

Using Farm Financial Standards Council Recommendations in the Profitability Linkage Model: The ROA Dilemma

By Freddie L. Barnard and Michael Boehlje

Abstract

The DuPont profitability linkage model is used to analyze business profitability. However, if ratio calculations recommended by the Farm Financial Standards Council (FFSC) are used in the model, adjustments are needed. The adjustments are needed due to the different treatments of interest in the calculation of the Return on Assets (ROA) by the FFSC and the business school's application of the DuPont profitability linkage model. Two alternatives are presented to resolve the "ROA Dilemma."

Introduction

Business schools commonly use the profitability linkage or DuPont model to analyze profitability of a business. This model includes three components: net profit margin, asset turnover, and financial leverage. It is based on the relationships among these three components expressed as ratios. When the net profit margin ratio is multiplied by asset turnover, the result is rate of return on assets (ROA). When ROA is multiplied by a financial leverage ratio or equity multiplier, which is defined as total assets divided by owners' equity, the result is rate of return on equity (ROE) (i.e., Shapiro and Balbirer).

In the field of agricultural finance, recommendations of the Farm Financial Standards Council (FFSC), released in 1991 and revised in 1995 (July 1995), initiated an industry-wide effort to promote uniformity in financial reporting and analysis for agriculture. The recommendations include calculations for three profitability ratios and an efficiency ratio that are used in the profitability linkage model: operating profit margin, ROA, ROE, and asset turnover. The recommendations have been adopted, in varying degrees, by major segments of the agricultural industry.



Freddie L. Barnard is professor and Extension economist in the Department of Agricultural Economics, Purdue University. He is also a member of the Technical Committee of the Farm Financial Standards Council. He holds a Ph.D. in agricultural economics, with a specialty in agricultural finance, from the University of Illinois.

Michael Boehlje is a Professor in the Department of Agricultural Economics and the Center for Food and Agricultural Business (CAB) at Purdue University. Dr. Boehlje is involved in teaching and research in agricultural finance, farm and business strategy and management and structural change in the agricultural industries. Dr. Boehlje is the author or co-author of four books, and over 450 articles and other publications. He is a Fellow of the American Agricultural Economics Association.

However, if the FFSC recommended calculations for the operating profit margin, ROA, and ROE are used in the profitability linkage model, adjustments are needed to accurately calculate ROA and ROE. This paper discusses the dilemma faced by users of the profitability linkage model who also wish to comply with the FFSC recommendations for calculating ROA and ROE. The authors also offer two alternatives to resolve what will be referred to in this article as the "ROA Dilemma."

Profitability Linkage Model

Fundamentally, there are two primary strategies to enhance operating performance of a business as measured by ROA: 1) increase net income per dollar of revenue or unit of output, and 2) increase the revenue generated per dollar invested. The operating profit margin captures the effects of the first strategy and the asset turnover ratio captures the effects of the second. If operating profits exceed the cost of borrowed capital, operating performance through the use of borrowed capital can be augmented. This enhances the ultimate performance for the individual investor as measured by ROE. Thus, there are three primary factors that affect bottom line financial performance: net profit margin, asset turnover, and financial leverage.

These basic concepts are captured in the profitability linkage model. The model is used as a diagnostic tool to assess the impact of changing any of a variety of factors and immediately assessing the impact on ROA and ROE (Barnard and Boehlje and Boehlje, et al). The relationship among the three factors, in the simplest and most straightforward business school approach illustration, is shown by the following calculations:

$$\frac{\text{NET PROFIT MARGIN}}{\text{Sales}} \times \frac{\text{ASSET TURNOVER}}{\text{Assets}} \times \frac{\text{EQUITY MULTIPLIER}}{\text{Equity}} = \frac{\text{ROE}}{\text{Equity}}$$

Any decision that influences product prices, per unit costs, volume, or efficiency/ productivity (output per unit of input) will affect the net profit margin and/or asset turnover. And, any decision that affects the amount of borrowed capital will affect the equity multiplier ratio as well as the net profit margin. Consequently, the profitability linkage model allows users to determine the financial impact of any of a number of decisions that might improve performance.

