation of ROA.

As with ROA, use of the market-value approach to valuing assets is recommended when comparing profitability across individual farms, while the cost approach is recommended for making comparisons of an individual's business performance over time.

Calculating the rate of return on farm equity for the Madison's operation involves estimating the return to farm equity and dividing it by average farm equity. The return to farm equity using the market-value approach to valuing assets, including deferred taxes, is calculated as follows:

$31,546	Net farm income from operations
- $53,000	Value of unpaid operator and family labor and management
= - $ 21,454	Return to farm equity

Average farm equity using the market-value approach to valuing assets is calculated as follows:

$2,327,435	Beginning total farm equity
+$2,375,182	Ending total farm equity
=$4,702,617	

$4,702,617 ÷ 2 = $2,351,308.5

The rate of return on equity for the Madison's operation is as follows:

–$21,454 ÷ $2,351,308.5 = – 0.00912, or –.912%

In general, the higher the value of ROE, the more profitable the farm business. The ROE estimated for a farm business might be compared to alternative rates of return which could be earned by the funds currently invested in the farm. If the farm equity capital was employed in some nonfarm alternative, such as certificates of deposit at the local bank, the expected rate of return would approximate current rates on bank CDs. If the ROE from farming is less than this opportunity rate of return on equity capital, the profitability of farming might be considered low. Nationally, estimates of ROE for agriculture are typically between two and four percent, but have been as high as 9 percent (1973) and even slightly negative (1983-84). While the national average may be relatively low, ROE on individual farms can vary widely.

Some caution must be exercised in interpreting the rate of return on equity. A high rate, normally associated with a profitable agricultural business, may also indicate a relatively small capital base or a highly-leveraged agricultural business. A low rate of return on equity, which normally indicates a relatively unprofitable farm business, may also indicate a

more conservative, high-equity agricultural business. So, this measure, like many others, should be used in conjunction with other measures when analyzing an agricultural business.

Operating Profit Margin Ratio

The final profitability measure is the operating profit margin ratio, which measures the return to capital per dollar of gross farm revenue (or per dollar of value of farm production). The operating profit margin ratio is calculated as follows:

(Net farm income from operations + Farm interest expense - Value of unpaid operator and family labor and management)
÷
Gross farm revenue or value of farm production

The numerator for the operating profit margin ratio is the same as for the rate of return on assets. The basis for the calculation is net farm income from operations. Farm interest expense, which was subtracted in estimating net farm income from operations, is added back into the numerator. This action focuses attention on operating efficiency in order to compare performance between businesses without considering the impact of different levels of debt. It is important to use accrual-adjusted income measures in calculating this ratio. Finally, an estimate of the value of unpaid operator and family labor and management is subtracted to get the operating profit margin.

The operating profit margin ratio can be calculated by dividing the operating profit margin by either gross farm revenue or the value of farm production. The value of farm production is calculated by subtracting from gross farm revenue the amount of purchased feed and purchased livestock held for resale (feeding livestock). Thus, the difference in the operating profit margin based on the two different calculations will depend on the amount of purchased feed and livestock held for resale in the business.

The operating profit margin for the Madison's is calculated, using the market-value approach to valuing assets, as net farm (found on the income statement) income from operations ($31,546) + farm interest expense ($18,603) - value of unpaid operator and family labor and management ($53,000) = $-2,851. The value of farm production is calculated as follows:

	$368,025	Gross farm revenue
-	$ 85,000	Purchased market livestock
-	$ 9,796	Purchased feed/grain
+	$ 0	Change in purchased feed/grain
=	$273,229	Value of farm production

The operating profit margin ratio can then be calculated by dividing the operating profit margin of -$2,851 by gross farm revenue of $368,025 then multiply by 100 to get -.77 percent, or dividing by the value of farm production of $273,229 then multiply by 100 to get -1.04 percent. There is no absolute standard for this profitability measure, but the higher the ratio, the more profitable the farm business.

An agricultural business can increase profits by increasing the profit per unit produced or by increasing the volume of production while maintaining the profit per unit. The operating profit margin ratio focuses more on increasing profit per unit, while the asset turnover ratio, which is discussed later, focuses more on increasing volume of production while maintaining the profit per unit.

Measuring Financial Efficiency

There are a number of ratios that measure efficiency, which is an important component of profitability. The ratios relate physical output to selected physical inputs, and help evaluate whether or not farm assets are being used efficiently to generate income. The measures most widely used and generally applicable to all types of agricultural businesses are the asset turnover ratio and four operating ratios: operating expense ratio, depreciation expense ratio, farm interest expense ratio, and net farm income from operations ratio.

