SERIES

FINANCIAL MANAGEMENT

STATEMENTS AND ANALYSIS

Contents

OVERVIEW

Financial management involves the evaluation of liquidity and solvency, financial planning, acquisition and use of financial resources, asset purchases and farm growth, and relationships with agricultural lenders. This series starts by taking a deep dive into the key components of financial statements such as a market value balance sheet, an income statement, a sources and uses of funds statement, and a statement of owner's equity. Key ingredients to this section include computing the sources of changes in farm equity, and the measurement of profitability and the efficiency of farm asset utilization. With this background, a producer is ready to examine benchmarks of financial performance, repayment capacity, crop machinery investments and costs, and labor efficiency and productivity, and to stress test their financial position and performance.

Market Value Balance Sheet and Analysis

By Michael Langemeier

This article is one of a series of financial management articles that examine financial statements and financial analysis. In this article, the components of market value balance sheet and liquidity and solvency ratios are illustrated and described. Before illustrating an example of a market value balance sheet, it is important to define terms. A balance sheet represents a systematic organization of everything owned and owed by a farm at a given point in time. A balance sheet shows the financial position of the farm. Depending on the type of balance sheet, it may also show the liquidation values of the assets. A cost-based balance sheet shows the initial cost of the assets plus improvements minus depreciation. A cost-based balance sheet provides a more accurate picture of actual performance of invested capital and is critical to the examination of changes in net worth or owner equity. A market value balance sheet estimates asset values using current prices for similar assets. The market value balance sheet is relatively easy to derive, more comparable across farms, includes opportunity cost, and often required by lenders. The market value balance sheet allows us to examine the liquidation values of the assets. However, it is important to note that the change in owner equity for a market value balance sheet is computed by adding capital gains to retained earnings. Because it contains both of these elements, it is harder to use a market value balance sheet to examine retained earnings and changes in net worth over time.

Table 1 contains an example of a market value balance sheet for a case farm in west central Indiana for 2019. Notice that there are three columns in table 1. The first column contains values for the beginning of 2019. The second column contains values for the end of 2019. The third column presents an average of the values from the first two columns. Average values are often used to compute financial ratios and are thus illustrated in table 1.

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Table 1. Balance Sheet for White County Farms, 2019.

		Beginning	Ending	Average
ASSETS:				
Cash	(1)	2,110,287	2,296,378	2,203,333
Marketable Securities	(2)	0	0	0
Accounts Receivable	(3)	0	0	0
Fertilizer and Supplies	(4)	52,701	54,340	53,520
Investment in Growing Crops	(5)	0	0	0
Crops Held for Sale and Feed	(6)	961,117	897,660	929,388
Market Livestock	(7)	0	0	0
TOTAL CURRENT ASSETS (Add Lines 1 through 7)	(8)	3,124,105	3,248,378	3,186,241
Breeding Livestock	(9)	0	0	0
Machinery and Equipment	(10)	1,527,584	1,544,369	1,535,977
Buildings	(11)	87,292	82,927	85,110
Investments in Cooperatives	(12)	0	0	0
Land	(13)	5,861,250	5,888,250	5,874,750
TOTAL NONCURRENT ASSETS (Add Lines 9 through 13)	(14)	7,476,126	7,515,546	7,495,837
TOTAL ASSETS (Add Lines 8 and 14)	(15)	10,600,231	10,763,924	10,682,078
LIABILITIES AND OWNER EQUITY:				
Accounts Payable	(16)	0	0	0
Taxes Payable	(17)	0	0	0
Accrued Expenses	(18)	0	0	0
Current Portion: Deferred Taxes	(19)	0	0	0
Notes Due Within One Year	(20)	500,000	500,000	500,000
Current Portion of Term Debt	(21)	46,948	52,373	49,661
Accrued Interest	(22)	29,663	31,139	30,401
TOTAL CURRENT LIABILITIES (Add Lines 16 through 22)	(23)	576,611	583,512	580,062
Noncurrent Portion: Deferred Taxes	(24)	0	0	0
Noncurrent Portion: Notes Payable	(25)	433,522	493,748	463,635
Noncurrent Portion: Real Estate Debt	(26)	479,904	465,082	472,493
TOTAL NONCURRENT LIABILITIES (Add Lines 24 through 26)	(27)	913,426	958,830	936,128
TOTAL LIABILITIES (Add Lines 23 and 27)	(28)	1,490,037	1,542,342	1,516,190
OWNER EQUITY (Subtract Line 28 from Line 15)	(29)	9,110,194	9,221,582	9,165,888
TOTAL LIABILITIES AND OWNER EQUITY (Add Lines 28 and 29)	(30)	10,600,231	10,763,924	10,682,078

Current assets are valued using values at the beginning and end of the year. Important current assets for this farm include cash, fertilizer and supplies, and crops held for sale. This farm sells a portion of their crops in the fall and remainder of their crops in the spring. The farm's marketing plan or strategy results in large crop inventories at the end of the year. If all of the crops were sold in the fall, the ending inventories for crops held for sale would of course be zero. Machinery, equipment, and building values are computed using original purchase prices and economic depreciation. This method comes closer to capturing the current market value of these assets than using tax depreciation rates. If good estimates were available, it would be even more appropriate to use market values at the beginning and end of the year for the machinery, equipment, and building values in table 1. This case farm has 3000 acres, of which 750 acres are owned. Land is valued using the Purdue Farmland Value Survey results. Total assets increased $163,693 or approximately 1.5 percent, from the beginning to the end of the year. Approximately 24 percent of the increase in total assets resulted from an increase in noncurrent assets (e.g., machinery, buildings, and land). The remaining portion of the increase was due to an increase in current assets. Total liabilities increased $52,305 or 3.5 percent from the beginning to the end of the year. Due to increases in land values and positive retained earnings (net farm income minus operator labor and income taxes), owner equity increased from $9,110,194 to $9,221,582, or approximately 1.2 percent in 2019. As is noted above, it is difficult to disentangle the impacts of retained earnings and capital gains using a market value balance sheet. It is important to attempt to disentangle the respective impacts of retaining earnings and capital gains to more fully understand the profitability and viability of the farm. This task will be left to another article.

When comparing balance sheets across farms of varying sizes, it is often useful to use percentages rather than actual dollars to illustrate the relative importance of various assets and liabilities. Table 2 presents a common size balance sheet for the case farm. Current assets represent approximately 30.2 percent of total assets for the case farm. Land, representing 54.7 percent of total assets, comprises by far the largest percentage of total assets. As is true with many farms, changes in land values have a major impact on asset values for this farm. Total liabilities represent approximately 14.3 percent of total liabilities and owner equity or total assets.

The balance sheet in table 1 was used to compute the liquidity and solvency ratios found in table 3. Liquidity measures the ability of a business to meet financial obligations as they come due in the ordinary course of business, without disrupting the normal operations of the business. Commonly used liquidity ratios include the current ratio, working capital, working capital to gross revenue, working capital to total expense, and working capital per crop acre. The current ratio is computed by dividing current assets by current liabilities. Using ending balance sheet values, the current ratio for the case farm is 5.57, which is well above 2, a commonly used benchmark. Working capital is computed by subtracting current liabilities from current assets. Working capital, using ending balance sheet values, is $2,664,866. It is difficult to compare working capital values across farms. For this reason, the working capital to gross revenue ratio and the working capital to total expense ratio are often used. For the case farm, the working capital to gross revenue ratio and the working capital to total expense ratios were 131 percent and 144 percent, respectively, indicating that the farm has a strong liquidity position. Working capital can also be expressed as a proportion of crop acres. For the case farm, working capital per crop acre was approximately $888.

Table 2. Common Balance Sheet for White County Farms, 2019.

Assets	**% of Total**
Cash	0.2133
Marketable Securities	0.0000
Accounts Receivable	0.0000
Fertilizer and Supplies	0.0050
Investment in Growing Crops	0.0000
Crops Held for Sale and Feed	0.0834
Market Livestock	0.0000
Total Current	0.3018
Breeding Livestock	0.0000
Machinery and Equipment	0.1435
Buildings	0.0077
Investment in Cooperatives	0.0000
Land	0.5470
Total Noncurrent	0.6982
Total Assets	1.0000
Liabilities and Owner Equity	**% of Total**
Accounts Payable	0.0000
Taxes Payable	0.0000
Accrued Expenses	0.0000
Notes Due Within One Year	0.0465
Current Portion of Term Debt	0.0049
Accrued Interest	0.0029
Total Current	0.0542
Notes Payable	0.0459
Real Estate Debt	0.0432
Total Noncurrent	0.0891
Total Liabilities	0.1433
Owner Equity	0.8567
Total Liabilities and Owner Equity	1.0000

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Table 3. Computation of Liquidity Ratios for White County Farms, 2019.

Liquidity Ratios

Current Ratio = Ending Current Assets ÷ Ending Current Liabilities

Current Ratio = 3,248,378 ÷ 583,512 = 5.57

Working Capital = Ending Current Assets - Ending Current Liabilities

Working Capital = 3,248,378 - 583,512 = 2,664,866

Working Capital to Gross Revenue = Working Capital ÷ Gross Revenue

Working Capital to Gross Revenue = 2,664,866 ÷ 2,035,268 = 1.309

Working Capital to Total Expenses = Working Capital ÷ Total Expenses

Working Capital to Total Expenses = 2,664,866 ÷ 1,854,710 = 1.437

Working Capital per Crop Acre = Working Capital ÷ Crop Acres

Working Capital per Crop Acre = 2,664,866 ÷ 3,000 = $888

Solvency Ratios

Debt to Asset Ratio = Ending Total Liabilities ÷ Ending Total Assets

Debt to Asset Ratio = 1,542,342 ÷ 10,763,924 = 0.143

Equity to Asset Ratio = Ending Owner Equity ÷ Ending Total Assets

Equity to Asset Ratio = 9,221,582 ÷ 10,763,924 = 0.857

Debt to Equity Ratio = Ending Total Liabilities ÷ Ending Owner Equity

Debt to Equity Ratio = 1,542,342 ÷ 9,221,582 = 0.167

Solvency measures the amount of debt and other expense obligations used in the farm business relative to the amount of owner equity invested in the business. Solvency ratios provide an indication of the farm's ability to repay all financial obligations if all assets are sold, as well as an indication of the ability to continue operations as a viable farm business after a financial adversity, such as a drought. Computations for three commonly used solvency measures can be found in table 3. The three solvency measures convey similar information. Here, we will focus on just one of these measures, the debt to asset ratio, which compares total farm liabilities to the value of total farm assets. This ratio is one measure of the risk exposure of the farm business; thus, it is important to compare this ratio over time. Farm management studies have found the debt to asset ratio to be highly correlated to the variability of net farm income, a commonly used measure of risk. The debt to asset ratio for the case farm, using ending balance sheet values, is 0.143. This ratio indicates the case farm has a strong solvency position.

A final note needs to be made regarding market value balance sheets. A market value balance sheet typically shows liquidation values of the assets. Often there is tax liability associated with the liquidation of assets. Because of this, deferred taxes are sometimes included as liabilities in a market value balance sheet.

This article illustrated and described a market balance sheet, a common size balance sheet, and liquidity and solvency ratios. Other articles in the financial management series include information pertaining to the income statement, the cash flow statement, the sources and uses of funds statement, the statement of owner equity, pro forma financial analysis, stress testing, and benchmarking financial efficiency and performance.

Components of an Accrual Farm Income Statement

By Michael Langemeier

This article is part of a series of financial management articles that examine financial statements and financial analysis. In this article, the components of an income statement for a case farm in west central Indiana for 2019 are illustrated and discussed.

An income statement measures the success of a business for a period of time. The most common period of time used for a farm business is a calendar year. However, many farms use a fiscal year as their tax year and use a fiscal year to measure accrual income. An accrual income statement contains one of the most important financial measures used by farms, net farm income. Because this measure is accrual, it measures the actual performance of a farm during the year.

Major categories typically highlighted in an income statement include gross revenue, value of farm production, cash operating expenses, expense inventory adjustment, depreciation, interest expense, and net farm income. Value of farm production and net farm income are used extensively in the computation of financial ratios. Value of farm production is computed by summing accrual gross revenue from crops, accrual gross revenue from livestock, gain or loss on sale of breeding livestock, agricultural program payments, crop insurance proceeds, and other income, and subtracting livestock purchases, and cost of purchased grain and feed. Value of farm production is a measure of "gross income". Net farm income is computed by subtracting total expense from value of farm production. Due to the inclusion of inventory changes from the beginning to the end of the year and depreciation in the computation of net farm income, total net cash farm income does not equal net farm income. Given recent crop price volatility, the difference between these two items (total net cash farm income and net farm income) can be quite wide for individual farms. Tax management can also contribute to differences between these two measures.

Table 1 illustrates an income statement for a case farm in west central Indiana for 2019. This case farm produces corn and soybeans so livestock income, purchases, and expenses are zero. The case farm sells 50 percent of the corn and soybean crops before the end of the year and the remaining portion after the first year. Thus, part of the cash crop sales for 2019 represent the sale of the 2018 corn and soybean crops. The beginning and ending crop and feed inventories, which are reported in the balance sheet for the farm, represent corn and soybean inventories at the beginning and end of 2019. Crop yields for corn and soybeans in 2019 were 3.4 percent and 6.5 percent below trend yields, respectively. Government payments reflect participation in the ARC-CO program and market facilitation payments for corn and soybeans. The case farm did not receive crop insurance indemnity payments for corn or soybeans in 2019.

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Table 1. Income Statement for White County Farms, 2019.

Farm Business Receipts:			
Crop Cash Sales	(1A)	1,855,725	
Ending Crop and Feed Inventory	(1B)	897,660	
Beginning Crop and Feed Inventory	(1C)	961,117	
Accrual Gross Revenue from Crops (Line 1A + Line 1B - Line 1C)	(1)		1,792,268
Livestock and Milk Cash Sales	(2A)	0	
Ending Livestock Inventory	(2B)	0	
Beginning Livestock Inventory	(2C)	0	
Accrual Gross Revenue from Livestock and Milk (Line 2A + Line 2B - Line 2C)	(2)		0
Gain/Loss on Sale of Breeding Livestock	(3)		0
Agricultural Program Payments	(4)		243,000
Crop Insurance Proceeds	(5)		0
Other Farm Income	(6)		0
GROSS REVENUE (Add Lines 1 through 6)	(7)		2,035,268
Livestock Purchases	(8)		0
Cost of Purchased Feed/Grain	(9)		0
VALUE OF FARM PRODUCTION (Line 7 - Line 8 - Line 9)	(10)		2,035,268
Farm Business Expenses:			
Fertilizer	(11)		247,171
Seed	(12)		279,837
Chemicals	(13)		150,380
Dryer Fuel	(14)		54,039
Machinery Fuel	(15)		39,301
Machinery Repairs	(16)		63,687
Hauling	(17)		38,280
Insurance	(18)		56,077
Miscellaneous	(19)		56,077
Hired Labor	(20)		50,815
Cash Rent	(21)		551,250
TOTAL CASH OPERATING EXPENSES (Add Lines 11 through 21)	(22)		1,586,914
Expense Inventory Adjustment	(23)		-1,639
Depreciation	(24)		172,283
TOTAL OPERATING EXPENSES (Line 22 + Line 23 + Line 24)	(25)		1,757,558
Interest	(26)		97,152
TOTAL EXPENSES (Line 25 + Line 26)	(27)		1,854,710
NET FARM INCOME FROM OPERATIONS (Line 10 - Line 27)	(28)		180,558
Gain/Loss on Sale of Capital Assets	(29)		0
NET FARM INCOME (Line 28 + Line 29)	(30)		180,558

Gross revenue and value of farm production for the case farm was $2,035,268. Note that depreciation and interest are listed as separate expenses below total cash operating expenses. This layout makes it easier to compute the depreciation and interest expense ratios which are discussed in another article in this series. The expense inventory adjustment considers inventories of fertilizer and supplies at the beginning and end of 2019. Subtracting total expenses from value of farm production yields a net farm income of $180,558. This amount can be used to cover family living withdrawals, pay taxes, reduce debt, and/or make capital asset purchases. Because the case farm only produces crops, it is useful to also express net farm income on a per acre basis. Net farm income per acre was approximately $60 in 2019.

It is important to note that two expenses that are typically discussed by economists are not found in table 1. Specifically, the opportunity costs on family and operator labor, and equity invested in the business are not included. Income statements typically do not contain opportunity costs. However, these costs are an integral part of the computation of some financial measures. The opportunity cost for family and operator labor for the case farm is $84,340. The case farm has substantial equity invested in the farm. Using a long-term interest rate, the opportunity cost on this equity is $471,002.

The information in the income statement in table 1 is used in other articles in this series to compute profitability and financial efficiency measures such as the operating profit margin, rate of return on farm assets, rate of return on farm equity, asset turnover ratio, and expense ratios. Without an income statement, it is very difficult to compute these key performance measures.

Sources and Uses of Funds Statement

By Michael Langemeier

This article is one of a series of financial management articles that examine financial statements and financial analysis. In this article, a sources and uses of funds statement will be illustrated and described. A sources and uses of funds statement, often referred to as a flow of funds report, provides a mechanism for reporting how a farm's performance during an accounting period influenced and was influenced by major funding activities. This report also reconciles information in the income statement, the balance sheet, and the cash flow statement.

Sources of funds include cash farm receipts, capital asset sales, increases in liabilities, outside equity capital infused into the business, and net non-farm cash income. The increase in total liabilities is derived from the beginning and ending balance sheets. It is particularly important to track the change in total liabilities from the beginning to the end of the year. If a farm borrows more money than its reduction in short-term and long-term debt (i.e., principal payments), we have a source of funds. Conversely, if a farm pays back more debt than it borrows, we have a use of funds.

Uses of funds include farm cash operating expenses, capital asset purchases, decreases in total liabilities, equity capital withdrawals, family living withdrawals, and income and self-employment taxes. A farm that is expanding will typically have a larger amount of capital purchases than capital sales so capital assets are generally a use of funds rather than a source of funds. A farm that is expanding would probably also have an increase in total liabilities rather than a decrease in total liabilities. In contrast, a farm that is downsizing, perhaps in anticipation of future retirement, would typically have relatively higher asset sales compared to asset purchases, and may exhibit a decrease in total liabilities as loans are paid back.

The five primary categories of a sources and uses of funds statement are beginning cash balances, cash flows from operating activities, cash flows from investing activities, cash flows from financing activities, and ending cash balances. If all cash is accounted for unlocated funds will be zero. If unlocated funds are not zero (either positive or negative), all cash is not accounted for. This is often the case if family living withdrawals, and income and self-employment taxes are not included in the statement.

Table 1 presents a sources and uses of funds statement for a case farm in west central Indiana for 2019. The net cash provided by operating activities; which subtracts cash farm expenses, family living withdrawals, and taxes from cash farm receipts; was $319,965. Net asset purchases for this farm were $184,703 (capital asset purchases minus capital asset sales) so the net cash provided by investing activities was -$184,703. On most farms, the net cash provided by investing activities will be negative, and thus will need to be covered by cash from operating activities or financing activities, or by drawing down cash balances. The net cash provided by financing activities was $50,829, which is indicative of a situation where a farm increases total liabilities (loan receipts are larger than loan payments) to help pay for capital asset purchases. For this case farm, loan receipts were $97,777 and principal payments were $46,948. The net cash provided by operating and financing activities was larger than the net cash provided by investing activities for this farm resulting in an increase in the ending cash balance.

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Table 1. Sources and Uses of Funds Statement for White County Farms, 2019.

Beginning Cash Balances		2,110,287
Cash Flows from Operating Activities:		
Cash Farm Receipts	2,098,725	
Outside Equity Capital	0	
Net Non-Farm Cash Income	0	
Sub-Total (1)	2,098,725	
Cash Farm Expenses	1,682,590	
Equity Capital Withdrawals	0	
Family Living Withdrawals	84,340	
Income and Self-Employment Taxes	11,830	
Sub-Total (2)	1,778,760	
Net Cash Provided by Operating Activities (1 - 2)		319,965
Cash Flows from Investing Activities		
Capital Asset Sales	36,092	
Capital Asset Purchases	-220,795	
Net Cash Provided by Investing Activities		-184,703
Cash Flows from Financing Activities		
Current Debt Financing - Loans Received	5,425	
Term Debt Financing - Loans Received	92,352	
Cash Received from Gifts, Inheritances, and Paid-In Capital	0	
Personal Investment of Cash Added into Business Assets	0	
Sub-Total (3)	97,777	
Operating Debt Principal Payments	0	
Term Debt Principal Payments	46,948	
Principal Portion of Payments on Capital Leases	0	
Cash Distributions of Dividends, Capital, or Gifts	0	
Sub-Total (4)	46,948	
Net Cash Provided by Financing Activities (3 - 4)		50,829
Ending Cash Balances		2,296,378
Unlocated Funds		0

Note: If all cash flows (farm and non-farm) are accounted for, unlocated funds will be zero.

Unlocated funds are zero in table 1 indicating that all cash is accounted for. If this balance is not zero, it is important to check the accuracy of the balance sheet, the income statement, and the cash flow statement. It is particular important to check the accuracy of capital flows in and out of the business and family living withdrawals.

This newsletter article illustrated and described a sources and uses of fund statement. Other articles in this series discuss the balance sheet, the income statement, the statement of owner's equity, and benchmarking.

Statement of Owner's Equity

By Michael Langemeier

SUB-HEADING

This article is one of a series of financial management articles that examine financial statements and financial analysis. In this article, the components of a statement of owner's equity are illustrated and described. This statement is used to reconcile beginning and ending owner's equity. It is also helpful in determining whether increases in owner's equity are due to increases in retained earnings and/or increases in asset values.