Recommendations of the FFSC

The FFSC recommended sixteen financial measures and the calculation for each (Financial Guidelines for Agricultural Producers). Four of these measures are included in the profitability linkage model: operating profit margin, asset turnover, ROA, and ROE. The FFSC recommended calculations are shown below:

<p>OPERATING PROFIT MARGIN Net Farm Income From Operations Plus: Interest Minus: Unpaid Family Labor <hr/> Gross Farm Revenue</p>	<p>ASSET TURNOVER Gross Farm Revenue Farm Revenue <hr/> Total Farm Assets</p>	<p>ROA Net Farm Income From Operations Plus: Interest Minus: Unpaid Family Labor <hr/> Total Farm Assets</p>	<p>ROE Net Farm Income From Operations Minus: Unpaid Family Labor <hr/> Owners' Equity</p>
---	---	--	---

As an alternative, the FFSC allows value of farm production to be substituted for gross farm revenue in the operating profit margin and asset turnover ratios. The one restriction is if that substitution is made in one ratio, it must be in both ratios.

Profitability Linkage Model Using the FFSC Recommendations

When the FFSC recommended calculations for operating profit margin and asset turnover are used in the profitability linkage model, the result is the FFSC recommended calculation for ROA, as illustrated in Table 1. However, when ROA is multiplied by the financial leverage ratio or equity multiplier, the result is not the FFSC recommended calculation for ROE, as illustrated in Table 1.

Table 1. Profitability Linkage Model Using the FFSC Recommendations

OPERATING PROFIT MARGIN	X	ASSET TURNOVER	=	ROA
Net Farm Income From Operations Plus: Interest Minus: Unpaid Family Labor <hr/> Gross Farm Revenue	X	Gross Farm Revenue <hr/> Total Farm Assets	=	Net Farm Income From Operations Plus: Interest Minus: Unpaid Family Labor <hr/> Total Farm Assets
ROA	X	FINANCIAL LEVERAGE	≠	ROE
Net Farm Income From Operations Plus: Interest Minus: Unpaid Family Labor <hr/> Total Farm Assets	X	Total Farm Assets <hr/> Owners' Equity	≠	Net Farm Income From Operations Plus: Interest Minus: Unpaid Family Labor <hr/> Owners' Equity

As can be seen by evaluating the ROE calculation using the formula from the profitability linkage model, interest is not expensed, whereas, the ROE calculation recommended by the FFSC clearly includes interest as an expense.

Differences in the Business School and the FFCS Ratios

As can be seen by examining the ratios included in the profitability linkage model using the business school approach and the ratios recommended by the FFSC, there are two basic differences. First, net income used in the business school model does not include a return to family labor and management, since a charge for those resources would have been subtracted from gross revenue as an operating expense in the form of salaries and/or wages. That is not the case for net farm income from operations (NFIFO), because a return to operator and family labor and management is not subtracted as an expense to calculate NFIFO. Since the majority of agricultural operations are organized as sole proprietorships, agricultural operators and their families are paid from the net amount that is designated as NFIFO.

Second, the interest expense has been subtracted to calculate net income in the business school approach and to calculate NFIFO using the FFSC recommended ratios. However, the interest expense is then added back to NFIFO to calculate the operating profit margin and ROA using the FFSC recommendations. The interest expense is added to NFIFO in those ratios to properly calculate a return to total assets. But, interest expense must be subtracted to calculate ROE, because that return is paid to the lender rather than being retained by the owner.

The first difference is addressed by the FFSC recommendations on financial criteria and measures. A charge for unpaid operator and family labor and management is subtracted from NFIFO when calculating the operating profit margin ratio, ROA, and ROE. Consequently, neither the ratios used in the business school approach nor the ratios recommended by the FFSC include a return to operator and family labor and management.

However, the second difference presents a dilemma for users of the profitability linkage model who want to use the ratios recommended by the FFSC. An inconsistency in how interest is treated in the computations results in the "ROA dilemma."

ROA Dilemma

To use the FFSC recommended ratios in the profitability linkage model the user is faced with an inconsistency in the calculation of ROA and, as a result, the calculation of ROE. That inconsistency can be alleviated by using one of two approaches.

One approach is to make an interest cost adjustment in computing the ROE from a properly computed (i.e., not including interest as an expense) ROA. The interest cost is divided by total farm assets, and then the result is subtracted from ROA. This adjusted ROA is then multiplied by the financial leverage ratio to calculate ROE as recommended by the FFSC, as illustrated in Table 2.