Asset Turnover Ratio

The asset turnover ratio is calculated by dividing gross farm revenue by average total farm assets. The asset turnover ratio for the Madison's, calculated using the market-value approach to valuing assets, is calculated as follows:

Gross farm revenues ÷ Average total farm assets =
$368,025 ÷ $3,085,188.5 = 0.119

The asset turnover ratio measures how efficiently farm assets are being used to generate gross farm revenue. Intensity of use of physical assets is also reflected in the ratio. An agricultural business may have a large asset base, but not use those assets effectively to generate farm revenue. Ways to increase the asset turnover ratio
include renting or leasing additional land, grazing winter wheat, double cropping, and using existing machinery and equipment more hours over the additional acres. Other ways include renting or leasing equipment and/or facilities rather than owning those assets, assuming that these are profitable alternatives.

This ratio can vary substantially across agricultural businesses, but the higher the ratio, the more efficiently farm assets are being used to generate farm revenue. The agricultural industry generally tends to have both a slow rate of asset turnover, particularly when assets are valued using the market-value approach, and a relatively low operating profit margin. As a result, agricultural firms tend to earn a low rate-of-return on farm assets.

Important relationships exist between and among the rate-of-return on farm assets, the operating profit margin ratio, and the asset turnover ratio. Multiplying the asset turnover ratio by the operating profit margin ratio will equal the rate of return on farm assets. For the Madison's operation, multiplying the asset turnover ratio of 0.119 by the operating margin ratio of -0.0077 then multiply by 100 results in the rate of return on farm assets of -0.0916 percent. The asset valuation approach used to calculate the asset turnover ratio must be the same as the approach used to calculate the rate of return on farm assets. In addition, non-business assets should be excluded from the denominator.

Operational Ratios

The four operational ratios that reflect the composition of gross farm revenue (or value of farm production) are the operating expense ratio, the depreciation expense ratio, the farm interest expense ratio, and the net farm income from operations ratio.

Operating Expense Ratio

The operating expense ratio is calculated as follows:

(Total operating expenses - Depreciation expense)
÷ Gross farm revenues

This ratio reflects the extent to which gross farm revenues are expended on farm operating inputs, excluding depreciation and interest. Since total operating expenses are defined without including interest expenses, this ratio compares non-interest, non-depreciation operating expenses to total farm revenues. The higher the value of the ratio, the larger the proportion of gross farm revenues needed to offset all operating expenses.

For the Madisons, the operating expense ratio is calculated as follows:

$317,876 Operating expenses
- $69,224 Depreciation expense
=$248,652 Operating expenses

$248,652 ÷ $368,025 = .6756, or 67.5%

Ratios in the 40 to 60 percent range indicate an operation is relatively efficient, with efficiency declining as the ratio rises. Ratios in the 60 to 75 percent range would reflect average efficiency, while ratios of 75 percent or larger would reflect marginal efficiency. The Madison's ratio of nearly 70 percent indicates that about 30 percent of gross farm revenue are available to replace depreciable assets, make all interest and principal payments on real assets, and provide family living. This ratio, while in the average range, is approaching the marginal efficiency level.

Depreciation Expense Ratio

The depreciation expense ratio is calculated as follows:

Depreciation expense ÷ Gross farm revenues

This ratio measures the proportion of gross farm revenue represented by the depreciation expense. Depreciation is a noncash expense, yet reflects the level of capital replacement required to maintain the depreciable assets of the business. A relatively low depreciation expense ratio would tend to indicate little difficulty in making planned and timely replacement of capital assets. A relatively high ratio indicates that proportionally more gross farm revenue is required to maintain the capital base of the operation. The depreciation expense ratio varies between types of farm businesses due to variations in depreciation methods used and the differences in amounts of depreciable assets used in the production process.

For the Madison's operation, the depreciation expense ratio is as follows:

$69,224 ÷ $368,025 = 0.1880, or 18.8%

This depreciation expense ratio of 18.8 percent indicates that the Madison's would have little trouble making planned and timely replacement of capital assets. A relatively low ratio could also indicate that the Madison's have a relatively old set of equipment.