Table 1 contains an example of a market value balance sheet for a case farm in west central Indiana in 2019. Beginning owner equity was $9,110,194. Owner equity increased to $9,221,582 by the end of the year, an increase of $111,387 or 1.2 percent. The statement of owner's equity in table 2 reconciles the change in owner equity during 2019, and illustrates the relative importance of retained earnings and increases in land values to the increase in owner equity.

Ending owner equity in table 2 is derived using three sub-totals: beginning owner equity, the change in contributed capital and retained earnings, and the change in valuation equity. The change in contributed capital and retained earnings was $84,387, and was derived by subtracting family living withdrawals and income and self-employment taxes from net farm income. In years when net farm income is relatively low, this change is often negative. In other words, in these years, net farm income is not large enough to cover family living withdrawals and taxes. The change in valuation equity was $27,000. This change was the result of increasing land values during 2019. Note that the ending owner equity figure of $9,221,582 in table 2 is equal to the corresponding balance sheet figure. If ending owner equity is not equal to the balance sheet figure, we would need to make sure that we have accurately recorded net farm income, owner withdrawals, asset valuation, and capital contributions.

Most businesses have a goal of increasing owner equity over time. As indicated above, the change in owner equity can be separated into two categories: changes in retained earnings and changes in asset values. For this case farm, the increase in retained earnings and the increase in land values contributed to the increase in owner equity. Approximately 76 percent of the increase can be attributed to positive retained earnings.

This article illustrated and described a statement of owner's equity for a case farm in west central Indiana. Other articles in the financial management series discuss the balance sheet, the income statement, the sources and uses of fund statements, and benchmarking.

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Table 1. Balance Sheet for White County Farms, 2019.

		Beginning	Ending	Average
ASSETS:				
Cash	(1)	2,110,287	2,296,378	2,203,333
Marketable Securities	(2)	0	0	0
Accounts Receivable	(3)	0	0	0
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Investment in Growing Crops	(5)	0	0	0
Crops Held for Sale and Feed	(6)	961,117	897,660	929,388
Market Livestock	(7)	0	0	0
TOTAL CURRENT ASSETS (Add Lines 1 through 7)	(8)	3,124,105	3,248,378	3,186,241
Breeding Livestock	(9)	0	0	0
Machinery and Equipment	(10)	1,527,584	1,544,369	1,535,977
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Investments in Cooperatives	(12)	0	0	0
Land	(13)	5,861,250	5,888,250	5,874,750
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LIABILITIES AND OWNER EQUITY:				
Accounts Payable	(16)	0	0	0
Taxes Payable	(17)	0	0	0
Accrued Expenses	(18)	0	0	0
Current Portion: Deferred Taxes	(19)	0	0	0
Notes Due Within One Year	(20)	500,000	500,000	500,000
Current Portion of Term Debt	(21)	46,948	52,373	49,661
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TOTAL LIABILITIES AND OWNER EQUITY (Add Lines 28 and 29)	(30)	10,600,231	10,763,924	10,682,078

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Table 2. Statement of Owner's Equity for White County Farms, 2019.

Owner Equity, January 1		9,110,194
Change in Contributed Capital and Retained Earnings:		
Net Farm Income	180,557	
Family Living Withdrawals	-84,340	
Income and Self-Employment Taxes	-11,830	
Additions of Capital	0	
Distributions of Capital	0	
Total Change in Contributed Capital and Retained Earnings		84,387
Change in the Valuation Equity		
Machinery and Equipment	0	
Buildings	0	
Land	27,000	
Total Change in Valuation Equity		27,000
Owner Equity, December 31		9,221,581

Computation of Deferred Tax Liabilities

By Michael Langemeier

This article is one of a series of financial management articles that examine financial statements and financial analysis. Income tax liabilities arise from differences between balance sheet values of certain assets and liabilities, and the tax basis of those same assets and liabilities. Deferred taxes reconcile the tax basis of balance sheet assets and liabilities with the basis currently being used to value assets and liabilities on a balance sheet, which is usually market value. The question to be answered is as follows: if all assets could be liquidated for exactly the amount shown on the balance sheet, what would be the resulting taxable income and tax liability? To illustrate deferred tax liabilities, this article will use balance sheets for a cash crop farm in west central Indiana.

Tables 1 and 2 illustrate a market value balance sheet with and without deferred tax liabilities. Table 1 contains a beginning, an ending, and an average balance sheet without deferred tax liabilities. Table 2 is identical to Table 1 except for its inclusion of the current portion of deferred taxes and the noncurrent portion of deferred taxes. Tables 3 and 4 present the computations of deferred tax liabilities. A 30 percent tax rate is used to compute deferred tax liabilities.

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Marketable Securities	(2)	0	0	0
Accounts Receivable	(3)	0	0	0
Fertilizer and Supplies	(4)	52,701	54,340	53,521
Investment in Growing Crops	(5)	0	0	0
Crops Held for Sale and Feed	(6)	961,117	897,660	929,389
Market Livestock	(7)	0	0	0
TOTAL CURRENT ASSETS (Add Lines 1 through 7)	(8)	3,124,105	3,248,378	3,186,242
Breeding Livestock	(9)	0	0	0
Machinery and Equipment	(10)	1,527,584	1,544,369	1,535,977
Buildings	(11)	87,292	82,927	85,110
Investments in Cooperatives	(12)	0	0	0
Land	(13)	5,861,250	5,888,250	5,874,750
TOTAL NONCURRENT ASSETS (Add Lines 9 through 13)	(14)	7,476,126	7,515,546	7,495,836
TOTAL ASSETS (Add Lines 8 and 14)	(15)	10,600,231	10,763,924	10,682,078
LIABILITIES AND OWNER EQUITY:				
Accounts Payable	(16)	0	0	0
Taxes Payable	(17)	0	0	0
Accrued Expenses	(18)	0	0	0
Current Portion: Deferred Taxes	(19)	0	0	0
Notes Due Within One Year	(20)	500,000	500,000	500,000
Current Portion of Term Debt	(21)	46,948	52,373	49,661
Accrued Interest	(22)	29,663	31,139	30,401
TOTAL CURRENT LIABILITIES (Add Lines 16 through 22)	(23)	576,611	583,512	580,062
Noncurrent Portion: Deferred Taxes	(24)	0	0	0
Noncurrent Portion: Notes Payable	(25)	433,522	493,748	463,635
Noncurrent Portion: Real Estate Debt	(26)	479,904	465,082	472,493
TOTAL NONCURRENT LIABILITIES (Add Lines 24 through 26)	(27)	913,426	958,830	936,128
TOTAL LIABILITIES (Add Lines 23 and 27)	(28)	1,490,037	1,542,342	1,516,190
OWNER EQUITY (Subtract Line 28 from Line 15)	(29)	9,110,194	9,221,582	9,165,888
TOTAL LIABILITIES AND OWNER EQUITY (Add Lines 28 and 29)	(30)	10,600,231	10,763,924	10,682,078

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Table 2. Market Value Balance Sheet for White County Farms with Deferred Tax Liabilities, 2019.

		Beginning	Ending	Average
ASSETS:				
Cash	(1)	2,110,287	2,296,378	2,203,333
Marketable Securities	(2)	0	0	0
Accounts Receivable	(3)	0	0	0
Fertilizer and Supplies	(4)	52,701	54,340	53,521
Investment in Growing Crops	(5)	0	0	0
Crops Held for Sale and Feed	(6)	961,117	897,660	929,389
Market Livestock	(7)	0	0	0
TOTAL CURRENT ASSETS (Add Lines 1 through 7)	(8)	3,124,105	3,248,378	3,186,242
Breeding Livestock	(9)	0	0	0
Machinery and Equipment	(10)	1,527,584	1,544,369	1,535,977
Buildings	(11)	87,292	82,927	85,110
Investments in Cooperatives	(12)	0	0	0
Land	(13)	5,861,250	5,888,250	5,874,750
TOTAL NONCURRENT ASSETS (Add Lines 9 through 13)	(14)	7,476,126	7,515,546	7,495,836
TOTAL ASSETS (Add Lines 8 and 14)	(15)	10,600,231	10,763,924	10,682,078
LIABILITIES AND OWNER EQUITY:				
Accounts Payable	(16)	0	0	0
Taxes Payable	(17)	0	0	0
Accrued Expenses	(18)	0	0	0
Current Portion: Deferred Taxes	(19)	295,247	276,258	285,753
Notes Due Within One Year	(20)	500,000	500,000	500,000
Current Portion of Term Debt	(21)	46,948	52,373	49,661
Accrued Interest	(22)	29,663	31,139	30,401
TOTAL CURRENT LIABILITIES (Add Lines 16 through 22)	(23)	871,858	859,770	865,814
Noncurrent Portion: Deferred Taxes	(24)	583,108	587,926	585,517
Noncurrent Portion: Notes Payable	(25)	433,522	493,748	463,635
Noncurrent Portion: Real Estate Debt	(26)	479,904	465,082	472,493
TOTAL NONCURRENT LIABILITIES (Add Lines 24 through 26)	(27)	1,496,534	1,546,756	1,521,645
TOTAL LIABILITIES (Add Lines 23 and 27)	(28)	2,368,392	2,406,526	2,387,459
OWNER EQUITY (Subtract Line 28 from Line 15)	(29)	8,231,839	8,357,398	8,294,619
TOTAL LIABILITIES AND OWNER EQUITY (Add Lines 28 and 29)	(30)	10,600,231	10,763,924	10,682,078

Table 3. Current Portion of Deferred Taxes.

January 1	Market Value	Tax Basis	Difference
Accounts Receivable	0	0	0
Fertilizer and Supplies	52,701	0	52,701
Crops Held for Sale and Feed	961,117	0	961,117
Market Livestock	0	0	0
EXCESS OF CARRYING VALUE OVER TAX BASIS OF CURRENT ASSETS			1,013,818
Deferred Income Liability on Crop Insurance, Disaster Payments, and Contracts			0
TOTAL DEFERRED INCOME			1,013,818
Accounts Payable			0
Income Taxes Payable (State and Local Only)			0
Accrued Expenses			0
Accrued Interest			29,663
TOTAL DEFERRED EXPENSES			29,663
NET DEFERRED INCOME SUBJECT TO INCOME TAX			984,155
ESTIMATED DEFERRED TAX LIABILITY RELATED TO CURRENT ASSETS AND CURRENT LIABILITIES			295,247

December 31	Market Value	Tax Basis	Difference
Accounts Receivable	0	0	0
Fertilizer and Supplies	54,340	0	54,340
Crops Held for Sale and Feed	897,660	0	897,660
Market Livestock	0	0	0
EXCESS OF CARRYING VALUE OVER TAX BASIS OF CURRENT ASSETS			952,000
Deferred Income Liability on Crop Insurance, Disaster Payments, and Contracts			0
TOTAL DEFERRED INCOME			952,000
Accounts Payable			0
Income Taxes Payable (State and Local Only)			0
Accrued Expenses			0
Accrued Interest			31,139
TOTAL DEFERRED EXPENSES			31,139
NET DEFERRED INCOME SUBJECT TO INCOME TAX			920,861
ESTIMATED DEFERRED TAX LIABILITY RELATED TO CURRENT ASSETS AND CURRENT LIABILITIES			276,258

As illustrated in Table 3, the current portion of deferred taxes largely arises from crop inventories. These inventories have a basis of zero because the expenses related to producing these crops have been deducted in the previous year. Inclusion of the current portion of deferred taxes reduces average working capital from $2,664,866 to $2,388,608 or approximately 10.4 percent. This farm still has substantial liquidity after accounting for the current portion of deferred taxes. However, it is important to note that the average tax liability is not small ($285,753) and this money could have certainly been used to cushion losses or to assist with asset purchases.

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Table 4. Noncurrent Portion of Deferred Taxes.

January 1	Market Value	Tax Basis	Difference
Raised Breeding Livestock	0	0	0
Purchased Breeding Livestock	0	0	0
Machinery and Equipment	1,527,584	763,792	763,792
Buildings	87,292	21,823	65,469
Investments in Cooperatives	0	0	0
Land	5,861,250	2,803,125	3,058,125
DEFERRED TAXABLE INCOME RELATED TO EXCESS OF MARKET VALUE OVER BASE VALUE			3,887,386
ESTIMATED DEFERRED TAX LIABILITY RELATED TO VALUATION EQUITY			583,108

December 31	Market Value	Tax Basis	Difference
Raised Breeding Livestock	0	0	0
Purchased Breeding Livestock	0	0	0
Machinery and Equipment	1,544,369	772,185	772,184
Buildings	82,927	20,732	62,195
Investments in Cooperatives	0	0	0
Land	5,888,250	2,803,125	3,085,125
DEFERRED TAXABLE INCOME RELATED TO EXCESS OF MARKET VALUE OVER BASE VALUE			3,919,504
ESTIMATED DEFERRED TAX LIABILITY RELATED TO VALUATION EQUITY			587,926

The noncurrent portion of deferred taxes is estimated in Table 4. Looking at Table 2, which contains the numbers illustrated in Table 4, average deferred taxes on noncurrent assets is $585,517. A sizable portion of these taxes arises from the potential sale of land, which for this farm was primarily purchased more than 10 years ago. However, the deferred taxes for machinery and equipment are also quite large. Deferred taxes for machinery and equipment are due to the fact that tax depreciation is typically quite large compared to the actual decline in machinery and equipment value (i.e., economic depreciation). In recent years, tax depreciation has been relatively high due to accelerated depreciation rules and large section 179 expense deductions. The section 179 expense deduction allowed qualifying farmers to recover all or part of the cost of machinery and equipment in the year it was purchased on their tax forms. If used,

this deduction created a large reduction of the tax basis of machinery and equipment in the first year of ownership, and subsequently could result in large tax obligations if the machinery and equipment have to be sold.

This article illustrated deferred tax liabilities for a cash crop farm in west central Indiana. The recent low crop prices could make deferred taxes an important issue for farms with limited liquidity levels. If crop inventories from previous years need to be liquidated to meet cash flow requirements, taxes will have to be paid on the income from these sales. Taxes are also likely to be incurred if a farm is forced to sell assets that were purchased in recent years.

U.S. Farm Sector Balance Sheet

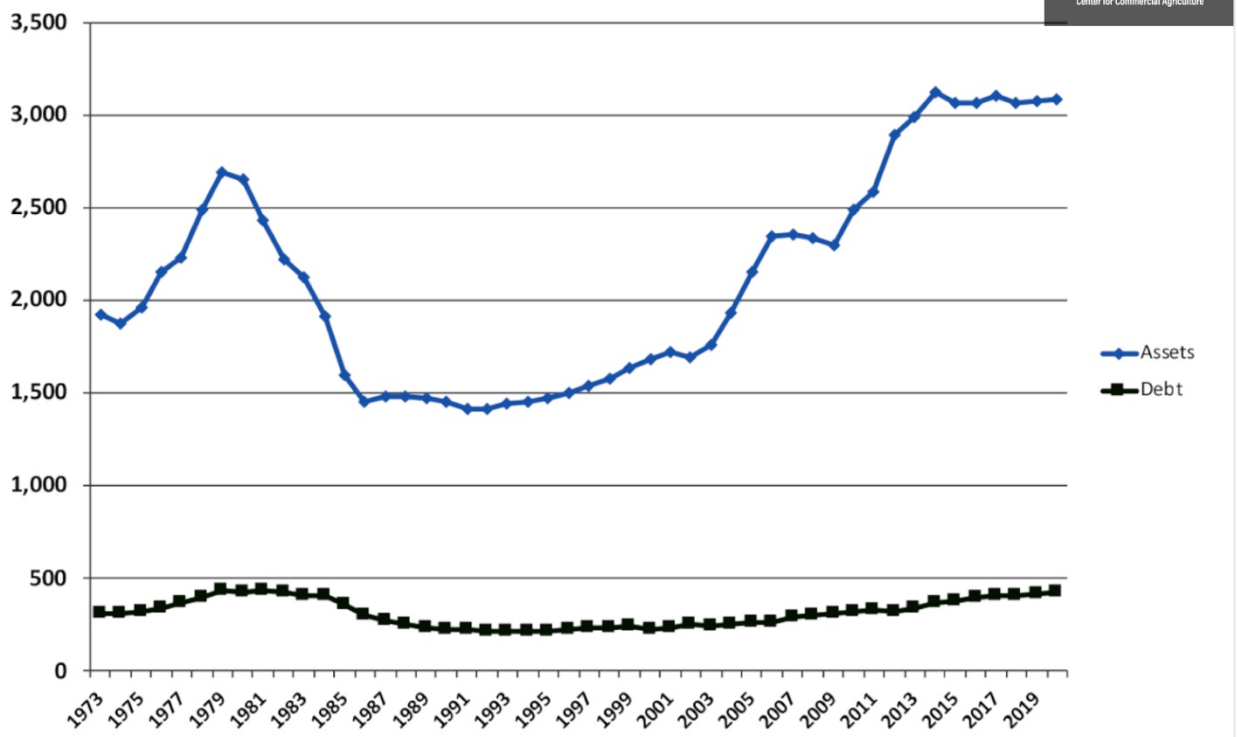
By Michael Langemeier

Since its peak in 2013 at $123.7 billion, average U.S. net farm income has averaged $82.7 billion or approximately 33% less than the peak value. The balance sheet for the U.S. farm sector continues to adjust to the declines in U.S. net farm income since 2013. Specifically, asset values and debt levels have adjusted to tighter cash flows and net farm income. This article discusses changes in the U.S. farm sector balance sheet as well as liquidity and solvency ratios.

TRENDS IN REAL ASSETS AND DEBT

Before analyzing the farm sector's current balance sheet, we will review trends in real assets and real debt. Figure 1 presents real U.S. farm sector asset and debt values using 2019 as the base year. With the exception of 2020, the values for each year represent end of the year values. Prior to 2012, the peak in real assets occurred in 1979 at a value of $2.693 trillion. In 2012, real assets for the farm sector totaled $2.893 trillion. Since 2014, real assets have exceeded $3 trillion. Real assets are projected to be valued at $3.087 trillion in 2020. The 2020 value of real assets is 3.1 percent higher than the value reached in 2013, which represents the most recent peak in real net farm income.

Figure 1. Real U.S. Farm Sector Asset and Debt Values (billions of dollars)
Source: USDA-ERS



The peak U.S. farm sector real debt occurred in 1979 at a value of $434 billion. Real debt for the U.S. farm sector was below $300 billion from 1987 to 2007. Except for in 2012, real debt has been increasing every year since 2003. Since 2013, the recent peak in terms of net farm income, real debt has increased 26.3 percent.

Projected farm sector equity in 2020 is expected to be very similar to farm sector equity in 2013. Prior to 2011, the peak in U.S. farm sector equity occurred in 1979 at a value of $2.259 trillion. Farm sector equity in 2013 and projected farm sector equity in 2020 are $2.654 trillion and $2.657 trillion, respectively.

FARM SECTOR BALANCE SHEET

Table 1 presents the U.S. farm sector balance sheet for 2010, 2015, and 2020. The values in table 1 represent real values using 2019 as the base year. The 2010 and 2015 balance sheets represent end of the year balance sheets. The 2020 balance sheet represents forecasted values and was updated on September 2, 2020.

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Table 1. Balance Sheet of the U.S. Farming Sector.

	2010	2015	2020
Farm Assets (billions of dollars)			
Financial Assets	135.3	87.7	92.8
Purchased Inputs	19.8	16.4	13.8
Crops Stored	57.2	52.5	49.0
Animals and Products	90.7	118.2	90.7
Machinery and Motor Vehicles	207.6	239.5	287.3
Real Estate	1,660.1	2,364.3	2,575.2
Total Farm Assets	2,170.7	2,878.6	3,108.8
Farm Debt (billions of dollars)			
Nonreal Estate	124.9	148.0	152.2
Real Estate	154.1	208.8	281.6
Total Farm Debt	279.0	356.8	433.8
Farm Equity (billions of dollars)	1,891.7	2,521.8	2,675.0

Projected real asset values for 2020 are substantially higher than those for 2010 and 2015. However, it is important to note that the asset values for financial assets, purchased inputs, and crops stored were lower in 2020 than they were for 2010. The value of machinery and motor vehicles in 2020 was approximately 38 percent higher than the value in 2010. Similarly, real estate values in 2020 were approximately 55 percent higher than the values in 2010.

Nonreal estate debt has increased 21.9 percent since 2010 and real estate debt has increased 82.7 percent. Current real estate debt, in real dollars, represents the highest level experienced during the 1973 to 2020 period. Though relatively high compared to levels in 2010, nonreal

estate debt was higher from 1975 to 1985, and from 2014 to 2019. Farm equity in 2020 is 41.4 percent larger than it was in 2010, and 6.1 percent larger than it was in 2012.

A common size balance sheet for the U.S. farm sector is presented in table 2. Common size balance sheets use percentages rather than actual dollars and are useful when comparing balance sheets across farms or years. The percentage of assets accounted for by financial assets, purchased inputs, crops stored, and animals and products were 14.0 percent in 2010, 9.5 percent in 2015, and 7.9 percent in 2020, reflecting the large drop in current assets since 2010. Machinery and motor vehicles were from 8.3 to 9.6 percent of total assets in 2010, 2015, and 2020. Currently, land makes up approximately 83 percent of total assets.

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Table 2. Common Size Balance Sheet for the U.S. Farming Sector.