Table 2. Interest Cost Adjustment and Return on Investment (ROI) Approaches: Interest Cost Adjustment Approach

ROA	-	INTEREST COST ADJUSTMENT	=	ADJUSTED ROA
Net Farm Income From Operations				Net Farm Income From Operations
Plus: Interest				
Minus: Unpaid Family Labor				Minus: Unpaid Family Labor
Total Farm Assets		Interest	=	Total Farm Assets
		Total Farm Assets		
ADJUSTED ROA	X	FINANCIAL LEVERAGE	=	ROE
Net Farm Income From Operations				Net Farm Income From Operations
Minus: Unpaid Family Labor				Minus: Unpaid Family Labor
Total Farm Assets		Total Farm Assets	=	Owners' Equity
		Owners' Equity		

A second approach is to not add the interest cost to NFIFO when calculating the operating profit margin ratio as shown in Table 3. The ratio could be referred to as return on revenue to distinguish it from the operating profit margin recommended by the FFSC.

Table 3. Interest Cost Adjustment and Return on Investment (ROI) Approaches: Return on Investment (ROI) Approach

RETURN ON REVENUE	X	ASSET TURNOVER	=	ROI
Net Farm Income From Operations		Gross Farm Revenue		Net Farm Income From Operations
Minus: Unpaid Family Labor				Minus: Unpaid Family Labor
Gross Farm Revenue		Total Farm Assets	=	Total Farm Assets
ROI	X	FINANCIAL LEVERAGE	=	ROE
Net Farm Income From Operations				Net Farm Income From Operations
Minus: Unpaid Family Labor				Minus: Unpaid Family Labor
Total Farm Assets		Total Farm Assets	=	Owners' Equity
		Owners' Equity		

Of course, the resulting ratio, when using return on revenue in the linkage model, would not be the recommended calculation for ROA. Instead, the resulting number would be the rate of return on investment (ROI), as is the case with the business school approach to using the model. Note that the numerical value of ROI will not be the same as for ROA. This difference is critical when benchmarking financial performance.

Hence, the recommended calculations for operating profit margin, ROA, and ROE can remain as published by the FFSC and the recommended ratios that are used in the profitability linkage model can be in compliance with those recommendations.

Case Example Illustrations

A case example is used to illustrate the changes in operating profit margin and ROA calculations when used in the profitability linkage model. The financial information for a hypothetical farm business is provided below:

Average Total Assets	\$1,000,000
Average Owners' Equity	750,000
Gross Farm Revenue	350,000
Interest Cost	15,000
NFIFO	70,000
Unpaid Family Labor	35,000

The first approach to resolving the "ROA dilemma" is illustrated in Table 4. Using this approach, the FFSC recommended calculations for the operating profit margin ratio, asset turnover, ROA, and ROE are included in the profitability model, and an interest cost adjustment is made to ROA before the resulting measure (Adjusted ROA) is multiplied by the financial leverage ratio to calculate ROE. The interest cost adjustment (0.015) is calculated by dividing the interest cost by average total assets (\$15,000/\$1,000,000).

Table 4. Case Example Illustrations: Interest Cost Adjustment Approach

OPERATING PROFIT MARGIN	X	ASSET TURNOVER	=	ROA
$\frac{70,000 + 15,000 - 35,000}{350,000}$ 0.14	X	$\frac{350,000}{1,000,000}$ 0.35	=	$\frac{70,000 + 15,000 - 35,000}{1,000,000}$ 0.05 or 5.0%
ADJUSTED ROA	X	FINANCIAL LEVERAGE	=	ROE
$(0.05 - 0.015)$ 0.035	X	$\frac{1,000,000}{750,000}$ 1.33	=	0.047 or 4.7%

The second approach is illustrated by not adding the interest expense to NFIFO when calculating the return on revenue and ROI (Table 5). ROI is then multiplied by financial leverage to calculate ROE as illustrated in Table 5.

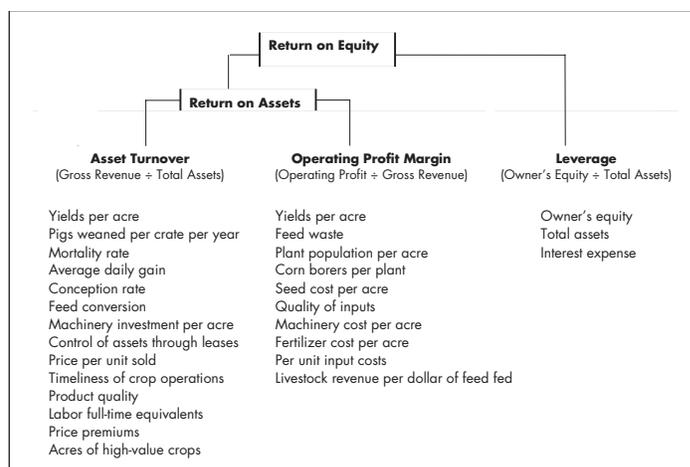
Table 5. Case Example Illustrations: Return on Investment (ROI) Approach

RETURN ON REVENUE	X	ASSET TURNOVER	=	ROI
$\frac{70,000 - 35,000}{350,000}$ 0.10	X	$\frac{350,000}{1,000,000}$ 0.35	=	$\frac{70,000 - 35,000}{1,000,000}$ 0.035 or 3.5%
ROI	X	FINANCIAL LEVERAGE	=	ROE
0.035	X	1.33	=	0.047 or 4.7%

So What?