Farm Interest Expense Ratio

The farm interest expense ratio is calculated as follows:

Total farm interest expense ÷ Gross farm revenues

This ratio focuses on the proportion of gross farm revenues required to cover the farm's interest expenses. Large interest expenses and large interest expense ratios are characteristic of highly leveraged farm operations. The acceptable percentage will vary according to the other claims against revenues, such as other production expenses and withdrawals for family living expenses. However, when this ratio rises to 15 percent, total farm interest expense is a sufficiently large proportion of gross farm revenues that the farm is likely suffering "financial stress." Revenues from nonfarm sources, such as off-farm employment or investments, may offset the higher ratio and reduce financial stress. If the ratio is above 20 percent, however, financial stress may be more serious. The operator may want to consider alternative types of financing which would reduce interest rates, or may want to delay anticipated capital purchases that require additional debt financing.

For the Madison's operation, the farm interest expense ratio is as follows:

$18,603 ÷ $368,025 = 0.0505, or 5.05%

This ratio is less than the 15 percent at which many farm businesses are thought to be suffering some degree of financial stress.

The farm interest expense ratio also has important implications for the profitable use of debt financing and financial risk. As indicated in earlier discussions of profitability, if the rate of return on total farm assets (ROA) exceeds the cost of debt financing, increasing debt increases growth in farm equity. So, if the farm is profitable, a farm interest expense ratio above 0.20 might not be of concern. However, if the ROA is less than the interest rate on debt, then the rate of return on equity (ROE) will be less than ROA. If the firm is not profitable, additional debt financing would reduce growth in equity and a farm interest expense ratio of 0.20 would be of concern. In general, farm interest expense ratios in the 0.20-0.25 range are probably high for many agricultural operations.

Net Farm Income from Operations Ratio

The net farm income from operations ratio is calculated as follows:

Net farm income from operations ÷ Gross farm revenues

This ratio measures net farm income from operations as a proportion of gross farm revenues. Net farm income from operations reflects the return to unpaid operator and family labor and management and equity capital. Thus, it reflects the proportion of gross farm revenues which remain after allowances for farm operating expenses. Net farm income from operations is calculated on a before-tax basis.

For the Madison's operation, the net farm income from operations ratio is as follows:

$31,546 ÷ $368,025 = 0.0857 = 8.57%

If the four operational ratios discussed above are added

together, the total should equal to 100 percent. For the Madison's operation, the total of the four ratios is as follows:

Operating expense ratio	67.6%
Depreciation expense ratio	18.8%
Interest expense ratio	5.0%
Net farm income from operations ratio	8.6%
Total	100.0%

Measures of Repayment Capacity

Repayment capacity is the ability of the farm operation to cover its financial obligations as they come due. Two measures of repayment capacity which focus on the ability of the farm operation to repay term debt and capital lease obligations from farm and nonfarm income are the term debt and capital lease coverage ratio and the capital replacement and term debt repayment margin.

Term Debt and Capital Lease Coverage Ratio

The term debt and capital lease coverage ratio is calculated by dividing term debt and capital lease repayment capacity by term debt and capital lease repayment commitments. These components are reflected in the numerator and denominator, respectively, of the following equation:

(Net farm income from operations + Total nonfarm income + Depreciation expense + Interest on term debt + Interest on capital leases - Total income and Social Security tax expenses - Withdrawals for family living)

÷

(Annual scheduled principal and interest payments on term debt + Annual scheduled principal and interest payment on capital leases)

The following equation is for those using consolidated financial information. Nonfarm term debt principal and interest payments are included with the farm term debt. Some discussion of reasons for including various components used to calculate this ratio may be helpful. Nonfarm income is included because that source of income can be used, along with farm income, to repay debt and capital lease commitments. Depreciation expense is added to net farm income from operations because it is a non-cash expense. Interest on term debt and capital leases is added because the coverage ratio is calculated for the total payment of principal and interest. Income and social security taxes are subtracted because those uses would compete for the funds needed to repay term debt. Finally, withdrawals are subtracted because those dollars are not available to repay other obligations. Term debt is debt that is due beyond the current year.

For the Madison's operation, the term debt and capital lease coverage ratio is calculated as follows:

$31,546	Net farm income from operations
+$14,556	Nonfarm income
+$69,224	Depreciation expense
+$ 6,397	Interest on term debt [2]
+$ 0	Interest on capital leases
- $10,350	Total income and Social Security tax expense
- $53,000	Withdrawals for family living
=$58,373	Numerator

$33,630	Scheduled principal payments on term debt
+$6,397	Scheduled interest payments on term debt
- $ 0	Scheduled principal and interest payments on capital leases
=$40.027	Denominator

$ 58,373 ÷ $40,027= 1.46

Obviously, the ratio should be greater than 1.0. A strong ratio would be 1.5 or above, while an acceptable ratio would be 1.10 to 1.49. Higher ratio values also indicate greater flexibility to weather temporary economic adversity. If the ratio is less than 1.0, the operator will not be able to cover all debt and lease payments. With a ratio of 1.46, The Madison's are in an acceptable repayment capacity position.