		2010	2015	2020
Farm Assets				
	Financial Assets	6.2%	3.0%	3.0%
	Purchased Inputs	0.9%	0.6%	0.4%
	Crops Stored	2.6%	1.8%	1.6%
	Animals and Products	4.2%	4.1%	2.9%
	Machinery and Motor Vehicles	9.6%	8.3%	9.2%
	Real Estate	76.5%	82.1%	82.8%
	Total Farm Assets	100.0%	100.0%	100.0%
Farm Debt				
	Nonreal Estate	5.8%	5.1%	4.9%
	Real Estate	7.1%	7.3%	9.1%
	Total Farm Debt	12.9%	12.4%	14.0%
Farm Equity		87.1%	87.6%	86.0%

Nonreal estate debt as a percent of total assets in 2020 is smaller than it was 2010. Conversely, real estate debt in 2020 was quite a bit higher as a percent of total assets than it was in both 2010 and 2015. Nonreal estate debt as a proportion of nonreal estate assets is currently 28.5 percent and real estate debt as a proportion of real estate assets is currently 10.9 percent. Total farm debt as a percentage of assets in table 2 ranged from 12.4 percent in 2015 to 14.0 percent in 2020. Long-term trends in the debt to asset ratio for the U.S. farm sector will be discussed further below.

LIQUIDITY RATIOS

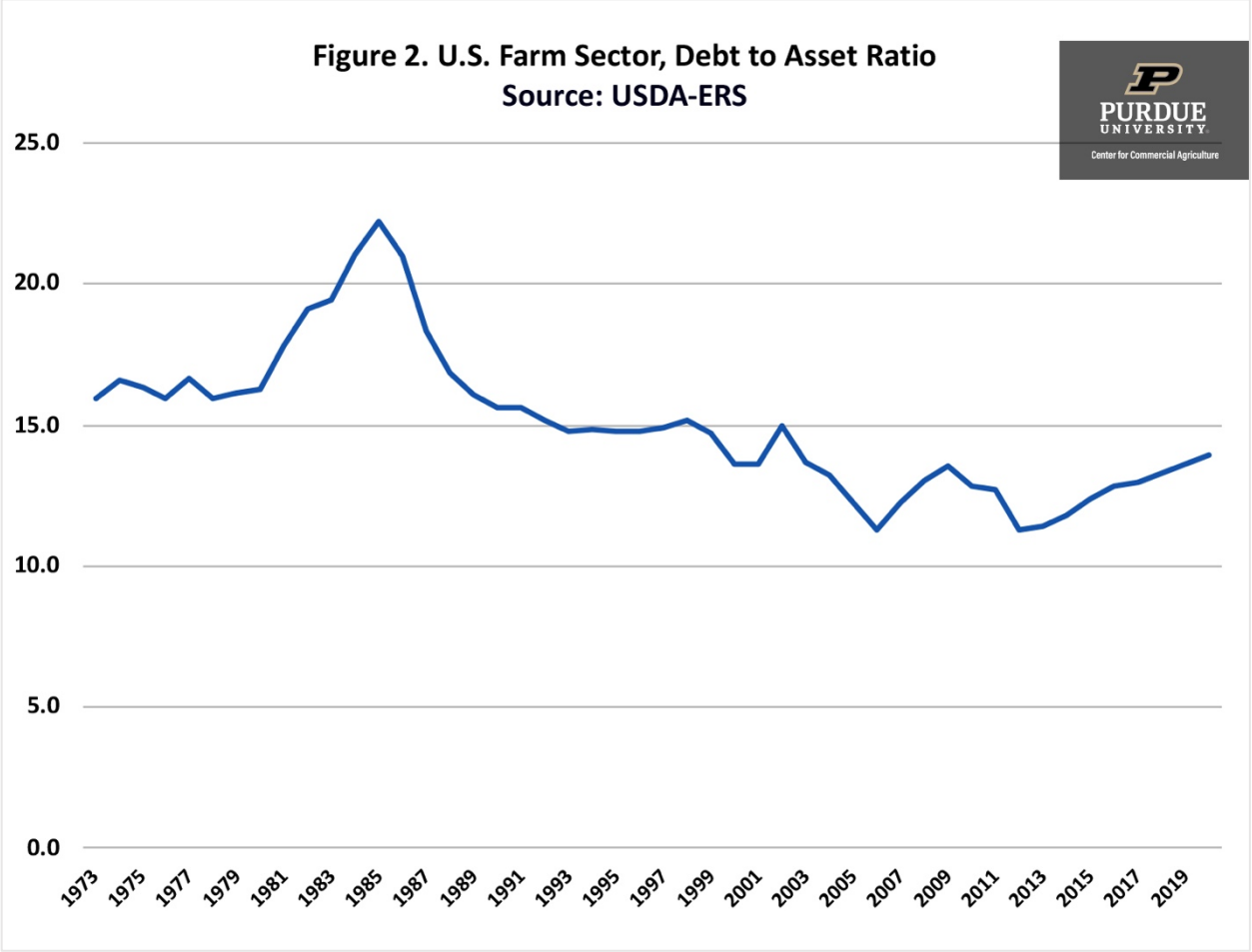
USDA-ERS has been reporting the average current ratio and the average working capital to value of farm production since 2009. Working capital is computed by subtracting current liabilities such as operating debt and the current portion of term debt from current assets such as financial assets, inventories of purchased inputs, and crop and market livestock inventories.

The average current ratio for the farm sector declined from 2.87 in 2012 to 1.62 in 2020. The 2020 value is well below the commonly used benchmark value of 2. The average working capital to value of farm production ratio declined from a value of 0.37 or 37 percent in 2012 to an average value of 0.15 or 15 percent in 2020. A commonly used benchmark value for this ratio is 35 percent or greater. The average 2020 values for both the current ratio and the working capital to value of farm production ratio illustrate the liquidity problems that farms currently face.

SOLVENCY RATIOS

Solvency ratios, such as the debt to asset ratio, provide an indication of the farm's ability to repay all financial obligations if all assets are sold, as well as an indication of the ability to continue operations as a viable farm business after a financial adversity, such as drought.

Figure 2 illustrates the debt to asset ratio for U.S. farm sector since 1973. The debt to asset ratio peaked in 1985 at 22.2 percent. The debt to asset ratio has been below 15 percent since 1999. The 2020 debt to asset ratio at 13.6 percent represents the highest ratio since 2003, but is still relatively low by historical standards. That is why many economists indicate that U.S. agriculture is currently facing a liquidity crisis, but not a solvency crisis.



How could a solvency crisis similar to that experienced in the 1980s come about? For solvency to increase dramatically at least two things would need to happen. First, net farm income would need to stay relatively low compared to the average since 2007. Projected net farm income for 2020 are currently above the average since 2007. Second, land values would need to sharply decline. A relatively low net farm income and a decline in land values would increase total debt and decrease asset values, resulting in an increase in the debt to asset ratio. The decrease in land values would have to be very sharp to repeat the conditions experienced in the 1980s. The combination of relatively low net farm income and sharply lower land values does not appear to be imminent.

CONCLUSIONS

The balance sheet for the U.S. farm sector continues to adjust to the relatively lower levels of net farm income experienced since 2013. Primarily due to land values, total asset values in 2020 are higher than they were in 2010 and 2015. Nonreal and real debt have increased 21.9% and 82.7% since 2010. Liquidity has dropped substantially since 2012. Due to relatively strong land values, solvency is only slightly higher than it was in 2012.

This article focused on the U.S. balance sheet for the farm sector. Regional changes in the balance sheet are likely quite different than changes at the national level. Differences in regional and the national balance sheet reflect differences in how land values have adjusted over the last several years, and regional differences in enterprise mix. While land values at the national level have not declined, land values for some states in the Great Plains and the Corn Belt have seen declines of 20% to 25%. A future article will compare common size balance sheets at the U.S. with those for full-time farms.

REFERENCES

USDA-ERS. "Farm Income and Wealth Statistics." www.ers.usda.gov/data-products/farm-income-and-wealth-statistics/, accessed September 2, 2020.

Working Capital: What is it and do you have enough?

By Michael Boehlje and Michael Langemeier

Maintain your working capital! This phrase is commonly heard in discussions with lenders, advisors, and management specialists in today's environment of relatively low crop net returns or margins. This brief article answers the following questions: what is working capital and how is calculated, why is working capital needed, how much working capital do you need, what are common errors in measuring working capital, and how can you manage working capital. Working capital concepts are illustrated using a west central Indiana case farm.

WHAT IS WORKING CAPITAL AND HOW IS IT CALCULATED?

Working capital is the liquid funds that a business has available to meet short-term financial obligations. The amount of working capital a business has is calculated by subtracting current liabilities from current assets. Numbers can be obtained from the farm's balance sheet. Current assets include cash, accounts receivable, inventories of grain and livestock, inputs or resources to be used in production such as feed, fertilizer, seed, chemicals, and fuel, and the investment in growing crops. Current liabilities include accounts payable, unpaid taxes, accrued expenses, including accrued interest, operating lines of credit, and principal payments due this year on long-term loans.

WHY IS WORKING CAPITAL NEEDED?

In essence, working capital provides the short-term financial reserves that a business needs to quickly respond to financial stress as well as to take advantage of opportunities. It provides a buffer to a financial downturn that might impair the business's ability to buy the inputs needed to operate as well as to service debt obligations. It also provides the financial resources to quickly take advantage of opportunities that might develop before others can do so.

HOW MUCH WORKING CAPITAL DO YOU NEED?

The answer to this question depends on both the risk and size characteristics of the farm, and the volatility of the business climate. Larger farms need more working capital, so it is best to determine the amount of working capital buffer relative to either gross revenue or total expense. A frequently suggested goal is a 20-35% buffer, or working capital that is 20-35% of gross revenue or total expense. A firm facing more volatility in the business climate needs a larger buffer. When margins for a farm are negative, these operating losses are typically covered by the use of working capital, resulting in a reduction in working capital (the speed at which working capital is reduced is often referred to as the "burn rate"). If margins are expected to be negative for more than a year or two, the burn rate on working capital may be relatively high, leading to a dramatic increase in the vulnerability to financial stress. Given the margin pressures and increased uncertainty that farmers are facing today, some suggest the buffer should be 35% or greater in relation to gross revenue or total expense.

WHAT ARE COMMON ERRORS IN MEASURING WORKING CAPITAL?

Clearly, the accuracy of the working capital calculation depends on an accurate balance sheet

with assets and liabilities properly classified as current and non-current in terms of their ability to be converted to cash or their drain on cash, respectively. But even with an accurate balance sheet, working capital can be over-stated. First, inventories are typically valued as of the date of the balance sheet, and if values (prices) decline before the underlying items are sold, working capital will be overstated unless those prices are locked in with forward contracts or futures market positions.

Second, current assets typically include the inventory of purchased inputs such as feed, fertilizer, seed, chemicals, and fuel that will be needed for future production. If these inventories are converted into cash to cover unexpected losses or other cash needs, they must be replaced relatively quickly to continue to feed the livestock or produce the crop, so they are not readily available as a buffer for financial losses.

Third, the vast majority of farmers file their taxes on a Schedule F tax return, and the tax rules define the tax basis for raised grain and livestock as zero (0) for Schedule F filers. Consequently, any inventory of raised grain or livestock must be reported as taxable ordinary income at its full gross revenue value. Only if cash expenses are incurred for production in the upcoming season will a tax deduction be allowed. Given expected cash flow and financial pressures, farmers may not have the cash to prepay expenses at the same level as they have in the past, so income tax burdens are expected to be higher in 2020. The sale of inventory from previous years is likely to trigger a deferred tax obligation, thus reducing the cash available upon that sale and thus the financial buffer from those liquid inventory assets.

HOW CAN YOU MANAGE WORKING CAPITAL?

Managing working capital involves maintaining an adequate portion of the asset base that can be easily converted to cash, and/or controlling the short-term drains on that cash resulting from debt service, capital expenditures, or cash withdrawals. So one of the easiest ways to manage working capital is to protect cash. When the business generates cash from the sale of products, it can be held in that form, committed to the purchase of inputs for the upcoming production season, or it can be used to purchase capital items or withdrawn from the business. Purchasing assets or withdrawing cash from the business may be necessary in specific instances. However, it is extremely important in today's environment to carefully monitor these uses of cash because their use can significantly reduce the liquid financial reserves of the business. Other techniques to preserve cash are to lease capital assets or hire custom services; to reduce expenditures that don't increase production; to improve yield through timely operations; and to sell at higher prices. The discussion above suggests that maintaining a strong cash position is an important way to manage working capital.

In addition to the drain on cash and thus working capital from asset purchases or withdrawals, the repayment schedule on debt also has a significant impact on working capital. Shorter repayment schedules on debt used to purchase capital assets such as land and machinery results in larger annual principal payments and reduced working capital. Extending the repayment terms through refinancing can reduce principal payments and thus the pressures on cash flows, leaving more working capital to be available to buffer financial stress. If adequate collateral is available, the debt might be restructured with some of the operating line added to the term debt so that it can be repaid over more years, thus reducing current debt obligations and increasing working capital.

Finally, capital assets such as land or machinery could be sold and the proceeds used to improve the farm's working capital position. This strategy is often not the first strategy pursued, but it

situations in which cash is relatively short it cannot be excluded from the tool box. When selling capital assets, it is important to consider capital gains and losses, and depreciation recapture, which may trigger a tax obligation resulting from the sale of assets.

WORKING CAPITAL ILLUSTRATION

Table 1 presents a balance sheet for a case farm in west central Indiana. Liquidity ratios are frequently used to examine a firm's working capital position. The computation of various liquidity ratios for the case farm are illustrated in table 2. The working capital to gross revenue and working capital to total expense ratios were 131 percent and 144 percent, respectively, indicating that the farm has a strong liquidity position. Working capital can also be expressed as a proportion of crop acres. For the case farm, working capital per crop acre was approximately $888. Some individuals also use the current ratio to evaluate a firm's liquidity position. The current ratio was approximately 5.6, which is well above 2, a commonly used benchmark.

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Table 1. Balance Sheet for White County Farms, 2019

		Beginning	Ending	Average
ASSETS:				
Cash	(1)	2,110,287	2,296,378	2,203,333
Marketable Securities	(2)	0	0	0
Accounts Receivable	(3)	0	0	0
Fertilizer and Supplies	(4)	52,701	54,340	53,520
Investment in Growing Crops	(5)	0	0	0
Crops Held for Sale and Feed	(6)	961,117	897,660	929,388
Market Livestock	(7)	0	0	0
TOTAL CURRENT ASSETS (Add Lines 1 through 7)	(8)	3,124,105	3,248,378	3,186,241
Breeding Livestock	(9)	0	0	0
Machinery and Equipment	(10)	1,527,584	1,544,369	1,535,977
Buildings	(11)	87,292	82,927	85,110
Investments in Cooperatives	(12)	0	0	0
Land	(13)	5,861,250	5,888,250	5,874,750
TOTAL NONCURRENT ASSETS (Add Lines 9 through 13)	(14)	7,476,126	7,515,546	7,495,837
TOTAL ASSETS (Add Lines 8 and 14)	(15)	10,600,231	10,763,924	10,682,078
LIABILITIES AND OWNER EQUITY:				
Accounts Payable	(16)	0	0	0
Taxes Payable	(17)	0	0	0
Accrued Expenses	(18)	0	0	0
Current Portion: Deferred Taxes	(19)	0	0	0
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Current Portion of Term Debt	(21)	46,948	52,373	49,661
Accrued Interest	(22)	29,663	31,139	30,401
TOTAL CURRENT LIABILITIES (Add Lines 16 through 22)	(23)	576,611	583,512	580,062
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TOTAL LIABILITIES AND OWNER EQUITY (Add Lines 28 and 29)	(30)	10,600,231	10,763,924	10,682,078

Table 2. Computation of Liquidity Ratios for White County Farms

Current Ratio = Ending Current Assets ÷ Ending Current Liabilities

Current Ratio = 3,248,378 ÷ 583,512 = 5.57

Working Capital = Ending Current Assets - Ending Current Liabilities

Working Capital = 3,248,378 - 583,512 = 2,664,866

Working Capital to Gross Revenue = Working Capital ÷ Gross Revenue

Working Capital to Gross Revenue = 2,664,866 ÷ 2,035,268 = 1.309

Working Capital to Total Expenses = Working Capital ÷ Total Expenses

Working Capital to Total Expenses = 2,664,866 ÷ 1,854,710 = 1.437

Working Capital per Crop Acre = Working Capital ÷ Crop Acres

Working Capital per Crop Acre = 2,664,866 ÷ 3,000 = $888

Although the case farm has a strong working capital position, several caveats are in order. First, corn and soybean prices were $4.05 per bushel and $9.10 per bushel, respectively, at the end of 2019. If corn and soybean prices fall below these values when the crops are sold, the farm's working capital position is overstated on the balance sheet. Second, the prepaid expenses related to fertilizer and supplies are not readily available sources of working capital. Third, using a tax rate of 30 percent, the deferred income tax liability on the ending inventory of crops is approximately $269,298. Deducting prepaid expenses and deferred tax liability from working capital would yield a working capital to gross revenue ratio of 115 percent and working capital per crop acre of $780, which are still indicative of a strong working capital position.

Even after the adjustments to working capital related to prepaid expenses and deferred tax liabilities, the case farm has a relatively strong working capital position. Is this position strong enough to weather two or three more years of very low margins? As with most things dealing with economics, the answer depends. Specifically, the answer to this question depends on how low the margins will be and how many years in a row of low margins are anticipated. Let's examine one scenario. If crop net losses for 2020, 2021, and 2022 were $100 per acre, what would the firm's working capital position look like? Under this scenario, working capital to gross revenue and working capital per acre would still be relatively strong.

CONCLUSIONS

This article discussed important working capital concepts and provided an illustration of how working capital is computed and analyzed for a case farm. It is important to note in closing that strategies to manage working capital often require major adjustments in the business and are not easily or quickly implemented. Consequently, when volatility increases and/or losses are expected, it is critical to anticipate the potential of future financial stress and move to maintain or rebuild working capital prior to encountering actual debt servicing or cash flow problems.

How Much Debt Can a Farm Carry?

By Michael Langemeier

INTRODUCTION

Using FINBIN data (Center for Farm Financial Management, 2020), the average debt to asset ratio in 2007, the start of the ethanol boom, was 0.44. The bottom quartile had debt to asset ratios above 0.65. The top quartile had debt to asset ratios below 0.26. Due to strong earnings from 2007 to 2013, the average debt to asset ratio improved to 0.35 in 2013, the latest peak in terms of U.S. net farm income. By 2019, after several years of earnings below the 2007 to 2013 average, the debt to asset ratio averaged 0.42. The bottom and top quartiles had debt to ratios above 0.68 and below 0.24, respectively, in 2019. Obviously, there are large differences in leverage among farms.

Given the wide variability in debt to asset ratios among farms, it is natural to think about how much debt a particular farm can carry. Although this question is too general for a specific response, some guidelines can be provided for certain debts where repayment terms are known. Important factors to be considered when estimating the amount of debt that can be repaid and the amount of debt that a farm is comfortable with include current liquidity and solvency positions, repayment capacity, length of repayment period and interest rate, stability of income, skill and experience of each operator, age and health of operators, and an operator's risk aversion level.

A case farm in west central Indiana is used to illustrate liquidity, solvency, and repayment capacity in the discussion below. This case farm utilizes a corn/soybean rotation and operates 3000 acres, 750 of which is owned.

CURRENT LIQUIDITY AND SOLVENCY POSITIONS

Farms with solid liquidity and solvency positions have more flexibility regarding increases in debt levels. A farm with a solid liquidity position has sufficient current assets to cover current liabilities as well as a potential increase in current liabilities. A farm with a solid solvency position has sufficient current and noncurrent assets to cover current debt obligations as well as potential increases in debt levels.

The case farm had a current ratio of 5.57 and a solvency ratio of 0.143 at the end of 2019. In general, a current ratio above 2.0 and a solvency ratio below 0.30 are indicative of strong financial positions. Thus, the case farm has strong liquidity and solvency positions.

REPAYMENT CAPACITY

Repayment capacity measures include capital debt repayment capacity, capital debt repayment margin, and replacement margin. Capital debt repayment capacity and capital debt repayment margin address a farm's ability to repay operating loans and to cover the current portion of principal and interest due on noncurrent loans such as a machinery, building, or land loan. The replacement margin enables borrowers and lenders to evaluate whether a farm has sufficient funds to repay term debt and replace assets. For a farm to grow, it is essential that the replacement margin be large enough to repay term debt, replace assets, and purchase new assets. For this to occur, the long-run average replacement margin has to be positive.

Langemeier (2019) further discusses the relationship between repayment capacity and farm growth potential.