So how can understanding the drivers of financial performance as illustrated by the DuPont Profitability Linkage Model be used to improve management decisions? Figure 1 summarizes a few illustrative examples of factors that farm business managers should be able to influence that, in turn, will affect the measured value for ROA and ROE. For the sake of simplicity, the financial measures used in Figure 1 are the same as recommended by the FFSC prior to an interest cost adjustment.

Figure 1. Selected Production and Management Factors that Influence Return on Assets and Equity



For example, an increase in yields per acre from better weed control will increase asset turnover, even if per bushel prices do not change, through its impact on gross revenues. The precise impact of a yield increase on the operating profit margin is less clear, because the yield increase will likely affect both revenues and variable costs. However, if the value of the additional yield

exceeds the added cost to produce the increase, then operating profit margin will also increase. As reflected by the DuPont Model linkages discussed earlier, these increases in asset turnover and operating profit margin will in turn increase ROA and ROE.

In identifying strategies that can be used to improve performance or the rates of return (return on assets and return on equity), realize that some actions may affect only one of the performance measures (operating profit margin, asset turnover, or financial structure), whereas others will affect two or more. Cost-control strategies, such as lowering the cost of fertilizer or seed, will only improve the operating profit margin. Other strategies, such as devoting more time to the improvement of marketing skills, or increasing thru-put would increase both the operating profit margin and the asset turnover ratio. Improving both the operating profit margin and the asset turnover ratio gives one a better chance to improve the return on assets and return on equity than those strategies with just a single impact.

In reality, every decision that a farm manager makes to improve business operations can be captured by the DuPont Model and the profitable impact can be documented. Consequently, this model is a very powerful diagnostic tool to assess the different decisions a farm manager might consider to enhance the financial performance of a farm business.

Closing Comments

The DuPont Profitability Linkage Model is a commonly used and powerful tool for assessing the impact of management decisions on the determinants of profitability. But there is an inconsistency in the application of this model in business schools and in agricultural finance - the ROA dilemma.

The reason for discussing the "ROA dilemma" is not to suggest the FFSC recommendations be changed. Instead, it is to discuss the alternatives available to users of the profitability linkage model who wish to comply with the FFSC recommended calculations. Two alternatives are available to users. The first alternative is to adjust the FFSC recommended calculation of ROA with an interest cost adjustment. The second alternative is

to omit the interest expense when calculating operating profit margin and to calculate a return on revenue instead, and then to use ROI in the model rather than ROA. The alternative approaches result in the same number for ROE, but the numerical values for ROI and ROA will clearly be different. The approach to use depends on how the results will be evaluated and benchmarked. If business school corporate comparisons are made, the second alternative using ROI is probably more appropriate. For farm financial analysis, ROA is the more common benchmark profitability ratio, so the first alternative is likely preferred.

Endnotes

¹ In some versions of the profitability linkage model, the measure known as Earnings Before Interest and Taxes (EBIT) is used.

References

- Barnard, Freddie L. and Michael Boehlje. 1998-1999. "The Financial Troubleshooting of Farm Businesses: A Diagnostic and Evaluation Tool (DES)", *1998-1999 Journal of the ASFMRA*:6-14.
- Boehlje, Michael, Craig Dobbins, Alan Miller, Dawn Miller, and Freddie Barnard. *Farm Management for the 21st Century: Measuring and Analyzing Farm Financial Performance*. Department of Agricultural Economics, Purdue Cooperative Extension Service Publication Number 712. Purdue University, West Lafayette, IN: 1999.
- Financial Guidelines for Agricultural Producers; Recommendations of the Farm Financial Standards Council* (Revised): July 1995.
- Shapiro, Alan C. and Sheldon D. Balbirer. *Modern Corporate Finance: A Multidisciplinary Approach to Value Creation*. 2000. Prentice Hall: Upper Saddle, New Jersey.