Even though the farm may generate sufficient earnings to cover all term debt and capital lease payments, cash may not be sufficient on a specific date to actually make the payments on a timely basis. Interpretation of this ratio can be incorrect in the short run if the operator is liquidating inventories to generate cash or is building inventories. Even though depreciation expense appears in the calculation, there is no provision in the ratio for the replacement of capital farm assets. In addition, the appropriate value for this ratio will vary depending on the production and price variability associated with the farm enterprise, the degree of diversification for farm and nonfarm enterprises, and the financial and risk management abilities of the operator.

Capital Replacement and Term Debt Repayment Margin

Another measure of repayment capacity is the capital replacement and term debt replacement margin. The margin is determined by calculating the capital replacement and term debt repayment capacity and then subtracting principal payments to be made on operating debt and the current portions of term debt and capital leases. The capital replacement and term debt replacement margin is calculated as follows:

Net farm income from operations
+Total nonfarm income
+Depreciation expense
- Total income and Social Security tax expense
- Withdrawals for family living
=Capital replacement and term debt repayment capacity

Capital replacement and term debt repayment capacity
- Payments on unpaid operating debt from a prior period
- Principal payments on current portions of term debt
- Principal payments on current portions of capital leases
- Total annual payments on personal liabilities not included in withdrawals
=Capital replacement and term debt repayment margin

This measure enables the operator and agricultural lender to evaluate the ability of the farm to generate funds necessary to repay debts that have maturity dates longer than one year and to replace capital leases. The measure also enables farmers to evaluate the ability to acquire additional capital or service ad-

[2] This number is calculated by adding lines 51 and 53 used in the Madison Case farm on the Developing a Cash Flow Statement fact sheet.

ditional term debt and to evaluate the risk margin for capital replacement and debt service.

For the Madison's operation, the capital replacement and term debt repayment margin is calculated as follows:

$31,546	Net farm income from operations
+$14,556	Non-farm income
+$69,224	Depreciation expense
- $10,350	Total income and Social Security tax expense
- $53,000	Withdrawals for family living
=$51,976	Capital replacement and term debt repayment capacity
- $0	Payments on unpaid operating debt from prior period
- $33,630	Principal payments on current portion of term debt [3]
- $0	Principal payments on current portion of capital leases
- $0	Annual payments on personal liabilities
=$18,346	Capital replacement and term debt repayment

As indicated, about $18,346 is available to replace capital and to serve as a margin during times of adversity. The depreciation expense for the Madisons was $69,224, so they do not have sufficient margin available to replace capital.

In general, the larger the dollar amount of the capital replacement and term debt repayment margin, the greater the ability to handle risk. However, the margin can be misleading if the funds are not available when needed during the year to repay term debt and capital lease obligations. Also, the economic relationship between depreciation and cash payments for capital purchases is important. Depreciation of capital assets tends to be reflected rather evenly across tax years. However, capital purchases tend to be "lumpy," with the entire purchase price or the down payment and some financing costs paid at discrete points in time. So, business analysis is often more relevant if actual useful life is used to calculate depreciation rather than using tax depreciation.

Finally, one should attempt to look ahead for several years, rather than just at a single year in isolation, when evaluating the margin for capital replacement and debt service. An evaluation of repayment capacity should also include the liquidity ratios discussed earlier, and an analysis of the cash flow plan.

Summary and Conclusions

Analyzing the level of key financial measures and their relationships can provide valuable insights to farm and ranch managers. Comparisons of measures from year to year signal whether the business financial performance is satisfactory and whether the financial position is improving or deteriorating. It is often very difficult to compare the absolute levels of financial measures for different farms due to fundamental differences in the size, capital requirements, and cash flow produced by the operations.

For more information on the financial statements, see OSU Extension Fact Sheets AGEC-751, "Developing a Cash Flow Plan;" AGEC-752, "Developing a Balance Sheet;" and AGEC-753, "Developing an Income Statement."

[3] This number is calculated by adding lines 52 and 54 used in the Madison Case farm on the Developing a Cash Flow Statement fact sheet.

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