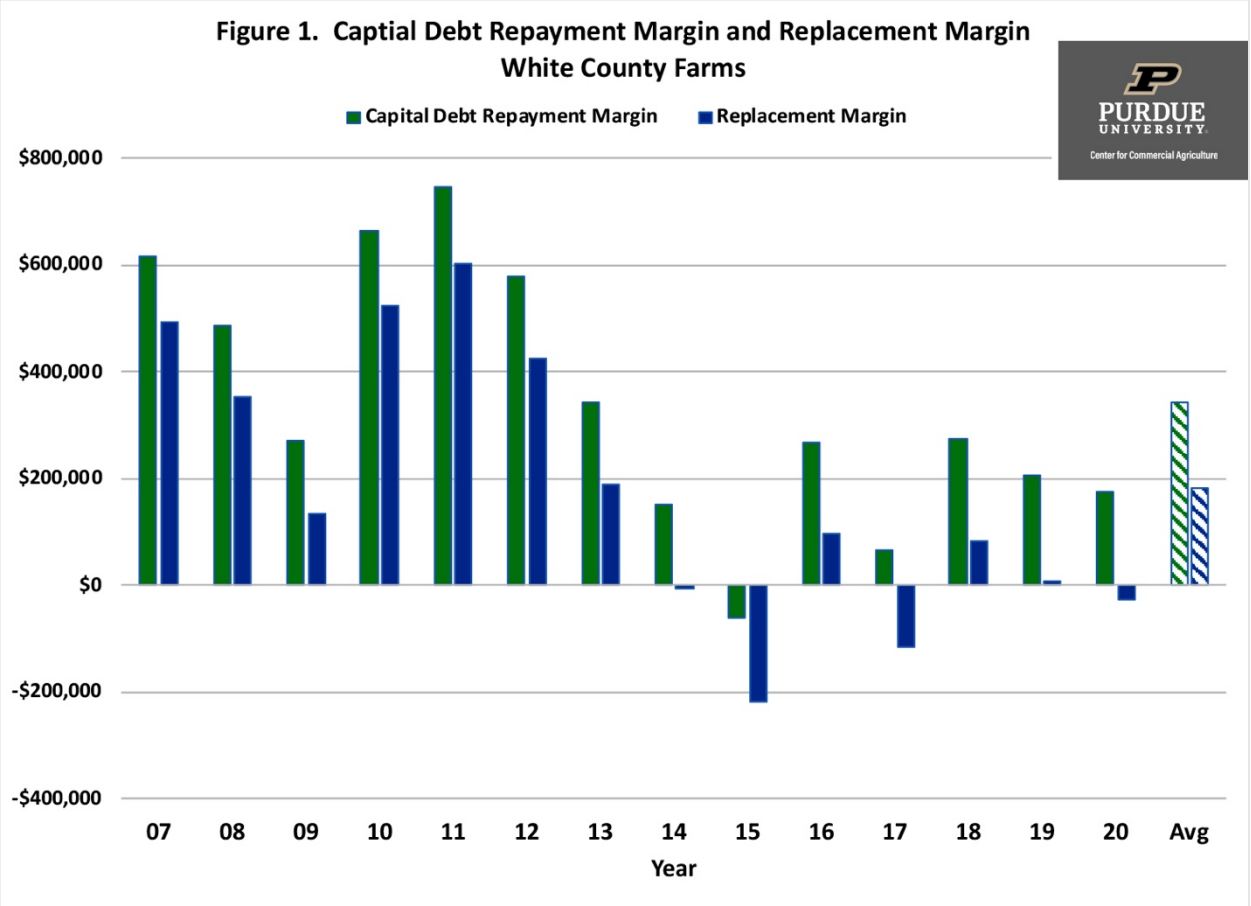
Repayment capacity projections for the case farm in 2020 can be found in table 1. The projections of accrual net farm income use trend yields and futures prices for this fall and winter adjusted for basis. It appears that the case farm will be able to cover term debt payments, but the negative replacement margin indicates that the farm will have difficulty replacing capital assets. The cash used for capital replacement was estimated by multiplying depreciation by 1.15. This computation assumes that over the long-run the farm is interested in replacing machinery as it wears out and needs an additional margin for farm growth.

Table 1. Repayment Capacity Measures for White County Farms, 2020

Capital Debt Repayment Capacity and Margin, and Replacement Margin

Accrual Net Farm Income	1	$139,074
Off-Farm Income	2	0
Income and Self-Employment Taxes	3	0
Interest Expense on Term Debt	4	63,148
Depreciation	5	175,292
Family Living Expenses	6	85,000
Capital Debt Repayment Capacity {(1+2-3+4+5)-6}	7	**$292,514**
Principal on Term Debts and Capital Leases	8	52,373
Unpaid Operating Debt from Prior Period	9	0
Capital Debt Repayment Margin {7 - (4+8+9)}	10	**$176,993**
Cash Used for Capital Replacement	11	201,586
Replacement Margin {10-11}	12	**-$24,593**
Term Debt and Capital Lease Coverage Ratio {7 / (4+8+9)}	13	**253.2%**
Replacement Margin Coverage Ratio {7 / (4+8+9+11)}	14	**92.2%**

Figure 1 illustrates the capital debt repayment margin and replacement margin for the case farm since 2007. Though both of these measures appear to be relatively low in 2019, the long-run averages (2007 to 2020) are positive indicating the case farm has been able to repay debt, replace assets, and expand since 2007.



LENGTH OF REPAYMENT PERIOD AND INTEREST RATE

The longer the repayment period and the lower the rate of interest, the greater the debt that can be carried by any level of funds available for loan repayment. It is important to compare the life of an asset to the length of the loan used to help finance the asset. If the loan length is substantially less that the life of the asset, repayment capacity diminishes. The case farm has a ten-year note on machinery and a thirty-year note on land. These loan lengths make it easier for the case farm to repay noncurrent loans.

STABILITY OF INCOME

Income risk varies widely between farms and enterprises. Price, weather, and disease all impact risk levels. When heavy debt loads are necessary, a farm should reduce risks as much as possible. The greater the weather or price risk for the farm's enterprises, the more conservative the amount of loans should be. Where crop and livestock insurance can be used to reduce risk, its use should be considered. Also, the greater the risk, the greater the importance of doing things right. When everything is done well and on time, prospects for success are greatly improved, and risk is reduced.

EFFECT OF SKILL AND EXPERIENCE

The value of each operator's skill and experience is important. Superior performance resulting from excellent management may be the most important factor influencing debt carrying capacity. Superior management will cause income prospects to improve and reduce the possibility of losses.

AGE AND HEALTH OF OPERATORS

These factors are, of course, relative ones. Younger, more ambitious operators, who also have the advantage of good health, can expect to meet relatively heavy debt repayment demands compared to anyone lacking in health and vigor. Young operators are often relatively more interested in expansion. When an operation is aggressively expanding, it is imperative to gauge the impact of this expansion on the farm's liquidity, solvency, and repayment capacity positions.

RISK AVERSION

Debt is one of the largest sources of risk (i.e., volatility of income). For this reason, among others of course, operators that are averse to risk tend to have lower debt-to-asset ratios. These lower debt-to-asset ratios often reduce the rate of expansion. However, they also may reduce the probability of large losses and the anxiety often associated with high debt levels.

CONCLUDING COMMENTS

There are numerous factors impacting a farm's debt holding capacity. It is important to remember that financial leverage or debt directly impacts a farm's growth rate through its effect on expected returns and risk (Langemeier and Boehlje, 2018). As long as a farm's return on assets is larger than the interest rate on borrowed funds, financial leverage will increase the return on equity and the sustainable growth rate. However, financial leverage also increases risk. For this reason, a farm needs to weigh the benefits (in the form of higher returns and farm growth) and the costs (in the form of higher interest costs and increased risk) of financial leverage or debt.

CITATIONS

Center for Farm Financial Management, University of Minnesota, FINBIN web site, accessed September 8, 2020.

Langemeier, M. "Measuring Repayment Capacity and Farm Growth Potential." Center for Commercial Agriculture, Purdue University, March 2019.

Langemeier, M. and M. Boehlje. "What is my Sustainable Growth Rate?" Center for Commercial Agriculture, Purdue University, May 2018.

Schedule F Net Farm Profit and Accrual Net Farm Income

By Michael Langemeier

INTRODUCTION

It is widely accepted that accrual accounting provides a more accurate estimate of annual farm profitability than cash accounting or Schedule F net farm profit (Farm Financial Standards Council, 2017; Kay, Edwards, and Duffy, 2016). Though there are numerous adjustments needed to convert cash net farm income to accrual net farm income, two of the major adjustments include prepaid expenses and crop inventories. This article compares cash and accrual net farm income for a case farm in west central Indiana given alternative scenarios pertaining to prepaid expenses and crop inventories.

CASE FARM EXAMPLE

The case farm is located in west central Indiana, has 3000 acres, and utilizes a corn/soybean rotation. The case farm owns 750 acres and cash rents the remaining acres. The case farm participates in the ARC-CO and PLC programs, and purchases 80 percent revenue protection coverage.

Table 1. Relationship between Schedule F Net Farm Profit and Accrual Net Farm Income.

		Base	Prepaids	Sell More at Harvest
Net Farm Profit	(1)	243,852	298,192	421,317
Change in Crop Inventories	(2)	-63,457	-63,457	-242,989
Change in Prepaid Expenses	(3)	1,639	-52,701	1,639
Change in Accrued Interest	(4)	-1,476	-1,476	-1,476
Accrual Net Farm Income (1+2+3+4)	(5)	180,558	180,558	178,491

The first column of table 1 contains Schedule F net farm profit, the change in crop inventories, the change in prepaid expenses, and the change in accrued interest for the base scenario. The base scenario assumes that one-half of the corn and soybean crops are sold in the year of production and the remaining one-half is sold in the subsequent year. In other words, the farm's marketing plan does not change from year to year. It further assumes that approximately ten percent of seed and fertilizer for the next crop year is purchased in the prior year. Of course, for some farms these percentages would be substantially higher. Beginning and ending prepaid

expenses for the base scenario were $52,701 and $54,340, respectively. Under the base scenario, crop inventories were $961,117 at the beginning of the year and $897,660 at the end of the year. Using these inventories, the change in prepaid expenses and crop inventories were $1,629 and a negative $63,457, respectively. The change in accrued interest was a negative $1,476.

The difference between Schedule F net farm profit and accrual net farm income for is $63,294 for the base scenario. This difference is primarily due to the change in production levels (i.e., crop yields) between the two most recent years.

SENSITIVITY OF ESTIMATES TO CHANGES IN PREPAID EXPENSES

Due to changes in taxable income and liquidity, farms do not necessarily purchase the same amount of seed, fertilizer, and other inputs prior to the start of the year. These changes in prepaid expenses impact the difference between cash and accrual net farm income. The second column in table 1 assumes that prepaid expenses at the end of the year were zero. The crop marketing plan remained the same as that of the base scenario. Specifically, one half of the corn and soybean production was sold in the production year. Accrued interest also did not change between the two scenarios.

For the reduction in prepaid expense (i.e., reduction in supply inventories) scenario, the change in prepaid expenses was -$52,701. For this scenario, net farm profit was $298,192 or $54,340 higher than that for the base scenario. Essentially the prepaid expenses purchased in the second half of the year under the base scenario were used to reduce net farm profit. Accrual net farm income was the same under the base and reduction in prepaid expense scenarios. The difference in net farm profit and accrual net farm income was $117,634.

SENSITIVITY OF ESTIMATES TO CHANGES IN CROP INVENTORIES

For numerous reasons, including changes in marketing plans, liquidity considerations, changes in crops produced and yields from one year to the next, and changes in crop prices; crop inventories at the end of the year vary over time. These changes in crop inventories have a large impact on the difference between cash and accrual net farm income. The third column of table 1 assumes that the case farm sold 60 percent the corn and soybean production before the first of the year. The change in prepaid expenses and change in accrued interest for this scenario was assumed to be the same as that for the base scenario.

For the sell more at harvest scenario, the change in crop inventories was a negative $242,989. For this scenario, net farm profit was $421,317 and accrual net farm income was $178,491. Note that the accrual net farm income was similar for the base scenario and the sell more at harvest scenario. If the crop prices received before the first of the year and the ending inventory prices were identical, there would have been no difference between accrual net farm income in the base case and sell more at harvest scenarios. The difference in net farm profit and accrual net farm income was $242,826, which is substantially larger than the difference between the two measures for the base scenario.

Obviously, the example in column 3 of table 1 is extreme. A farm would not likely increase taxable income this much. However, if the farm was interested in purchasing machinery and equipment before the first of the year using section 179 deductions or bonus depreciation, this change in the marketing plan may make sense. The point is that changes in the proportions of crops sold before and after the first of the year impact net farm profit.

CONCLUDING COMMENTS

Accrual accounting provides a more accurate assessment of annual farm profit than cash accounting. To compute accrual net farm income, a farm needs Schedule F information and accurate beginning and ending balance sheets. It is also important that the farm's balance sheet is created at the same time (e.g., early January) each year.

This article examined the impact of changes in prepaid expenses and crop inventories on accrual and cash net farm income. Changes in prepaid expenses and crop inventories have a large impact on net farm profit. Farms that change their prepaid input purchase decisions and their crop marketing plans from one year to the next will increase the difference between their net farm profit and accrual net farm income. In these instances, net farm profit becomes a very inadequate measure of farm profitability.

In summary, it is important for farms to compute both net farm profit and accrual net farm income. Net farm profit is used to compute tax obligations. Accrual net farm income is used to compute key financial ratios; such as the total expense ratio, operating profit margin ratio, return on assets, return on equity, and repayment measures; and to benchmark financial performance.

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CITATIONS

Farm Financial Standards Council. "Financial Guidelines for Agriculture, January 2017.

Kay, R.D., W.M. Edwards, and P.A. Duffy. Farm Management, Eighth Edition. New York: McGraw-Hill, 2016.

Measuring Farm Profitability

By Michael Langemeier

Farm profitability can be measured using earnings before interest, taxes, and amortization (EBITA), net farm income, operating profit margin ratio, rate of return on farm assets, and rate of return on farm equity. EBITA, as the name implies, is used to cover interest, taxes, and amortization, which includes depreciation on machinery and buildings. Net farm income is used for family living, to repay debt, and to purchase new and used assets. Though these two measures are extremely important to monitor over time on a particular farm, due to the fact that these measures depend on farm size, it seldom makes sense to compare EBITA and net farm income with other farms. Because they take into account farm size, the profitability measures other than EBITA and net farm income are more useful when making comparisons among farms. The rates of return on assets and equity are extremely useful when comparing farm investments with other investments. However, these two measures are sensitive to how farm assets are valued on the balance sheet. For this reason, the operating profit margin is more conducive for benchmarking profitability among farms. In this article, a case farm in west central Indiana is used to examine operating profit margin benchmarks.

The operating profit margin ratio is computed by adding interest expense and subtracting operator and family labor from net farm income, and dividing the result by value of farm production. Net farm income, interest expense, and value of farm production can be obtained from the farm's income statement. A discussion of an accrual income statement can be found (here). Operator and family labor can be estimated using family living expenditures. At first glance, it seems odd to add interest expense and subtract operator and family labor from net farm income. There are important reasons for making these two adjustments. Including interest expense in the computation of the operating profit margin ratio makes it easier to compare farms with very little debt to farms with high debt to asset ratios. Net farm income plus interest expense can be thought of as a return to equity and debt used in the business. Including operator and family labor in the computation enables us to compare farms that rely solely on operator and family labor to those for which hired labor is a major proportion of the labor used on the farm. Unlike operator and family labor, hired labor is an expense reported on an income statement. Subtracting operator and family labor from net farm income in the computation of the operating profit margin ratio ensures that both hired labor and operator and family labor are incorporated into our benchmarks.

Table 1 presents the computation of the operating profit margin ratio for a west central Indiana case farm. The case farm has 3000 acres of corn and soybeans. Of the 3000 acres operated by the farm, 2250 acres are cash rented from several landlords and 750 acres are owned. The columns in table 1 compare the projections for 2020 and 2021 with the five-year average ratio for the 2015 to 2019 period. Using stoplight terminology, the "green" region for the operating profit margin ratio is 20 percent and above, the "yellow" region applies to a ratio between 10 and 20 percent, and the "red" region applies to a ratio below 10 percent. These benchmarks apply to long-run performance, not individual years. Notice that the performance for this case farm was considerably below the 20 percent benchmark during the last several years.

Table 1. Operating Profit Margin Ratio for a West Central Indiana Case Farm.

	2015-2019 Average	Projected 2020	Projected 2021
Net Farm Income	114,751	64,378	40,460
Interest Expense	84,799	88,713	90,336
Operator and Family Labor	83,900	85,000	85,000
Value of Farm Production	1,924,809	1,912,734	1,884,735
Operating Profit Margin Ratio	0.060	0.036	0.024

To further evaluate the performance of the case farm, we can compare the farm's profit margin from 2015 to 2019 to data obtained from the Illinois Farm Business and Farm Management (FBFM) Association and the Center for Farm Financial Management (FINBIN database). The median operating profit margin from these two sources for the most recent five-year period for which data are available was from 5 to 6 percent. Using this information, the case farm's performance during the time period was average.

This article discussed the measurement of farm profitability. Using a case farm, the computation of the operating profit margin ratio was illustrated and discussed. The historical profit margin for the case farm is similar to that experienced by other farms during the 2015 to 2019 period. The operating profit margins projections for 2020 and 2021 at 3.6 and 2.4 percent, respectively, are relatively low, even compared to the most recent five-year period.

Measuring Efficiency of Farm Asset Utilization

By Michael Langemeier

Financial efficiency can be measured using the operating expense ratio, the depreciation expense ratio, the interest expense ratio, the net farm income ratio, and the asset turnover ratio. The three expense ratios and the net farm income ratio measure a farm's ability to produce on the production and cost frontiers. A farm's ability to operate on the production frontier depends on its ability to produce crop and livestock enterprises efficiently, while a farm's ability to produce on the cost frontier pertains to its ability to produce on the production frontier, manage costs, and market crop and livestock commodities. The asset turnover ratio, on the other hand, measures how efficiently farm assets are being used to generate value of farm production (a gross income measure). Farms that utilize assets more efficiently would have a higher asset turnover ratio. As capital requirements increase, it becomes increasingly important to measure the efficiency of asset utilization. In this article, a case farm in west central Indiana is used to examine asset turnover ratio benchmarks.

The asset turnover ratio is computed by dividing value of farm production by average total assets. Value of farm production can be obtained from the farm's income statement, and average total assets can be obtained from the farm's market value balance sheet. It is important to note that gross revenue is sometimes used instead of value of farm production to compute the asset turnover ratio.

Table 1 presents the computation of the asset turnover ratio for a west central Indiana case farm. The case farm has 3000 acres of corn and soybeans. Of the 3000 acres operated by the farm, 2250 acres are cash rented from several landlords and 750 acres are owned. The columns in table 1 compare the projected 2020 and 2021 ratios with the five-year average ratio for the 2015 to 2019 period. Using stoplight terminology, the "green" region for the asset turnover ratio is 35 percent and above, the "yellow" region ranges from 25 to 35 percent, and the "red" region is 25 percent and below. These benchmarks apply to long-run performance, not individual years. Notice that this case farm was in the "red" region during the 2015 to 2019 period. Prior to the most recent five-year period, the asset turnover ratio for the case farm was in the "yellow" region. The more rapid decline in value of farm production compared to total farm assets has contributed to the decline in the asset turnover ratio for the case farm in recent years. The projected ratios for 2020 and 2021 are even lower than the average ratio from 2015 to 2019. Looking for ways to improve revenue and use assets more efficiency is a high priority for the case farm.

Table 1. Asset Turnover Ratio for a West Central Indiana Case Farm.

	2015-2019 Average	Projected 2020	Projected 2021
Value of Farm Production	1,924,809	1,912,734	1,884,735
Average Total Assets	10,731,282	10,869,619	10,985,093
Asset Turnover Ratio	0.179	0.176	0.172

To further evaluate the performance of the case farm, we can compare the case farm's asset turnover ratio from 2015 to 2019 to data obtained from the Illinois Farm Business and Farm Management (FBFM) Association. The median asset turnover ratio for grain farms participating in the FBFM program for the 2014 to 2018 period was 20.2 percent. Though lower than this average, the asset turnover ratio for the case farm is similar to that of other farms.

Land ownership and farm type have important impacts on the asset turnover ratio. Holding all else constant, a farm that owns a higher proportion of their acres, will have a lower asset turnover ratio. Table 2 illustrates the impact of land ownership on the asset turnover ratio. The second column in table 2 represents the 2019 case farm information and is called the "base case". For the base case, 25 percent of the land on the case farm is owned. In contrast to the base case, the first column assumes that only 10 percent of the land on the case farm was owned and the third column assumes that 40 percent of the land on the case farm was owned. Table 2 illustrates the sensitivity of the asset turnover ratio to land ownership. Moving from 10 percent land ownership to 40 percent land ownership, reduces the asset turnover ratio from 0.286 to

Table 2. Sensitivity of Asset Turnover Ratio to Land Ownership Percentage.

	10% Ownership	Base Case	40% Ownership
Value of Farm Production	2,035,268	2,035,268	2,035,268
Average Total Assets	7,108,017	10,682,077	14,251,027
Asset Turnover Ratio	0.286	0.191	0.143

As noted above, the asset turnover ratio also varies by farm type. The stoplight benchmarks discussed above represent benchmarks for non-irrigated crop farms. The benchmarks for

irrigated crop farms would need to be higher. Conversely, the benchmarks for beef cow operations would need to be lower. Given this, it is important to use asset turnover benchmarks for farms that have similar enterprises.

This article discussed the importance of evaluating a farm's efficiency in asset utilization. The asset turnover ratio examines how efficiently farm assets are being used. A case farm was used to illustrate and discuss asset turnover ratios. The asset turnover ratio for the case farm was relatively low during the 2015 to 2019, and is projected to stay relatively low in 2020 and 2021. Thus, this farm needs to assess their gross revenues, and their machinery and land ownership costs, and determine whether actions need to be taken to improve asset utilization.

Du Pont Financial Analysis

By Michael Langemeier

The Du Pont financial analysis model is a useful method of illustrating the relationship between the asset turnover ratio, the operating profit margin ratio, return on assets, and return on equity. In this article, a case farm in west central Indiana is used to examine the relationships between profitability and financial efficiency ratios, and to examine the impact of a change in revenue, variable costs, or owning rather than leasing 150 acres on financial performance.

Table 1. Impact of Change in Revenue and Variable Cost on Financial Performance.

	Base Case	Higher Yield	Lower Yield	Lower Var Cost	Higher Var Cost
Return on Assets:					
Asset Turnover Ratio	0.170	0.186	0.153	0.170	0.170
Operating Profit Margin Ratio	0.015	0.101	-0.090	0.066	-0.037
Return on Assets	0.002	0.019	-0.014	0.011	-0.006
Return on Equity:					
Assets to Equity	1.17	1.17	1.17	1.17	1.17
Asset Turnover Ratio	0.170	0.186	0.153	0.170	0.170
Operating Profit Margin Ratio	0.015	0.101	-0.090	0.066	-0.037
Debt Burden	-2.323	0.562	1.595	0.264	2.323
Return on Equity	-0.007	0.012	-0.026	0.003	-0.017

Two previous articles illustrated the computation of the operating profit margin ratio and the asset turnover ratio (see here and here). The base case in Table 1 illustrates the projected profit margin and asset turnover ratio for the case farm in 2021. Trend yields and forecasted prices are used for the projections. As shown in Table 1, multiplying the operating profit margin for the base case (0.015) by the asset turnover ratio for the base case (0.170) yields a return on assets of 0.002 or 0.2 percent. The relationship between the asset turnover ratio, the operating profit margin ratio, and return on assets makes it very clear that increasing either the asset turnover ratio ("turns") or the operating profit margin ratio ("earns") leads to an increase in return on assets. To compute return on equity, in addition to return on assets, we need a solvency measure (assets to equity) and a measure called the "debt burden". The debt burden is computed by dividing net farm income minus unpaid operator labor by net farm income minus unpaid operator labor plus interest expense. Return on equity is then computed by multiplying

assets to equity by return on assets by the debt burden. This computation tells us that in addition to "turns" and "earns", return on equity depends on the farm's financial structure. Return on equity for the case farm is -0.007 or -0.7 percent. Whether return on equity is greater than or less than return on assets depends on how much profitability is being garnered through borrowing. If return on equity is greater than return on assets, borrowing is a profitability endeavor. If the situation is reversed (i.e., return on equity is less than return on assets), borrowing money does not pay. The projection for the base case suggests that the later situation is going to play out. Of course, it is not possible to know with certainty whether borrowing is going to pay in 2021 and beyond.

In addition to illustrating the performance of the base case in 2021, Table 1 compares the base case with four scenarios: higher yield, lower yield, lower variable cost, and higher variable cost. The first two scenarios in Table 1 examine the impact of a change in value of farm production (i.e., a gross income measure) in the form of 10 percent higher or 10 percent lower yields on financial performance. It is important to note that a change in value of farm production impacts both the asset turnover ratio and the operating profit margin ratio. A 10 percent increase in trend yields (decrease in trend yields) causes the asset turnover ratio to increase (decrease) from 0.170 for the base case to 0.186 (0.153), and the operating profit margin ratio to increase (decrease) from 0.015 for the base case to 0.101 (-0.090). Return on assets and return on equity respond sharply to a change in yields. Note that return on equity is positive, though still smaller than return on assets, for the higher yield scenario. A 10 percent change in value of farm production is not large by historical standards. Value of farm production for the case farm declined by more than 10 percent in 2013 and increased by more than 10 percent in 2011.

The third and fourth scenarios in Table 1 examine the impact of a 10 percent change in variable cost on financial performance. For purposes of this article, variable cost exclude cash rent, labor cost, and depreciation. Because it does not change value of farm production, a change in variable cost does not impact the asset turnover ratio. A 10 percent decrease (increase) in variable cost causes the operating profit margin ratio to increase (decrease) from 0.015 for the base case to 0.066 (-0.037). Though the impact of changing variable cost is not as large as the impact of changing value of farm production, the resulting change in financial performance is still relatively large. Under the reduction in variable cost scenario, return on assets and return on equity both increased approximately 1 percent.

The results in Table 1 illustrate the importance of stress testing financial performance. Also, they reveal the importance of managing costs without having a detrimental impact on yields. The Du Pont financial analysis model can also be used to examine the impact of expansion or asset purchases on financial performance. As an example, Table 2 illustrates the impact on financial performance associated with purchasing 150 acres that are currently be cash rented by the farm. The land is purchased with a 35 percent cash down payment and by borrowing the remaining 65 percent. Purchasing 150 acres resulted in a lower asset turnover ratio and a higher operating profit margin ratio. Return on assets and return on equity were similar for the base case and land purchase scenarios. Though not discussed in this article, in addition to examining the impact on financial performance associated with a large asset purchase, it would also be important to examine the impact on liquidity and solvency. For example, working capital per acre would decline from $892 for the base case to $746 as a result of the land purchase.

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Table 2. Impact of Owning Rather than Leasing 150 Acres.

	Base Case	Buy 150 Acres
Return on Assets:		
Asset Turnover Ratio	0.170	0.158
Operating Profit Margin Ratio	0.015	0.035
Return on Assets	0.002	0.006
Return on Equity:		
Assets to Equity	1.17	1.26
Asset Turnover Ratio	0.170	0.158
Operating Profit Margin Ratio	0.015	0.035
Debt Burden	-2.323	-0.999
Return on Equity	-0.007	-0.007

This article examined the relationship between profitability and financial efficiency ratios, and the impact of changes in value of farm production, variable cost, or purchasing rather than leasing land on financial performance. A 10 percent change in value of farm production or variable cost had a large impact on financial performance. Even a small change in value of farm production or cost can have a significant impact on financial performance. Another illustration examined the impact of a change in land ownership. Purchasing 150 acres of land that was previously cash rented resulted in a decline in the asset turnover ratio and an increase in the operating profit margin ratio. Rates of return on assets and equity were similar between the base case and the case that examined the purchase of 150 acres. Given the sensitivity of financial performance to operational changes, it is important to examine the impact of these changes on profitability and financial efficiency. The Du Pont financial analysis model is useful when analyzing the impact of operational changes.

Measuring Repayment Capacity and Farm Growth Potential

By Michael Langemeier

INTRODUCTION

Repayment capacity measures include the capital debt repayment capacity, capital debt repayment margin, replacement margin, term debt and capital lease coverage ratio, and replacement coverage ratio (Farm Financial Standards Council). Capital debt repayment capacity, capital debt repayment margin, and the term debt and capital lease coverage ratio address a farm's ability to repay operating loans and to cover the current portion of principal and interest due on noncurrent loans such as a machinery, building, or land loan. The replacement margin and the replacement margin coverage ratio enable borrowers and lenders to evaluate whether a farm has sufficient funds to repay term debt and replace assets. For a farm to grow, it is essential that the replacement margin be large enough to repay term debt, replace assets, and purchase new assets, and that the replacement coverage ratio be greater than one. This article defines and illustrates the use of key repayment capacity measures.

DEFINITIONS

The capital debt repayment capacity margin is computed by subtracting interest expense on term debt, principal on term debt and capital leases, and unpaid operating debt from prior periods from capital debt repayment capacity. Table 1 illustrates the computation of the projected capital debt repayment capacity for 2020 for a case farm in west central Indiana, which will be discussed more below. Essentially, to compute this measure, a farm subtracts family living expenses and income and self-employment taxes from a sub-total consisting of accrual net farm income, off-farm income, and depreciation. The capital debt repayment margin enables borrowers and lenders to evaluate the ability of a farm to generate the necessary funds to repay the current portion of term or noncurrent debt. For this to happen, accrual net farm income, off-farm income, and depreciation have to be large enough to cover family living expenses, income and self-employment taxes, principal and interest on term debt, and unpaid operating debt from prior periods. It is important to note that the appropriate margin will vary among farms, and depends on the size of the farm and the type of enterprises produced.

Table 1. Projected Repayment Capacity Measures for White County Farms, 2020

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Capital Debt Repayment Capacity and Margin, and Replacement Margin

Accrual Net Farm Income	1	$64,378
Off-Farm Income	2	0
Income and Self-Employment Taxes	3	0
Interest Expense on Term Debt	4	57,940
Depreciation	5	175,388
Family Living Expenses	6	85,000
Capital Debt Repayment Capacity {(1+2-3+4+5)-6}	7	**$212,706**
Principal on Term Debts and Capital Leases	8	54,154
Unpaid Operating Debt from Prior Period	9	0
Capital Debt Repayment Margin {7 - (4+8+9)}	10	**$100,612**
Cash Used for Capital Replacement	11	201,696
Replacement Margin {10-11}	12	**-$101,084**
Term Debt and Capital Lease Coverage Ratio {7 / (4+8+9)}	13	**189.8%**
Replacement Margin Coverage Ratio {7 / (4+8+9+11)}	14	**67.8%**

The term debt and capital lease coverage ratio is closely related to the capital debt repayment margin. To compute this ratio, divide capital debt repayment capacity by principal and interest on term debt. A ratio greater than one indicates that the farm has enough funds to cover principal and interest on term debt.

The replacement margin and the replacement margin coverage ratio take the analysis one step further. The replacement margin is computed by subtracting cash used for capital replacement from the capital debt repayment margin. This measure enables a borrower to evaluate a farm's ability to repay term debt and replace assets. It can also be used to evaluate a farm's ability to acquire additional assets. Cash used for capital replacement can be measured using actual capital purchases (more specifically the portion of capital purchases that need to be paid for in the first year) or depreciation. The idea behind using depreciation is straightforward. Depreciation represents wear and tear, and obsolesce of machinery and buildings. Over the long-run, a farm needs to be able to replace machinery that is wearing out, to be able to afford new technology, and to be able to expand. We typically recommend using depreciation plus another 10 to 20 percent of depreciation as the farm's measure of cash used for capital replacement. This amount will likely not be covered every year. However, over the long-run, it is essential that the replacement margin be positive. Without a positive replacement margin, a farm will not be able to fully replace depreciable assets or grow. Like the capital debt repayment margin, the replacement margin varies by farm size and type.

The replacement margin coverage ratio is closely related to the replacement margin. To compute this ratio, divide capital debt repayment capacity by the sum of principal and interest

on term debt, unpaid operating debt in prior periods, and cash used for capital replacement. If the replacement margin coverage ratio is greater than one, the farm has sufficient funds to repay term debt and replace assets.

CASE FARM EXAMPLE

Table 1 provides an illustration of the repayment capacity measures discussed above for a case farm in west central Indiana. This case farm has 3000 acres of corn and soybeans. Cash used for capital replacement was computed by multiplying depreciation by 1.15. This ensures that there are enough funds available long-term to replace equipment and to expand. The information in table 1 is based on projections in mid-September rather than actual data. It is often useful to compute both actual and projected repayment capacity measures.

Projected capital debt repayment capacity for the case farm is $212,706. This amount is large enough to cover principal and interest on term debt. Consequently, the farm's capital debt repayment margin is a positive $100,612. The replacement margin, however, is negative indicating that the farm is not expected to generate enough funds in 2020 to cover both term debt obligations and to replace assets. This is also signified by a replacement margin coverage ratio that is less than one or less than 100 percent.

Because of the negative projected replacement margin in 2020, it is important for this farm to evaluate whether the replacement margin is positive over the long-run. Figure 1 presents the capital debt repayment margin and the replacement margin for the case farm from 2007 to 2019. As a frame of reference, average value of farm production and average net farm income from 2007 to 2019 were $2,094,978 and $375,007, respectively. The capital debt repayment margin was negative in 2015, but positive in every other year. The average capital debt repayment margin was $356,131. This margin was particularly strong from 2007 to 2013. The replacement margin was negative in 2014, 2015, and 2017. The long-run average replacement margin was $198,774, indicating that the farm has the ability to cover both term debt obligations and replace assets. Whether the replacement margin is large enough in the long-run to bring another family member into the business or expand rapidly would need further analysis.

Some individuals prefer to use coverage ratios rather than dollar amounts to evaluate a farm's repayment capacity. Figure 2 presents trends in the term debt coverage ratio and replacement margin coverage ratio for the case farm. This figure contains similar information to that illustrated in figure 1.

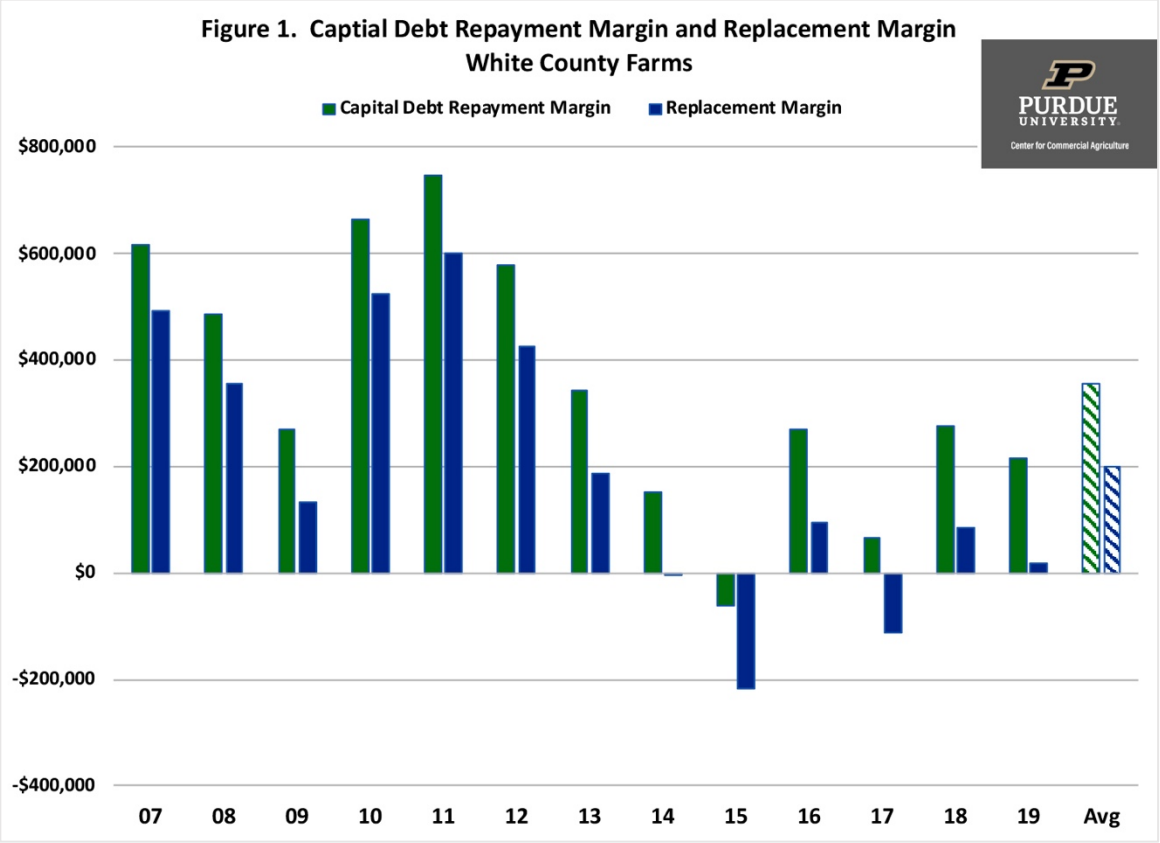
Figure 1. Captial Debt Repayment Margin and Replacement Margin
White County Farms
Capital Debt Repayment Margin
Replacement Margin
PURDUE UNIVERSITY
Center for Commercial Agriculture
$800,000
$600,000
$400,000
$200,000
$0
-$200,000
-$400,000
07
08
09
10
11
12
13
14
15
16
17
18
19
Avg

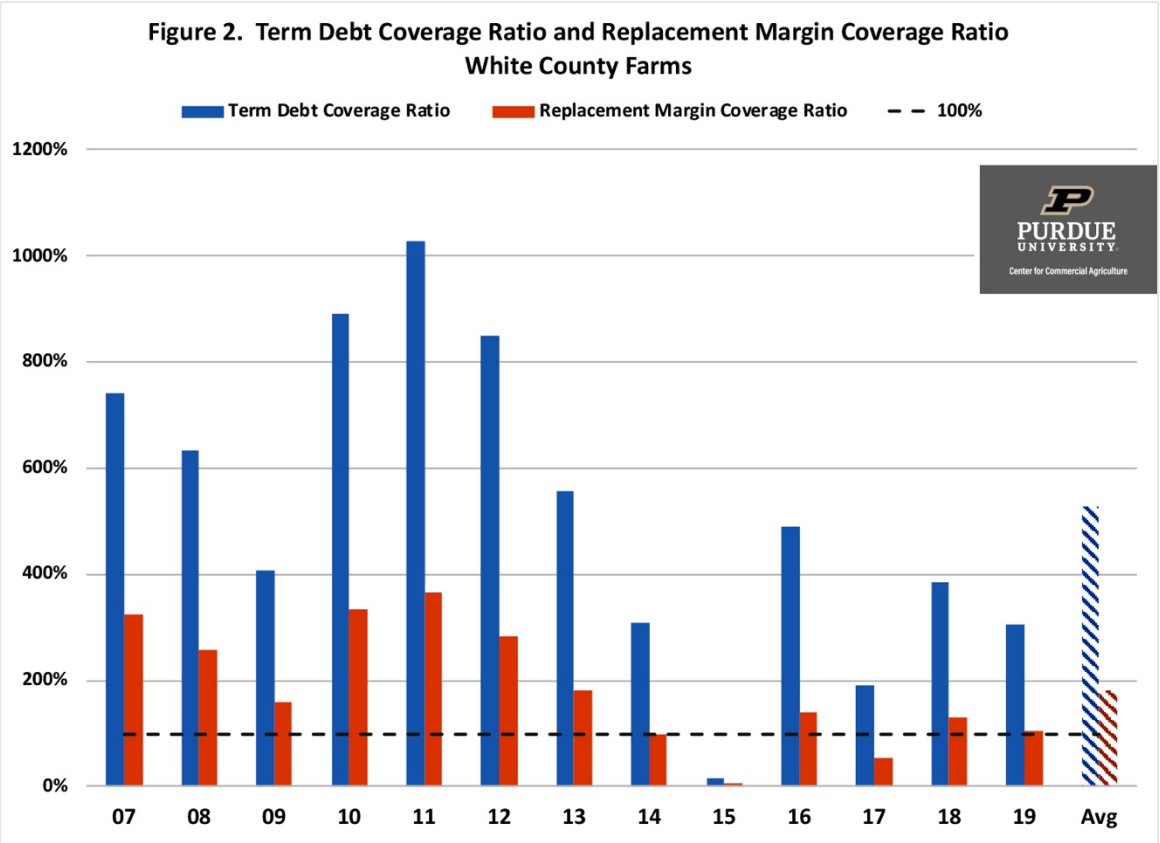
Figure 2. Term Debt Coverage Ratio and Replacement Margin Coverage Ratio
White County Farms
Term Debt Coverage Ratio
Replacement Margin Coverage Ratio
100%
PURDUE UNIVERSITY
Center for Commercial Agriculture
1200%
1000%
800%
600%
400%
200%
0%
07
08
09
10
11
12
13
14
15
16
17
18
19
Avg

CONCLUDING COMMENTS

Repayment capacity measures are used to evaluate the ability of a farm to repay term debt and replace assets. This article focused on the capital debt repayment margin, the term debt and capital lease coverage ratio, the replacement margin, and the replacement margin coverage ratio. A positive capital debt repayment margin and a term debt and capital lease coverage ratio greater than one indicates that a farm has generated enough funds to repay term debt. A positive replacement margin and a replacement margin coverage ratio greater than one signals that a farm has generated enough funds to repay term debt and replace assets. The replacement margin and the replacement margin coverage ratio can also be used to gauge a farm's ability to expand.

Repayment capacity measures for a case farm in west central Indiana were illustrated. The case farm had enough funds to repay term debt, but not enough funds to fully replace assets in 2020. The farm's average replacement margin since 2007, however, was positive. For this farm to expand in the future, the average replacement margin over the next five to ten years will also need to be positive.

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REFERENCES

Farm Financial Standards Council. "Financial Guidelines for Agriculture", January 2017.

Benchmarking Crop Machinery Investment and Cost per Acre

By Michael Langemeier

The continued increase in the size of tractors, combines, and other machinery has enabled farms to operate more acres and reduce labor use per acre. However, this increase in machinery size also makes it increasingly important to evaluate the efficient use of machinery. Two commonly used benchmarks to evaluate the efficient use of machinery are machinery investment per acre and machinery cost per acre. This article illustrates the computation of machinery investment and cost for a case farm in west central Indiana and compares these values to machinery investment and cost benchmarks.

Machinery investment per acre is computed by dividing total crop machinery investment (i.e., investment in tractors, combines, and other machinery) by crop acres or harvested acres. In regions where double-cropping is prevalent, using harvested acres gives a more accurate depiction of machinery investment.

Machinery investment per acre typically declines with farm size. It is important for farms to compare machinery investment per acre with similarly sized farms and to examine the trend in this value for a particular farm. A farm with relatively high machinery investment per acre needs to determine whether this high value is a problem. If the farm faces serious labor or timeliness constraints, their machinery investment per acre may be relatively high. However, if their machinery investment per acre is high due to the purchase of assets used to mitigate income tax obligations, the farm needs to think about whether this is a profitable long-term strategy (i.e., is the farm going to exhibit higher costs per acre due to this strategy).

Machinery cost per acre is computed by summing depreciation, interest, property taxes, insurance, building expense, leasing, repairs, fuel and lubricants, and custom hire and rental expense; and dividing the resulting figure by crop acres or harvested acres. Interest should include both cash interest paid and an opportunity charge on machinery and equipment that is owned. Again, in regions where double-cropping predominates, using harvested acres is preferable.

Machinery investment and cost for a case farm is presented in table 1. This case farm has 1500 acres of full-season corn and 1500 acres of full-season soybeans. If this farm had livestock, the relevant machinery investment and cost figures for the livestock operation would need to be excluded from total machinery investment and cost to compute the values in table 1. Machinery investment per acre for this farm is approximately $453. Machinery costs include depreciation, interest, insurance, building expense, repairs, and fuel and lubricant. The depreciation reported in table 1 represents economic depreciation rather than tax depreciation. Economic depreciation is approximated using purchase prices, salvage values, useful life, and straight-line depreciation for each piece of machinery. This farm does not custom hire or lease machinery so the values for these items are zero in table 1. Interest was computed my multiplying machinery investment by a long-term interest rate (6%). Machinery cost per acre for the case farm is approximately $125.

Table 1. Machinery Investment and Cost Estimates for White County Farms.

Item	$ per Acre
Machinery Investment per Acre	
Self-Propelled Equipment	321.97
Machinery	131.25
Total	$453.22
Machinery Cost per Acre	
Depreciation	55.97
Interest	27.19
Property Taxes	0.00
Insurance	4.53
Buildings	3.23
Leasing Expense	0.00
Repairs	21.23
Fuel and Lubricant	13.10
Custom Hire and Rental Expense	0.00
Total	$125.26

Unfortunately, crop machinery benchmarks are not readily available. However, some information is available from farm management association programs in Illinois, Kansas, and Minnesota (e.g., Center for Farm Financial Management; Langemeier and Ibendahl). For a farm with 3000 crop acres, machinery investment per acre and machinery cost per acre are typically below $475 and $110 per acre, respectively. The case farm's value of crop machinery

investment is slightly below the benchmark. However, machinery cost per acre is higher than the benchmark. This farm should compare individual cost items to benchmarks, and try to analyze machinery costs per acre for each enterprise.

It is also important to note that this farm has strong labor benchmarks. Given the potential tradeoff between labor cost and machinery cost, it is often important to compute both labor and machinery benchmarks.

This article defined, described, and illustrated the use of crop machinery investment and cost benchmarks for a case farm. The case farm had values that were similar to the benchmark targets. Related articles in this series discuss profitability and financial efficiency benchmarks, repayment capacity benchmarks, and labor benchmarks.

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REFERENCES

Center for Farm Financial Management, University of Minnesota, FINBIN database, accessed September 23, 2020.

Langemeier, M.R. and G. Ibendahl. "Crop Machinery Benchmarks." Journal of Farm Managers and Rural Appraisers. 77(2014):204-213.

Benchmarking Labor Efficiency and Productivity

By Michael Langemeier

It takes a lot of family and hired labor to run modern farms. Labor is an important and costly input and farm managers need to ask if they are getting the efficiency and productivity needed from that labor to be competitive. One way to evaluate this question is to use benchmarks created using data from similar farms. Labor benchmarks should include family and operator labor as well as hired labor. In this article, labor efficiency and productivity measures are illustrated for a case farm in west central Indiana and compared to benchmark targets.

This article focuses on two labor benchmarks: labor efficiency (a cost measure) and labor productivity (an output measure). Labor efficiency is computed by dividing total labor cost (hired labor plus family and operator labor) by gross revenue. Hired labor cost and gross revenue can be found on the farm's income statement. Family and operator labor can be represented by family withdrawals, which can be found on the farm's sources and uses of funds statement. The income statement and sources and uses of funds statement were illustrated in previous articles in this series. Labor productivity is computed by dividing gross revenue by the number of workers. If all of the employees, including the operator or operators, are fully employed, it is relatively easy to compute the number of workers. It is relatively more difficult to compute this figure when employing part-time or seasonal workers. If some of the hired labor is seasonal or part-time, the total months worked by all hired and seasonal employees should be summed and then divided by 12 to arrive at the number of workers.

If labor efficiency is relatively high and labor productivity is relatively low, it may indicate that the farm is going to have difficulty supporting all of the farm employees. Timeliness of operations should be incorporated into the evaluation of whether a farm has excess labor. Conversely, if labor efficiency is relatively low and labor productivity is relatively high, it is important to check the efficiency of machinery use. Sometimes a farm will be efficient with respect to labor, but have relatively high machinery benchmarks, or be inefficient with respect to labor, but have relatively low machinery benchmarks. Ideally, a farm would like to be competitive with respect to both labor and machinery.

Labor efficiency and productivity for a case farm in west central Indiana is presented in table 1. This case farm has 1500 acres of corn and 1500 acres of soybeans. The number of workers represents the operator, one full-time hired employee, and several part-time employees. Labor efficiency for this farm is approximately 6.6 percent. Gross revenue per worker is approximately $976,000 for the case farm. Information available from farm management association programs in Illinois, Kansas, and Minnesota suggest that for this size and type of farm, labor efficiency should be below 10 percent and labor productivity should be above $500,000 per worker. The benchmark values for the case farm achieved these targets. As noted above, this farm should also check its machinery benchmarks to determine whether it is doing a good job of controlling both machinery and labor costs.

Table 1. Labor Efficiency and Productivity for White County Farms, 2019.

Measure	
Labor Efficiency	
Hired Labor	50,815
Operator and Family Labor	84,340
Total Labor	135,155
Gross Revenue (GR)	2,035,268
Labor Efficiency (Total Labor / GR)	6.64%
Labor Productivity	
Gross Revenue (GR)	2,035,268
Number of Workers	2.086
Labor Productivity (GR / Number of Workers)	$975,680

This article defined, described, and illustrated labor efficiency and productivity measures for a case farm. The case farm had labor benchmarks that met the specified targets. Other articles in the financial management series discuss profitability and financial efficiency benchmarks, repayment capacity benchmarks, and machinery investment and cost benchmarks.

Benchmarking Profitability and Financial Efficiency

By Michael Langemeier

This article is one of a series of articles that examine financial statements and financial analysis. In this article, a case farm in west central Indiana is used to illustrate financial performance benchmarks for profitability and financial efficiency ratios.

Table 1 contains the profitability and financial efficiency ratios for the case farm for 2019 and 2010 to 2019, the latest ten-year period. Tables 2 and 3 contain definitions for each ratio, as well as the computation of each ratio for the case farm, using 2019 information. The case farm values were obtained from the balance sheet, the income statement, and the sources and uses of funds statement, all of which are illustrated in other articles in this series. Table 4 contains a financial scorecard for profitability and financial efficiency ratios. Ideally, a farm would like to be in the "green" region for each ratio illustrated in table 4. This is often not possible, which emphasizes the importance of analyzing the ratios as a group rather than focusing on one or two of the ratios.

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Table 1. Profitability and Financial Efficiency Ratios for White County Farms.

	2019	2010-2019
Profitability:		
EBITA	449,992	529,316
Net Farm Income	180,557	296,420
Operating Profit Margin Ratio	0.095	0.142
Rate of Return on Farm Assets	0.018	0.030
Rate of Return on Farm Equity	0.011	0.025
Financial Efficiency:		
Asset Turnover Ratio	0.191	0.211
Operating Expense Ratio	0.779	0.748
Depreciation Expense Ratio	0.085	0.070
Interest Expense Ratio	0.048	0.041
Net Farm Income Ratio	0.089	0.141

Table 2. Definitions of Profitability Ratios Using 2019 Data.

Profitability Measures

Earnings Before Interest, Taxes, and Amortization (EBITA) = Net Farm Income + Interest + Depreciation

Case Farm: 180,557 + 97,152 + 172,283 = $449,992

Net Farm Income

Case Farm: $180,557

Operating Profit Margin Ratio = (Net Farm Income + Interest - Unpaid Family and Operator Labor) ÷ Value of Farm Production

Case Farm: (180,557 + 97,152 - 84,340) ÷ 2,035,268 = 0.0950

Rate of Return on Farm Assets = (Net Farm Income + Interest - Unpaid Family and Operator Labor) ÷ Average Total Assets

Case Farm: (180,557 + 97,152 - 84,340) ÷ 10,682,077 = 0.0181

Rate of Return on Farm Equity = (Net Farm Income - Unpaid Family and Operator Labor) ÷ Average Owner Equity

Case Farm: (180,557 - 84,340) ÷ 9,165,888 = 0.0105

Before analyzing each ratio, let's define some of the terms and ratios. EBITA (Earnings Before Interest, Taxes, and Amortization), as the name implies, is used to cover interest, taxes, and amortization, which includes depreciation. Net farm income is used for family living, to repay debt, and to purchase new and used assets. Though these two measures are extremely important to monitor over time on a particular farm, due to the fact that these two measures depend on a farm's size, it seldom makes sense to compare EBITA and net farm income with other farms. Because they take into account farm size, the profitability measures other than EBITA and net farm income presented in tables 1 and 2 are more useful when making comparisons across farms. The "green" region for the operating profit margin ratio, rate of return on farm assets, and rate of return for farm equity are 20 percent, 7 percent, and 8 percent, respectively. It is important to note that the "green" region for the rate of return on farm equity is higher than the "green" region for the rate of return on farm assets. If a farm is

effectively utilizing borrowed funds, the rate of return on farm equity will be higher than the rate of return on farm assets. Also, it is important to note that the rates of return exclude asset appreciation during the year (e.g., increase in land values during the year). Thus, these rates of returns reflect the earning capacity of the farm rather than investment returns.

Table 3. Definitions of Financial Efficiency Ratios Using 2019 Data.

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Financial Efficiency Measures

Asset Turnover Ratio = Value of Farm Production ÷ Average Total Assets

Case Farm: 2,035,268 ÷ 10,682,077 = 0.1905

Operating Expense Ratio = (Total Cash Operating Expenses + Expense Inventory Adjustment)

÷ Value of Farm Production

Case Farm: (1,586,915 - 1,639) ÷ 2,035,268 = 0.7789

Depreciation Expense Ratio = Depreciation Expense ÷ Value of Farm Production

Case Farm: 172,283 ÷ 2,035,268 = 0.0846

Interest Expense Ratio = Interest Expense ÷ Value of Farm Production

Case Farm: 97,152 ÷ 2,035,268 = 0.0477

Net Farm Income Ratio = Net Farm Income ÷ Value of Farm Production

Case Farm: 180,557 ÷ 2,035,268 = 0.0887

Financial efficiency ratios include the asset turnover ratio, the expense ratios, and the net farm income ratio. The "green" region for the asset turnover ratio is 35 percent. This ratio varies widely among farm types and land tenure. Livestock farms and farms with a relatively higher percent of owned land tend to have lower asset turnover ratios. The asset turnover ratio monitors how efficiently a farm is utilizing its asset base. If assets are utilized more efficiently, the farm will have a relatively high asset turnover ratio. The "green" regions for the other efficiency ratios are 55 percent for the operating expense ratio, 7.5 percent for depreciation and interest expense ratios, and 30 percent for the net farm income ratio. The summation of operating expense ratio, depreciation expense ratio, interest expense ratio, and net farm income

ratio is 100 percent. So, if net farm income as a percent of value of farm production is relatively high for a particular farm, one or more of the expense ratios will be relatively low for this farm.

Many financial analysts focus on the relationship between the operating profit margin ratio, the asset turnover ratio, and the rate of return on farm assets. If we multiply the operating profit margin ratio by the asset turnover ratio, we obtain the rate of return on farm assets. This tells us that if we want to improve the rate of return on farm assets, we will need to increase profitability or earnings (i.e., the operating profit margin ratio), the efficiency with which we utilize assets or turns (i.e., the asset turnover ratio), or both of these measures.

Now let's focus on the ratios for the case farm, starting with the profitability ratios. The operating profit margin, the rate of return on farm assets, and the rate of return on farm equity were in the "red" region of the financial scorecard in 2019 and in the "yellow" region for the latest ten-year period. For both columns in table 1, the rate of return on farm equity was lower than the rate of return on farm assets. It is also worth noting that the average ten-year profit margin for the case farm (0.142) was higher than the median ten-year ratio (0.128) for crop farms included in the FINBIN database. The top quartile had an average ratio of approximately 0.295, so the value for the case farm is well below the benchmark for the top quartile. The profit margin for the case farm in 2019 was slightly higher than the median for the crop farms included in the FINBIN database, which was 0.071.

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Table 4. Financial Scorecard for Profitability and Financial Efficiency.

		Year _____ Vulnerable		Strong
Profitability				
1. EBITA	$ _____			
2. Net farm income	$ _____			
3. Operating profit margin	_____%		10%	20%
4. Rate of return on farm assets	_____%		2.5%	7%
5. Rate of return on farm equity	_____%		2%	8%
Financial efficiency				
6. Asset turnover ratio	_____%		25%	35%
7. Operating expense ratio	____.____		0.60	0.55
8. Depreciation expense ratio	____.____		0.10	0.075
9. Interest expense ratio	____.____		0.10	0.075
10. Net farm income ratio	____.____		0.20	0.30

The asset turnover ratio for the case farm was approximately 19.1 percent for 2019 and 21.1 percent for the latest ten-year period. In both instances, the ratio was in "red" region of the financial scorecard. The depreciation and interest expense ratios for the latest ten-year period were in the "green" regions of the scorecard, however, the operating expense ratio and the net farm income ratio were in the "red" region.

This article defined, described, and illustrated profitability and financial efficiency for a case farm. Ratios for the case farm were compared to financial scorecard values. The case farm compared unfavorably with respect to the benchmarks for several of the ratios. Often ratios identify problems, but do not pinpoint possible remedies to these problems. This is true for the case farm. In addition to examining ratios for the last several years, the case farm should compare specific cost items for the case farm to benchmarks for these cost items.

REFERENCES

Langemeier, M. "Market Value Balance Sheet and Analysis." Center for Commercial Agriculture, Purdue University, August 26, 2020.

Langemeier, M. "Components of an Accrual Farm Income Statement." Center for Commercial Agriculture, Purdue University, August 26, 2020.

Langemeier, M. "Sources and Uses of Funds Statement." Center for Commercial Agriculture, Purdue University, August 26, 2020.

University of Minnesota. FINBIN database, FINBIN | The Farm Financial Management Database, accessed September 25, 2020.

Benchmarking Repayment Capacity Measures

By Michael Langemeier

This article is one of a series of financial management articles that examine financial statements and financial analysis. In this article, repayment capacity measures are illustrated for a case farm and discussed.

Table 1 contains the definitions of the pertinent repayment capacity measures. This table also contains values for a case farm in west central Indiana using 2019 data. The case farm values were obtained from the balance sheet, the income statement, and the sources and uses of funds statement, all of which are illustrated in other articles in this series. Repayment capacity measures include capital debt repayment capacity, capital debt repayment margin, replacement margin, term-debt coverage ratio, and replacement margin coverage ratio.

Capital debt replacement capacity, capital debt replacement margin, and replacement margin measure a farm's ability to repay debt and replace assets. These three ratios are calculated sequentially. The replacement margin will be positive if the farm can cover all debt payments and replace assets. For this ratio to be positive, capital debt repayment capacity (net farm income plus depreciation plus interest on term debt minus family living withdrawals minus income and self-employment taxes) must be greater than principal and interest payments, and net asset purchases (asset purchases minus asset sales).

The term-debt coverage ratio provides a measure of the farm's ability to cover all term debt. The greater the ratio is over 1, the greater the margin to cover term debt obligations. The replacement margin coverage ratio measures a farm's ability to cover term debt and asset purchases. The greater the ratio is over 1, the greater the margin to cover term debt and asset purchases.

Table 2 summarizes the case farm values for the repayment capacity measures. Stoplight terminology can be used to evaluate repayment capacity measures. A negative replacement margin, a term-debt coverage ratio below 1, or a replacement margin coverage ratio below 1 would be in the "red" region. The measures for the case farm are in the "green" region. The repayment capacity measures illustrated in table 2 suggest that the case farm has sufficient funds to cover debt obligations and asset purchases. In particular, it is important to note that the replacement margin is positive and that the replacement margin coverage ratio is greater than one.

Though not shown in this article, it is also very important to determine whether the replacement margin is positive in the long-run (e.g., latest ten-year period). If it is not, the farm has had difficulty replacing depreciable assets in a timely fashion. Under this scenario, it is also likely that the farm will having trouble expanding the business, including bringing another family member into the business. The average replacement margin for the case farm for the latest ten-year period (2010 to 2019) was approximately $116,000.

This article defined, described, and illustrated repayment capacity measures for a case farm. The case farm had sufficient funds to cover debt obligations and asset purchases. Other articles in the financial management series discuss profitability and financial efficiency benchmarks, crop machinery benchmarks, and labor benchmarks.

Table 1. Definitions of Repayment Capacity Measures Using 2019 Data.

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Repayment Capacity Measures

Capital Debt Repayment Capacity = Net Farm Income + Depreciation + Interest Expense on Term Debt - Family Living Withdrawals - Income and Self-Employment Taxes

Case Farm: 180,557 + 172,283 + 60,802 - 84,340 - 11,830 = $317,472

Capital Debt Repayment Margin = Capital Debt Repayment Capacity - Prior Year Current Portion of Term Debt - Interest Expense on Term Debt - Payment on Unpaid Operating Debt from a Prior Period

Case Farm: 317,472 - 46,978 - 60,802 - 0 = $209,693

Replacement Margin = Capital Debt Repayment Margin - Cash Used for Replacement

Case Farm: 209,693 - 198,125 = $11,567

Term-Debt Coverage Ratio = Capital Debt Repayment Capacity ÷ Total Principal and Interest on Term Debt

Case Farm: 317,472 ÷ (46,978 + 60,802) = 2.95

Replacement Margin Coverage Ratio = Capital Debt Repayment Capacity ÷ (Total Principal and Interest on Term Debt + Payment on Unpaid Operating Debt from a Prior Period + Net Capital Asset Purchases)

Case Farm: 317,472 ÷ (46,978 + 60,802 + 0 + 198,125)) = 1.04

Table 2. Repayment Capacity Measures for White County Farms, 2019.

Repayment Capacity:

Capital Debt Repayment Capacity	$317,472
Capital Debt Repayment Margin	$209,693
Replacement Margin	$11,567
Term-Debt Coverage Ratio	2.95
Replacement Margin Coverage Ratio	1.04

REFERENCES

Langemeier, M. "Market Value Balance Sheet and Analysis." Center for Commercial Agriculture, Purdue University, August 26, 2020.

Langemeier, M. "Components of an Accrual Farm Income Statement." Center for Commercial Agriculture, Purdue University, August 26, 2020.

Langemeier, M. "Sources and Uses of Funds Statement." Center for Commercial Agriculture, Purdue University, August 26, 2020.

Operating Profit Margin Benchmarks

By Michael Langemeier and Elizabeth Yeager

This article examines trends in the operating profit margin for a sample of farms over a ten-year period and develops financial performance benchmarks. Specifically, using KFMA whole-farm data for farms with continuous data from 2010 to 2019, the operating profit margin ratio is computed for each farm and year. Also, the operating profit margin ratio and corresponding farm characteristics are compared across financial performance quartiles.

VARIABLE DEFINITIONS AND SUMMARY STATISTICS

The operating profit margin ratio was computed by adding interest expense and subtracting unpaid family and operator labor from net farm income and dividing the result by value of farm production. In addition to the operating profit margin, other variables compared across profit margin quartiles included value of farm production, net farm income, interest, unpaid family and operator labor, total assets, total debt, total expense ratio, adjusted total expense ratio, economic total expense ratio, asset turnover ratio, debt to asset ratio, percent of farms with positive cash flow, percent of farms financially stressed, percent of farms with expense ratios below 1.00, and percent of farms in four value of farm production categories (i.e., less than $250,000 in value of farm production; value of farm production between $250,000 and $500,000; value of farm production between $500,000 and $1,000,000; and value of farm production greater than $1,000,000). The total expense ratio was computed by summing cash costs, accrual adjustments to costs, and depreciation, and dividing the result by value of farm production. The adjusted total expense ratio was computed by adding unpaid family and operator labor to the expenses included in the total expense ratio and dividing by value of farm production. An adjusted total expense ratio below 1.00 indicates that a farm was able to cover accrual expenses, depreciation, and unpaid family and operator labor. The economic total expense ratio was computed by adding the opportunity cost on net worth to the expenses in the adjusted total expense ratio and dividing by value of farm production. If the economic total expense ratio was below 1.00, the farm or group of farms was covering all accrual and opportunity expenses, and was earning an economic profit. A farm was considered financially stressed if it had an adjusted total expense ratio above 1.00 and had a debt to asset ratio above 0.70.

Table 1 presents the summary statistics for the 437 KFMA farms with continuous data from 2010 to 2019. Value of farm production averaged $651,546 and net farm income averaged $127,473. The average profit margin was 0.113 or 11.3 percent while the average asset turnover ratio was 0.234. The average total expense ratio, adjusted total expense ratio, and economic total expense ratio were 0.804, 0.919, and 1.099, respectively. As indicated by the percent of farms with an adjusted total expense ratio below 1.00, approximately 64 percent of the farms covered accrual expenses, depreciation, and unpaid family and operator labor. Approximately 12 percent of the farms covered all accrual and opportunity costs and thus were earning an economic profit. Approximately 1.6 percent of the farms were, on average, financially stressed.

Table 1. Summary Statistics for 437 KFMA Farms with Continuous Data from 2010-2019.

Item	Average
Value of Farm Production (VFP)	$651,546
Net Farm Income	$127,473
Interest	$21,132
Unpaid Family and Operator Labor	$74,742
Total Assets	$2,781,375
Total Debt	$503,823
Total Expense Ratio (TER)	0.804
Adjusted Total Expense Ratio (ATER)	0.919
Economic Total Expense Ratio (ETER)	1.099
Operating Profit Margin Ratio	0.113
Asset Turnover Ratio	0.234
Debt to Asset Ratio	0.181
Percent of Farms with Positive Net Cash Flow	96.8%
Percent of Farms Financially Stressed	1.6%
Percent of Farms with TER less than 1.000	94.3%
Percent of Farms with ATER less than 1.000	63.8%
Percent of Farms with ETER less than 1.000	11.9%
Percent of Farms with VFP less than $250,000	22.2%
Percent of Farms with VFP between $250,000 and $500,000	31.6%
Percent of Farms with VFP between than $500,000 and $1,000,000	29.8%
Percent of Farms with VFP greater than $1,000,000	16.5%

Source: Kansas Farm Mangement Association 2019 Databank.

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Table 2. Summary Statistics for Operating Profit Margin Ratio Quartiles.[a]

Item	Profit Margin Quartile First	Second	Third	Fourth
Value of Farm Production (VFP)	$314,099	$500,775	$819,113	$975,292
Net Farm Income	$22,331	$77,290	$146,046	$265,188
Interest	$14,268	$16,316	$26,053	$27,956
Unpaid Family and Operator Labor	$66,053	$74,653	$78,246	$80,098
Total Assets	$1,438,530	$2,210,373	$3,190,081	$4,298,837
Total Debt	$303,399	$368,822	$628,418	$716,492
Total Expense Ratio (TER)	0.929	0.846	0.822	0.728
Adjusted Total Expense Ratio (ATER)	1.139	0.995	0.917	0.810
Economic Total Expense Ratio (ETER)	1.326	1.182	1.085	0.995
Operating Profit Margin Ratio	-0.094	0.038	0.115	0.218
Asset Turnover Ratio	0.218	0.227	0.257	0.227
Debt to Asset Ratio	0.211	0.167	0.197	0.167
Percent of Farms with Positive Net Cash Flow	89.1%	100.0%	100.0%	98.2%
Percent of Farms Financially Stressed	3.6%	1.8%	0.9%	0.0%
Percent of Farms with TER less than 1.000	77.3%	100.0%	100.0%	100.0%
Percent of Farms with ATER less than 1.000	0.0%	57.8%	98.2%	100.0%
Percent of Farms with ETER less than 1.000	0.0%	0.0%	12.8%	34.9%
Percent of Farms with VFP less than $250,000	52.7%	17.4%	9.2%	9.2%
Percent of Farms with VFP between $250,000 and $500,000	33.6%	46.8%	29.4%	16.5%
Percent of Farms with VFP between $500,000 and $1,000,000	10.0%	27.5%	39.5%	42.2%
Percent of Farms with VFP greater than $1,000,000	3.6%	8.3%	22.0%	32.1%
Number of Farms	110	109	109	109

[a] The first quartile is represented by farms with the lowest operating profit margin ratio. The fourth quartile is represented by farms with the highest operating profit margin ratio.

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PROFIT MARGIN QUARTILES

Table 2 presents the summary statistics for each profit margin ratio quartile. These tables were created using ten-year average data for each farm. The first quartile represents farms in the bottom quartile while the fourth quartile represents farms in the top quartile. The farms in the top profit margin quartile had an average operating profit margin ratio of 0.218 or 21.8 percent. In contrast, the farms in the bottom profit margin quartile had an average operating profit margin ratio of -0.094. The farms in the bottom profit margin quartile had relatively high

expense ratios. In fact, none of the farms in the bottom profit margin quartile were able to cover accrual expenses, depreciation, and unpaid family and operator labor, and only 77 percent of the farms covered accrual expenses and depreciation (i.e., had a total expense ratio below 1.00). Though their performance was relatively low, only 3.6 percent of the farms in the bottom quartile were financially stressed. All of the farms in the top quartile covered accrual expenses, depreciation, and unpaid family and operator labor. Moreover, approximately 35 percent of the farms in the top profit quartile earned an economic profit. The farms in the top profit margin quartile tended to be larger than the farms in the bottom quartile. However, there were farms in each farm size category in the top quartile.

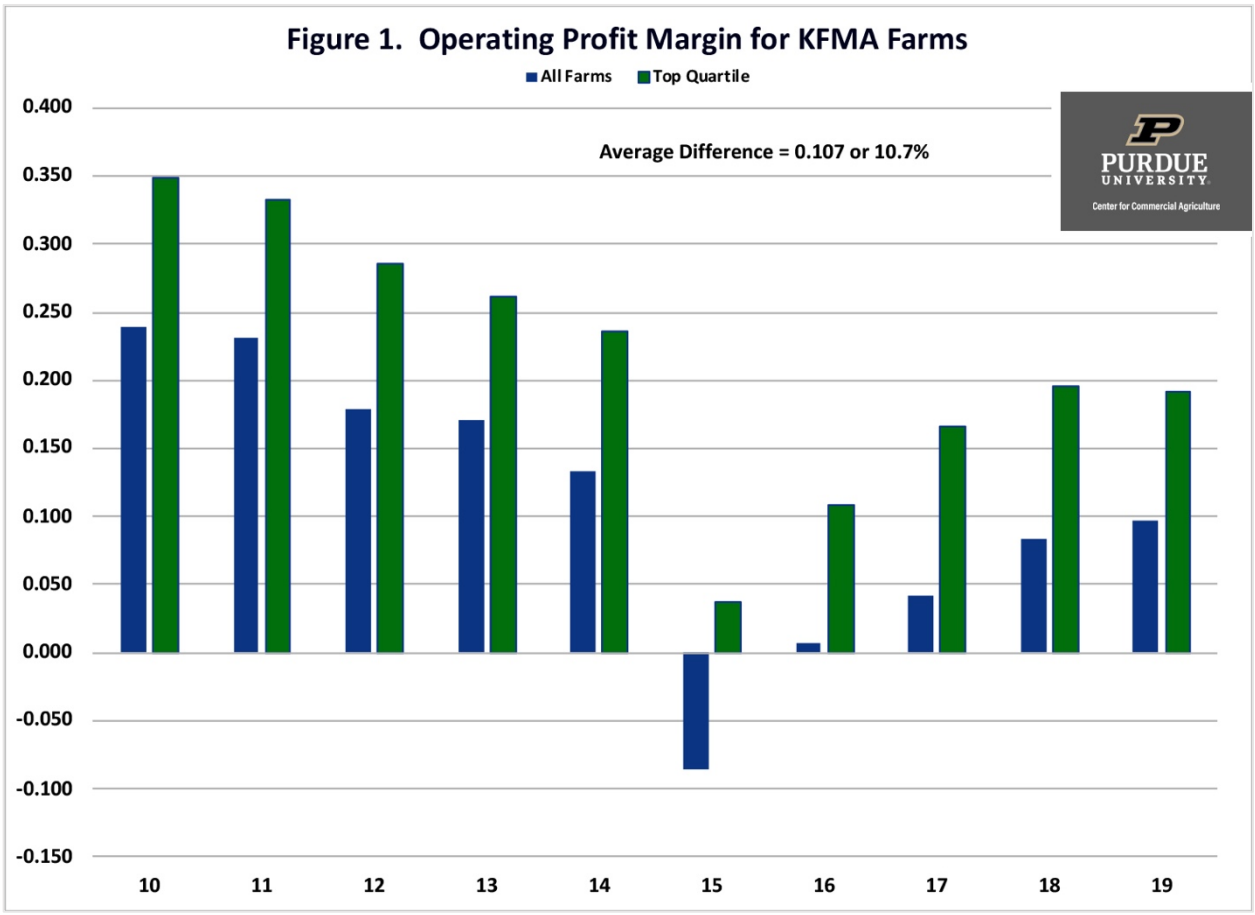

Figure 1 presents the average annual operating profit margin ratio for the entire sample of farms and for those farms in the top quartile. The average profit margin for the entire sample was negative in 2015, and close to zero in 2016. For farms in the top quartile, the average profit margin ranged from 3.7 percent in 2015 to 10.8 percent in 2016 for these same years. Figure 1 also stresses the importance of using multiple years to benchmark farms. For example, a 20 percent profit margin was relatively easy to attain in 2010 and 2011. From 2015 to 2017, this benchmark would have been very difficult to achieve.

The results in table 2 are consistent with FINBIN data (University of Minnesota, Center for Farm Financial Management). Rather than using quartiles, FINBIN reports use deciles. Using FINBIN data from 2010 to 2019, farms in the bottom 20 percent and 30 percent had average

operating profit margin ratios of -11.5 and -4.3 percent, respectively. Farms in the top 30 percent and 20 percent had an average operating profit margin ratio of 25.7 and 32.7 percent.

PROFIT MARGIN PERSISTENCE

In addition to examining the profit margin quartiles for the ten-year period, we examined how common it was for farms in the bottom or top profit margin quartile from 2010 to 2014 to also be in the bottom or top profit margin quartiles from 2015 to 2019. For the ten-year period, there were 110 and 109 farms in the bottom and top profit margin quartiles, respectively. Approximately 56 percent and 53 percent of the farms in the bottom and top quartiles, respectively, were in the bottom and top profit margin quartiles for both of the five-year periods.

The characteristics of farms in the bottom and top profit margin quartiles from 2010 to 2014 and from 2015 to 2019 are presented in table 3. The operating profit margin for the farms that were consistently in the top profit margin was 0.244 or 24.4 percent. This group of farms tended to be larger, and to have a higher asset turnover ratio than the group of farms in bottom quartile for both five-year periods.

Table 3. Summary Statistics for Farms in Top and Bottom Operating Profit Margin Quartiles for both the 2010-2014 and 2015-2019 Periods.

	Profit Margin Quartile	
Item	Bottom	Top
Value of Farm Production (VFP)	$240,426	$1,154,397
Net Farm Income	$9,782	$333,046
Interest	$10,927	$33,099
Unpaid Family and Operator Labor	$61,484	$84,136
Total Assets	$1,352,578	$4,967,380
Total Debt	$236,505	$879,358
Operating Profit Margin Ratio	-0.170	0.244
Asset Turnover Ratio	0.178	0.232
Debt to Asset Ratio	0.175	0.177
Number of Farms	61	58

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CONCLUDING COMMENTS

In summary, this paper examined the financial performance for a sample of KFMA farms over a ten-year period. Farms in the bottom quartile had a negative operating profit margin ratio indicating that they were not able to fully cover accrual expenses, depreciation, and unpaid family and operator labor. The average operating profit margin ratio for the sample of farms

was 11.3 percent. In contrast, the average operating profit margin ratio for farms in the top profit margin quartile was 21.8 percent, or 10.5 percent higher than the average profit margin. For farms that were in the top quartile during the 2010 to 2014 and 2015 to 2019 periods, the average profit margin was 24.4 percent. Based on the results in this paper, farms are encouraged to use an operating profit margin ratio of at least 20 percent as their benchmark.

Results also stress the importance of using several years of data to benchmark financial performance and suggest that it is possible for farms to have a sustained competitive advantage. Given the wide variability of financial performance documented in this study, a further examination of the characteristics of the farms in the top profit margin quartile, including obtaining information pertaining to management styles, experience, and decision-making abilities, would be a fruitful area for further research.

Persistence in Financial Performance

By Michael Langemeier and Elizabeth Yeager

This article examines the persistence of financial performance measures for a sample of farms over a five-year period. Specifically, using KFMA whole-farm data for farms with continuous data from 2015 to 2019, the operating profit margin ratio is computed for each farm and year. The number of years each farm was in the top and bottom performance quartiles is computed and discussed. Also, the operating profit margin ratio and corresponding farm characteristics are compared across financial performance quartiles. The operating profit margin ratio was computed by adding interest expense and subtracting unpaid family and operator labor from net farm income and dividing the result by value of farm production.

In addition to the operating profit margin, other variables compared across profit margin quartiles included value of farm production, net farm income, interest, unpaid family and operator labor, total assets, total debt, total expense ratio, adjusted total expense ratio, economic total expense ratio, asset turnover ratio, debt to asset ratio, percent of farms with positive cash flow, percent of farms financially stressed, percent of farms with expense ratios below 1.00, and percent of farms in five value of farm production categories (i.e., less than $250,000 in value of farm production; value of farm production between $250,000 and $500,000; value of farm production between $500,000 and $1,000,000; and value of farm production greater than $1,000,000). The total expense ratio was computed by summing cash costs, accrual adjustments to costs, and depreciation, and dividing the result by value of farm production. The adjusted total expense ratio was computed by adding unpaid family and operator labor to the expenses included in the total expense ratio and dividing by value of farm production. An adjusted total expense ratio below 1.00 indicates that a farm was able to cover accrual expenses, depreciation, and unpaid family and operator labor. The economic total expense ratio was computed by adding the opportunity cost on net worth to the expenses in the adjusted total expense ratio and dividing by value of farm production. If the economic total expense ratio was below 1.00, the farm or group of farms was covering all accrual and opportunity expenses, and was earning an economic profit. A farm was considered financially stressed if it had an adjusted total expense ratio above 1.00 and had a debt to asset ratio above 0.70.

Table 1 presents the summary statistics for the 601 KFMA farms with continuous data from 2015 to 2019. Value of farm production averaged $628,904 and net farm income averaged $76,024. The average operating profit margin ratio was 0.033 or 3.3 percent while the average asset turnover ratio was 0.207. The average total expense ratio, adjusted total expense ratio, and economic total expense ratio were 0.879, 1.008, and 1.227, respectively. As indicated by the percent of farms with an adjusted total expense ratio below 1.00, approximately 39 percent of the farms covered accrual expenses, depreciation, and unpaid family and operator labor. Approximately 7.5 percent of the farms covered all accrual and opportunity costs and thus were earning an economic profit. Approximately 3.3 percent of the farms were, on average during the five-year period, financially stressed.

Table 1. Summary Statistics for 601 KFMA Farms with Continuous Data from 2015-2019.

Item	Average
Value of Farm Production (VFP)	$628,904
Net Farm Income	$76,024
Interest	$25,518
Unpaid Family and Operator Labor	$80,897
Total Assets	$3,037,001
Total Debt	$625,904
Total Expense Ratio (TER)	0.879
Adjusted Total Expense Ratio (ATER)	1.008
Economic Total Expense Ratio (ETER)	1.227
Operating Profit Margin Ratio	0.033
Asset Turnover Ratio	0.207
Debt to Asset Ratio	0.206
Percent of Farms with Positive Net Cash Flow	95.0%
Percent of Farms Financially Stressed	3.3%
Percent of Farms with TER less than 1.000	81.4%
Percent of Farms with ATER less than 1.000	38.8%
Percent of Farms with ETER less than 1.000	7.5%
Percent of Farms with VFP less than $250,000	26.6%
Percent of Farms with VFP between $250,000 and $500,000	29.3%
Percent of Farms with VFP between than $500,000 and $1,000,000	27.6%
Percent of Farms with VFP greater than $1,000,000	16.5%

Source: Kansas Farm Mangement Association 2019 Databank.

Table 2 presents the number of farms and percent of farms by profit margin category. Farms in the first category were in the top or bottom quartile for all five years. Only 18 farms, or 3.0 percent of the farms, were in the top profit margin quartile for all five years. Approximately 18.8 percent of the farms were in the top profit margin category for three, four, or five years (i.e., in the first, second, or third top profit margin categories). Approximately 20.5 percent of the farms were in the bottom profit margin category for three or more years (i.e., in the first, second, or third bottom profit margin categories). It is important to note that approximately 43 percent of the farms were never in the bottom profit margin category.

Table 2. Number of Farms and Percent of Farms by Profit Margin Categories.[a]

Item	Number of Farms	Percent of Farms
Top Profit Margin Category		
First Category	18	3.0%
Second Category	36	6.0%
Third Category	59	9.8%
Fourth Category	100	16.6%
Fifth Category	139	23.1%
Sixth Category	249	41.4%
Bottom Profit Margin Category		
First Category	28	4.7%
Second Category	45	7.5%
Third Category	50	8.3%
Fourth Category	68	11.3%
Fifth Category	150	25.0%
Sixth Category	260	43.3%

[a] Farms in the first category were in the top or bottom quartile for all five years. Farms in the second category were in the top or bottom quartile for four of the five years. Farms in the third category were in the top or bottom quartile for three of the five years. Farms in the fourth category were in the top or bottom quartile for two of the five years. Farms in the fifth category were in the top or bottom quartile for one of the five years. Farms in the sixth category were not in the top or bottom quartile during the five year period.

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Variable comparisons among the profit margin quartiles can be found below. Before discussing this information, some of the characteristics of the 18 farms that were consistently in the top profit margin quartile will be discussed. The average operating profit for this group was 0.253

or 25.3 percent. The average asset turnover ratio for this group was 0.159 and the average return on assets, not including capital gains on land, was 4.0 percent. The average value of farm production for this group of farms was $1,516,800, more than double the average value of farm production for the entire sample of farms. All of these farms were covering accrual expenses, depreciation, and unpaid family and operator labor. Moreover, approximately 39 percent of the farms in this group were earning an economic profit.

Table 3. Summary Statistics for Operating Profit Margin Ratio Quartiles.[a]

	Profit Margin Quartile			
Item	First	Second	Third	Fourth
Value of Farm Production (VFP)	$266,016	$597,582	$733,528	$920,908
Net Farm Income	-$12,466	$24,601	$89,742	$202,808
Interest	$14,618	$26,926	$26,963	$33,636
Unpaid Family and Operator Labor	$72,651	$83,450	$83,322	$84,219
Total Assets	$1,794,933	$2,962,486	$3,193,955	$4,204,912
Total Debt	$334,395	$650,789	$655,648	$864,727
Total Expense Ratio (TER)	1.047	0.959	0.878	0.780
Adjusted Total Expense Ratio (ATER)	1.320	1.098	0.991	0.871
Economic Total Expense Ratio (ETER)	1.632	1.318	1.189	1.079
Operating Profit Margin Ratio	-0.265	-0.053	0.046	0.165
Asset Turnover Ratio	0.148	0.202	0.230	0.219
Debt to Asset Ratio	0.186	0.220	0.205	0.206
Percent of Farms with Positive Net Cash Flow	83.4%	100.0%	99.3%	97.3%
Percent of Farms Financially Stressed	3.3%	6.7%	2.7%	0.7%
Percent of Farms with TER less than 1.000	44.4%	83.3%	98.7%	99.3%
Percent of Farms with ATER less than 1.000	0.0%	0.0%	58.7%	96.7%
Percent of Farms with ETER less than 1.000	0.0%	0.0%	3.3%	26.7%
Percent of Farms with VFP less than $250,000	63.6%	22.0%	8.7%	12.0%
Percent of Farms with VFP between $250,000 and $500,000	27.2%	38.7%	34.7%	16.7%
Percent of Farms with VFP between $500,000 and $1,000,000	6.6%	26.7%	35.3%	42.0%
Percent of Farms with VFP greater than $1,000,000	2.7%	12.7%	21.3%	29.3%

[a] The first quartile is represented by farms with the lowest operating profit margin ratio. The fourth quartile is represented by farms with the highest operating profit margin ratio.

Table 3 presents the summary statistics for the operating profit margin ratio quartiles. This table was created using five-year average data for each farm. The farms in the top profit margin quartile had an average operating profit margin ratio of 0.165 or 16.5 percent (Table 3). In contrast, the farms in the bottom profit margin quartile had an average operating profit margin ratio of -0.265. The farms in the bottom profit margin quartile also had a relatively low asset turnover ratio and relatively high expense ratios. In fact, only 44.4 percent of farms in the bottom profit margin quartile covered accrual expenses and depreciation (i.e., had a total expense ratio below 1.00). In contrast, 26.7 percent of the farms in the top profit quartile earned an economic profit.

Interestingly, financial stress was more severe in the second profit margin quartile than it was in the first profit margin quartile. The primary reason for this relates to the percentage of farms with debt to asset ratios over 70 percent. For the first profit margin category, only 3.3 percent of the farms had high debt to asset ratios. In contrast, 6.7 of the farms in the second profit margin category had a high debt to asset ratio. The percentage of farms for the first profit margin quartile with no debt was more than double the percentage of farms in the second profit margin quartile with no debt.

The farms in the top profit margin ratio tended to be larger than the farms in the other profit margin categories, and had relatively lower expense ratios. Despite having a larger average farm size, the top quartile contained farms of various sizes. Approximately 12 percent of the farms in the top quartile had a value of farm production below $250,000. Approximately 29 percent of the farms in the top quartile had a value of farm production above $1,000,000. Given that the average value of farm production for farms in the bottom quartile was only $266,016, it is interesting to note that 2.7 percent of the farms in the bottom quartile had a value of farm production above $1,000,000.

In summary, this paper examined the persistence of financial performance for a sample of farms over a five-year period. Results suggest that weather and other external factors made it difficult for a farm to consistently be in the top profit margin quartile over time. However, using five-year average data there was a substantial difference in financial performance between farms in the top and bottom quartiles. For example, farms in the top profit margin ratio quartile had an average operating profit margin ratio of 0.165 compared to an average operating profit margin ratio for the sample of farms of only 0.033.

Results also stress the importance of using several years of data to benchmark financial performance and suggest that it is possible for farms to have a sustained competitive advantage. Given the wide variability of financial performance documented in this study, a further examination of the characteristics of the farms in the top profit margin quartile, including obtaining information pertaining to management styles, experience, and decision-making abilities, would be a fruitful area for further research.

U.S. Farm Sector Capital Expenditures

By Michael Langemeier

Real U.S. net farm income is forecasted to be approximately $102.0 billion in 2020, which if realized would represent the largest net farm income since 2013. Real U.S. capital expenditures on machinery, buildings, and land improvements peaked in 2014 at $47.9 billion, but are forecasted to only be $29.9 billion in 2020. It will be interesting to see if capital expenditures increase in response to potentially higher net farm income in the next couple of years. This article examines trends in capital expenditures and compares capital expenditures to capital consumption (i.e., economic depreciation).

TRENDS IN REAL CAPITAL EXPENDITURES

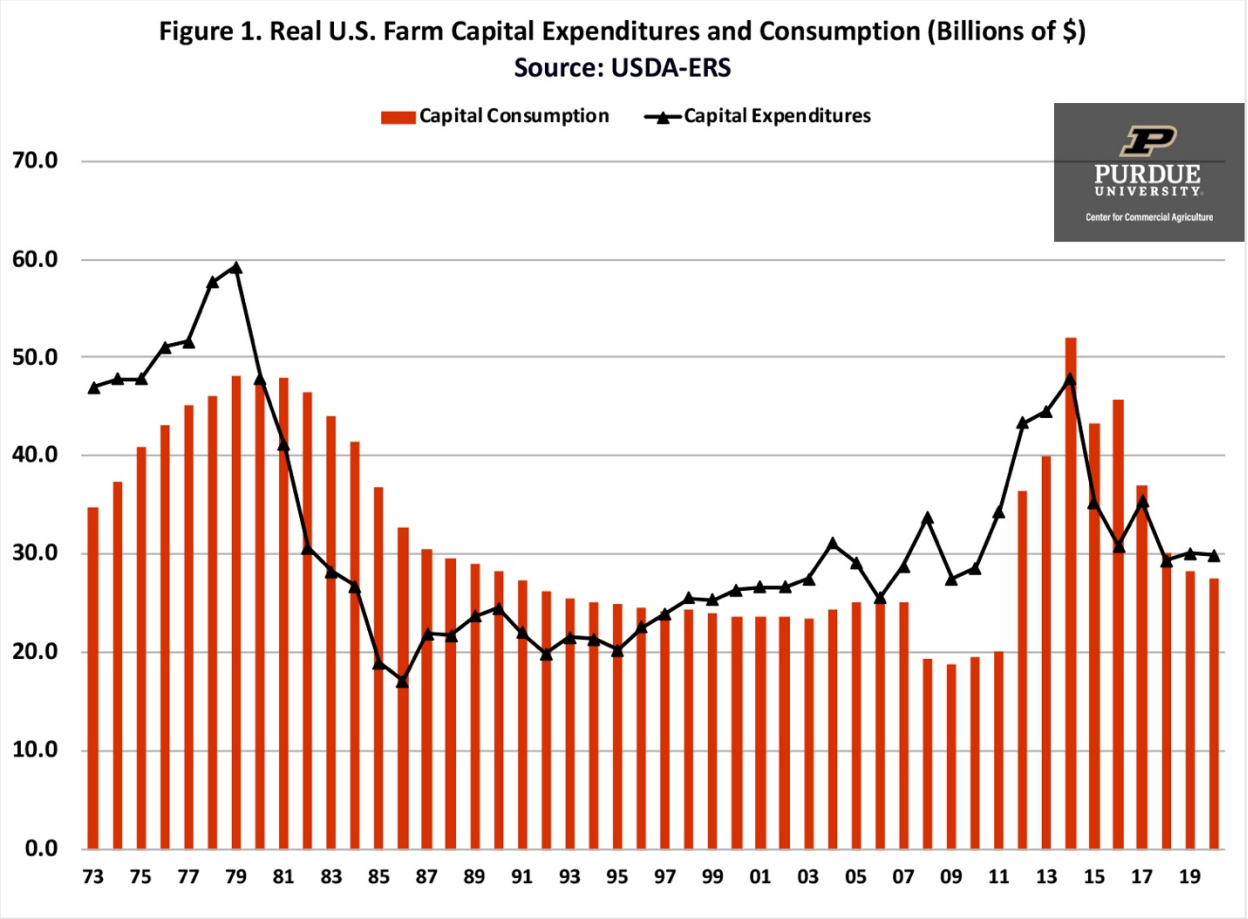
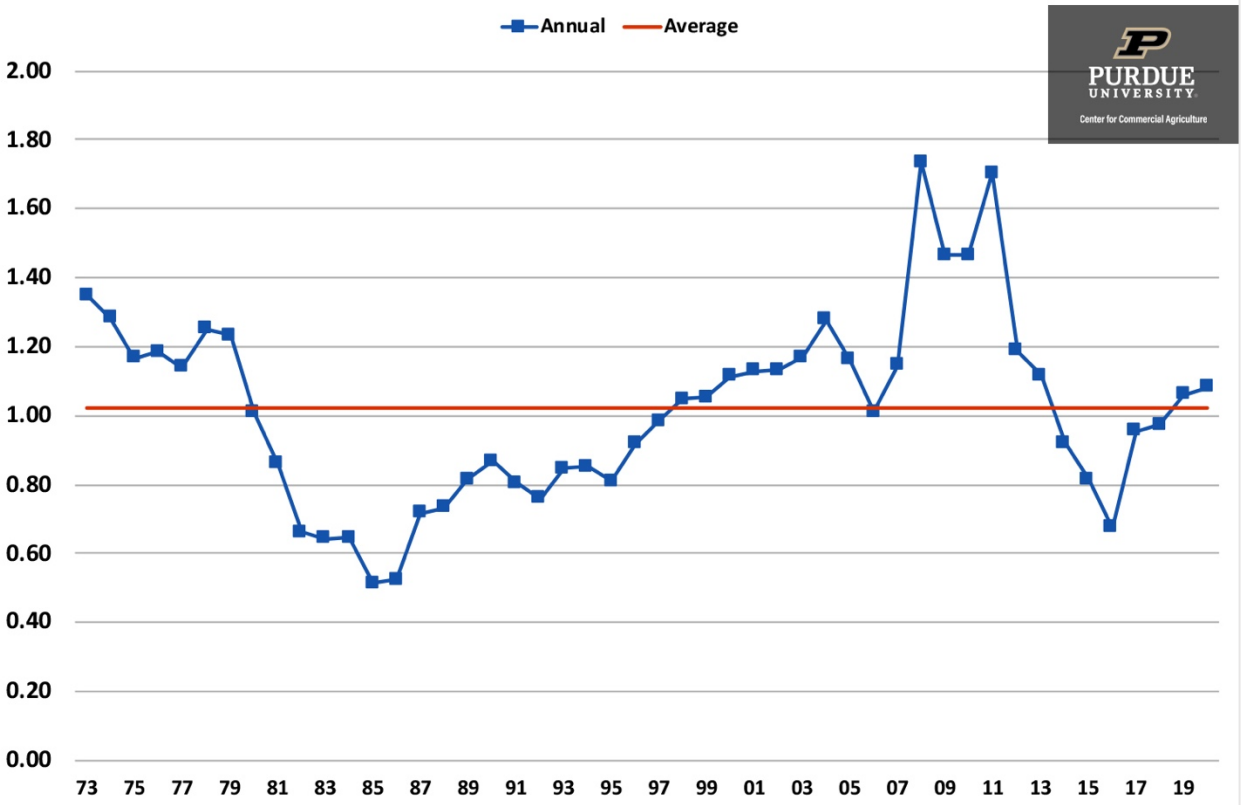


Figure 1 illustrates real U.S. farm capital expenditures and consumption from 1973 to 2020. The 2020 value represents a forecast. Capital expenditures and consumption are expressed in 2019 dollars in figure 1. Capital expenditures include tractors, trucks, autos, machinery, buildings, land improvements, and miscellaneous capital expenditures. Capital consumption represents the declining balance of capital stock or economic depreciation. Using figure 1, two large

increases in capital expenditures and two large decreases in capital expenditures have occurred since 1973. The first increase occurred during the 1973 to 1979 period. During this period, real capital expenditures increased from $46.9 billion in 1973 to $59.2 billion in 1979. The 1979 peak represents the highest annual capital expenditures level since 1973. The second increase occurred during the 2009 to 2014 period. During this period, real capital expenditures increased from $27.5 billion to $47.9 billion. The first large decrease in real capital expenditures occurred from 1979 to 1986. Real capital expenditures declined approximately 71 percent from the 1979 peak to the 1986 trough. The second large decrease is currently playing out. Since the 2014 peak, real capital expenditures have declined approximately 37 percent.

Figure 2. Ratio of Farm Capital Expenditures to Farm Capital Consumption
Source: USDA-ERS



An alternative way to examine trends in capital expenditures and consumption is to compute the ratio of capital expenditures to capital consumption. This ratio is depicted in figure 2. A ratio above 1 indicates that capital is being replaced at a rate higher than economic depreciation. Conversely, a ratio below 1 indicates that economic depreciation is larger than capital replacement. The average ratio over the 1973 to 2020 period was 1.020, which indicates that on average capital replacement exceeded capital consumption. The annual ratio appears to be quite cyclical. The ratio of capital expenditures to capital consumption was above 1 from 1973 to 1980, below 1 from 1981 to 1997, above 1 from 1998 to 2013, below 1 from 2014 to 2018, and above 1 in 2019 and 2020. The lowest annual ratios occurred during the 1980s farm financial crisis. As noted above there was a substantial decrease in capital expenditures in the 1980s. At the trough (i.e., 1986), the capital expenditure to capital consumption ratio was only 0.52. The three highest ratios occurred in 2008 (1.73), 2010 (1.47), and 2011 (1.70). Obviously, U.S. farms

replaced a substantial portion of their depreciable capital during the 2007 to 2013 period. The ratio dropped from 0.92 to 0.67 from 2014 to 2016, and then increased to 1.08 in 2020. The fact that the ratio has been above 1 the last couple of years indicates that U.S. farms have been able to fully compensate for the decline in machinery value associated with economic depreciation through machinery purchases the last couple of years.

The discussion above applies to total capital expenditures. The changes in expenditures since the most recent peak in 2014 differs among expenditure categories. Data by expenditure category is not available for 2020, so percentage decreases were computed using 2014 and 2019 data. The decline in total capital expenditures from 2014 to 2019 was 32.9 percent. The decline in expenditures for tractors (25.3 percent), autos (32.4 percent), and buildings (20.8 percent) were lower than the drop in total capital expenditures. In contrast, expenditures for trucks (38.9 percent), machinery (41.0 percent), and land improvements (35.5 percent) were relatively higher than the decline in total capital expenditures.

CAPITAL SPENDING DIFFUSION INDEX

The Federal Reserve Bank of Kansas City (here) has reported a capital diffusion index on a quarterly basis since the second quarter of 2002. This diffusion index is computed by asking bankers whether capital spending during a quarter was higher than, lower than, or the same as in the year-earlier period. The index is then computed by subtracting the percentage of bankers who responded "lower" from the percentage who responded "higher" and adding 100. An index below 100 indicates that capital spending is relatively lower than the year-earlier period. Conversely, an index above 100 indicates that capital spending is relatively higher than the year-earlier period.

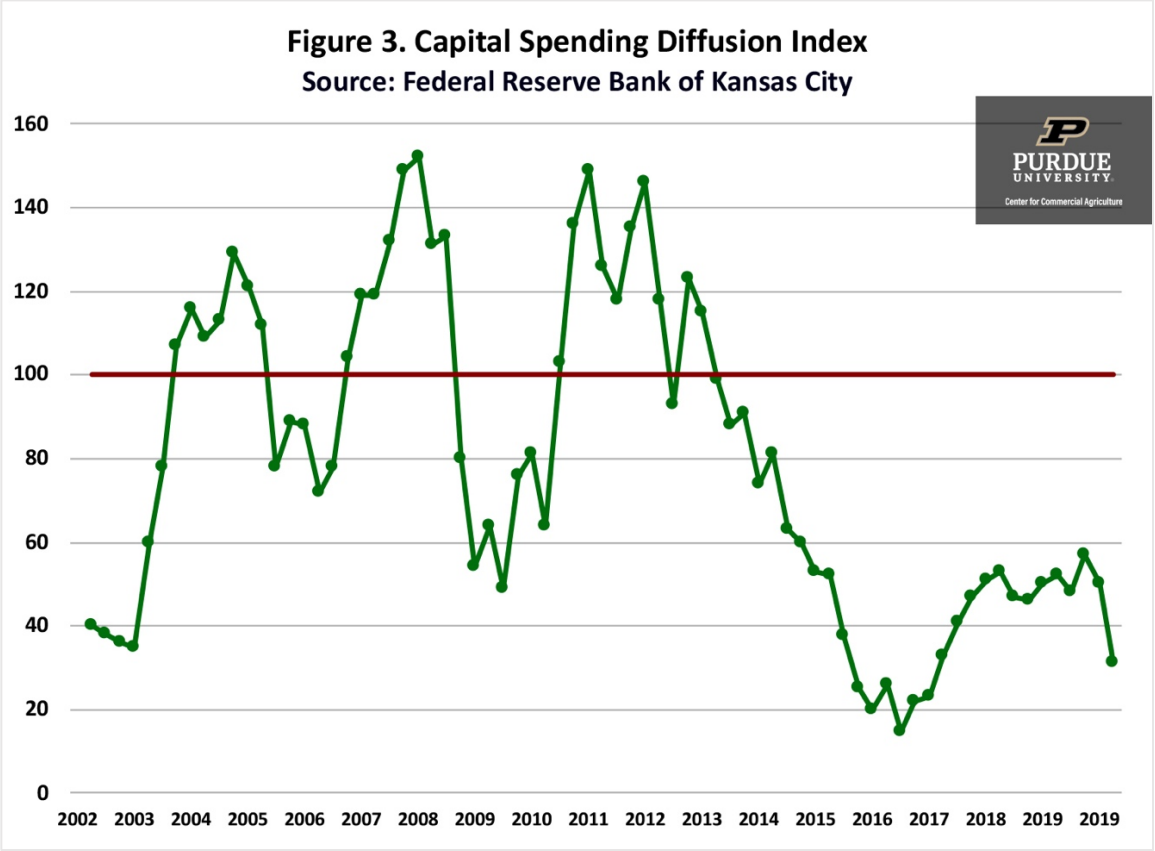


Figure 3 reports the capital spending diffusion index from the second quarter of 2002 to the second quarter of 2020. An index below 100 means that a higher percentage of agricultural bankers thought capital spending was lower than the percentage of agricultural bankers of agricultural bankers that thought capital spending was higher. The index has been below 100 since the second quarter of 2013. The lowest index since then occurred in the third quarter of 2016 (diffusion index value of 15). The index value was 50 in the first quarter of 2020 and 31 in the second quarter of 2020.

CONCLUSIONS

Real capital expenditures on U.S. farms have dropped significantly since 2014. In addition, the capital spending diffusion index reported by the Federal Reserve Bank of Kansas City has been below 100 since the second quarter of 2013. Real net farm income in 2020 is projected to be above the long-run average since 1973. If net farm income remains relatively high the next couple of years, we will probably see an increase in capital expenditures for machinery, buildings, and land improvements.

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REFERENCES

Federal Reserve Bank of Kansas City. "Agriculture and the Economy." www.kansascityfed.org/research/agriculture, accessed October 8, 2020.

USDA-ERS. "Farm Income and Wealth Statistics." www.ers.usda.gov/data-products/farm-income-and-wealth-statistics/, accessed October 8, 2020.

U.S. Farm Sector Financial Performance

By Michael Langemeier

Metrics that can be used to measure farm profitability include earnings before interest, taxes, and amortization (EBITA), net farm income, the operating profit margin ratio, return on assets, and return on equity (here). Each of these measures has its advantages and disadvantages. When focusing on operating profit, and not capital gains on assets, the operating profit margin serves as a useful measure for both internal and external benchmarking. However, if we want to include capital gains on assets in our financial performance metrics, return on assets and return on equity are preferable. This article examines trends in return on assets and its components for the U.S. farm sector.

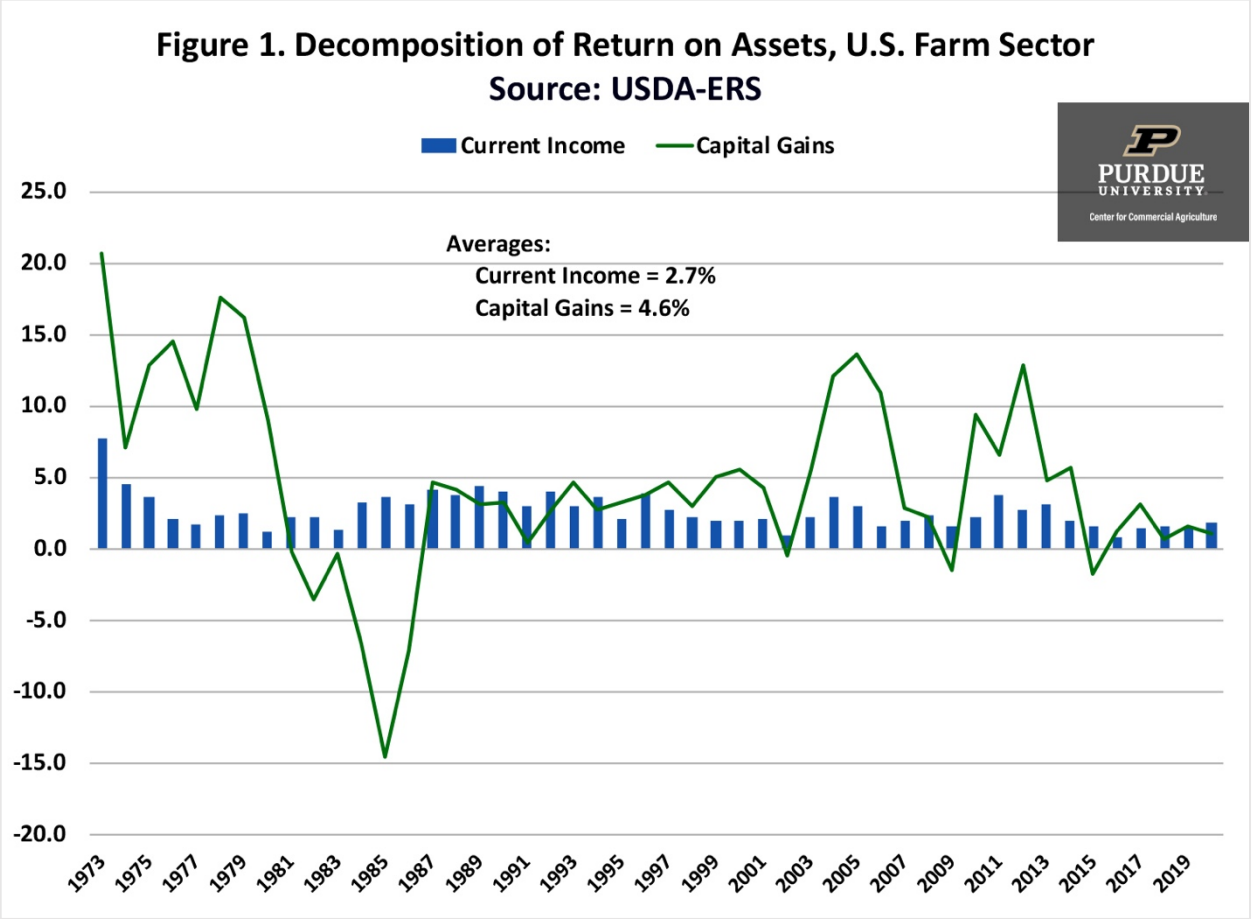
A recent article indicates that real estate comprises 83 percent of total assets on the U.S. farm sector balance sheet (here). There are two sources of income emanating from land ownership: current income and capital gains. Current income is represented by rental payments (e.g., share rent, cash rent) for non-operator landlords and by the net return to land for farm operators. Capital gains (losses) represent annual increases (decreases) in land values.

Data in this article was obtained from information reported by USDA-ERS (here). Return on assets (referred to as total rate of return on farm assets by USDA-ERS) is equal to current income (referred to as the rate of return on farm assets from current income by USDA-ERS) plus capital gains (referred to as the rate of return on farm assets from real capital gains by USDA-ERS). Current income represents the annual returns to farm sector assets from farm operations. Specifically, what we are referring to as current income in this article is computed by adding interest expense and subtracting unpaid labor and management from net farm income and dividing the result by average total assets. Capital gains (losses) measure the returns the assets from an increase (decrease) in the assets' value, apart from their income generating potential, and is computed on an annual basis.

Figure 1 illustrates the components of return on assets for the U.S. farm sector from 1973 to 2020. The data for 2020 represents a forecast. The average return on assets during this time period was 7.3 percent. This rate of return can be disaggregated into current income and capital gains. Current income and capital gains averaged 2.7 and 4.6 percent, respectively, over the 1973 to 2019 period, which indicates that approximately 64 percent of the return on assets for the U.S. farm sector was derived from capital gains.

From figure 1, it is evident the annual capital gain was considerably more variable than current income. The standard deviation of current income and capital gains was 1.2 and 6.5 percent, respectively. Relative variability can be computed by dividing the standard deviation by the average for each measure. This computation is referred to as the coefficient of variation. The coefficient of variation for return on assets was 0.95. For current income and capital gains, the coefficient of variation was 0.46 and 1.42. These results suggest that a large proportion of the variability of return on assets is due to capital gains and losses. We can also gauge the relative variability by examining downside risk. Only 5 of 47 years exhibited a negative return on assets during the 1973 to 2019 period. Capital gains were negative for 9 of the 47 years or 19 percent of

the years. In contrast, annual current income was positive for each year. Of course, for individual farms, current income would not be positive every year.



In summary, the return on assets for the U.S. farm sector since 1973 has averaged 7.3 percent. Approximately two-thirds of this return is due to capital gains and losses on assets. The other one-third is derived from current income. Though it represents a larger contributor to return on assets than current income, capital gains on assets are considerably more variable than current income. Moreover, capital gains are not readily available to meet financial obligations, purchase assets, or remunerate operators. Thus, the old adage, farms are cash poor and asset rich. A future article will contrast the national financial performance with results for a specific region of the country as well as decompose current income into the operating profit margin ratio and asset turnover ratio.

REFERENCES

Langemeier, M. "U.S. Farm Sector Balance Sheet." Center for Commercial Agriculture, Department of Agricultural Economics, Purdue University, September 9, 2020.

Langemeier, M. "Measuring Farm Profitability." Center for Commercial Agriculture, Department of Agricultural Economics, Purdue University, September 16, 2020.

USDA-ERS. "Farm Income and Wealth Statistics." www.ers.usda.gov/data-products/farm-income-and-wealth-statistics/, accessed October 8, 2020.