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CASH VERSUS ACCRUAL MEASURES OF FARM PROFITABILITY

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by

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Introduction

Farmers and their lenders make decisions based upon a complex set of factors including financial and nonfinancial information. One critical element of financial information is profitability. Lenders base decisions at least in part on the past and projected profitability of the business to which they are lending money. Farmers rely on measures of profitability to help make decisions on business expansion or contraction and to judge the financial success of the business relative to other employment or investment opportunities. However, it appears that many farmers and their lenders use inadequate measures of profitability in making such decisions.

Profits can be measured on either a cash or an accrual basis. The most common method used by both farmers and lenders in computing farm profits is on a cash basis. Federal tax laws allow farmers to calculate farm income on either a cash or accrual basis. An estimated 96-98 percent of all farmers report on a cash basis. Consequently, cash records are readily available to farmers and the concept of cash accounting is easily understood. In contrast, the concepts of accrual income accounting are not well understood by many farmers. Even if the concepts are understood, accrual income requires significantly larger amounts of information -- information that is often not readily available.

There is also a general feeling that over time, cash and accrual measures of income will "average out." Thus many lenders feel cash income figures over a 3-5 year period will provide a relatively accurate measure of average accrual income over the period. There is also a perception that differences between cash and accrual income measures are small and that the extra work in computing accrual income is not worth the effort.

In some cases, farmers and/or lenders recognize the importance of measuring income on an accrual basis, but do so in a manner which does not reflect a complete accrual accounting. For example, it is not uncommon for proxy measures of accrual income to start with cash income and make adjustments only for changes in crop and livestock inventories. While many other adjustments are needed to do a complete accrual adjustment, the issue is how much of the discrepancy between cash and accrual income is removed if one accounts simply for the change in crop and livestock inventories.

The objectives of this paper are to more fully explore the differences between cash and accrual income to determine: (1) the adjustments needed to move from cash income to accrual income, (2) the magnitude of discrepancy between cash and accrual measures of farm income, (3) whether discrepancies between cash and accrual income "average out" over time, and (4) which items account for the bulk of the discrepancies between cash and accrual income. Records from a sample of Illinois farm operators are used in the analysis.

Adjustments to Move From Cash to Accrual Measures of Income

The cash method of accounting measures expenses when they are paid, not incurred; and it measures revenue when cash is actually received not earned. To a certain degree, farmers can control the amount of net cash income for a specified accounting period due to the flexibility of the cash method. For example, net cash income can be reduced by delaying receipts (maintaining inventories) until after the current accounting period. Farmers can use the cash accounting procedure to manipulate net farm income for tax purposes, but it has severe shortcomings when used to measure business performance.

The accrual method of accounting more appropriately matches expenses with revenue to provide a more accurate estimate of business performance. The accrual accounting procedure records expenses when they are used (realized) by the business, and records revenue when goods are produced or services are rendered (when revenue is earned). Thus, if the farmer chooses to delay receipts until after the current accounting period, accrual basis accounting considers the change in inventory when recording net farm income.

The conversion of the cash basis to an accrual basis requires the use of a detailed accounting system. Table 1 provides a listing of the accounting items identified by Frey and Klinefelter that are needed to move from cash to accrual income measures. Each accounting item is derived from the current and previous year's balance sheet. Positive changes in entries from the asset side of the balance sheet contribute to an increase in accrual income, while positive changes in entries from the liability side contribute to a decrease in accrual income. Thus, net accrual income can be found by adding the change in those items from the asset side to net cash income, then subtracting the change in those items from the liability side.

Table 1: Adjustments Need to Move From Net Farm Income on a Cash Basis to Net Farm Income on an Accrual Basis

ASSET SIDE (Positive Changes Add to Accrual Income)

- *Changes in Crops & Feed Inventories
- *Changes in Livestock Inventories
- Changes in Hedging Account Equity
- *Changes in Supplies on Hand
- *Changes in Prepaid Expenses
- Changes in Cash Investment in Growing Crops
- *Changes in Notes and Accounts Receivable

LIABILITY SIDE (Positive Changes Subtract From Accrual Income)

- *Changes in Accounts Payable
- Changes in Accrued Property Taxes
- Changes in Accrued Real Estate Taxes
- Changes in Accrued Employer Payroll Withholdings
- Changes in Accrued Rents and Leases
- Changes in Accrued Interest Expenses

* = Accrual adjustments measured explicitly in this study.

Data and Analysis Procedures

Data used in this analysis is from a subsample of Farm Business Farm Management (FBFM) records kept by farm operators in Illinois. The subsample was chosen to reflect those operations which in the judgement of FBFM personnel kept the best measures of accrual income. The sample included 158 farms with income records for four accounting periods -- 1981-1984. While most farm accounting systems include the more significant accounting items needed to move from cash to accrual accounting, few farm accounting procedures are detailed enough to include all the adjustments that are listed in Table 1. Such is the case with the accounting system used by FBFM, the data source for this study. Those accounting items that are explicitly included in this study are marked with an asterisk in Table 1. Excluded items, however, may have been included in another category. For example, some FBFM records include changes in accrued interest as a part of changes in accounts payable. Accrual net farm income is therefore expected to be slightly misspecified in this study. However, the true magnitude of discrepancies between cash and accrual income is not likely to be lower than found in this study.

The accounting system used in this study provides net farm income on an accrual basis. To make the desired comparisons, cash income must be calculated, and is done so in the following manner:

Accrual Income
 - Inventory Change
 - Changes in Accounts Receivable
 - Farm Products Used
 + Farm Produced Inputs
 + Changes in Prepaid Expense
 + Changes in Accounts Payable
 = Net Cash Income

To analyze differences between cash and accrual income, both mean and absolute mean differences were computed. Regression analysis was also used to measure the relationships between cash and accrual income.

Magnitude of Difference

An analysis of the means provides immediate evidence of a significant difference between cash and accrual income. Table 2 identifies mean cash income, mean accrual income, and mean difference in cash and accrual income in both absolute and non-absolute terms. The mean difference is defined as:

$$\frac{\sum_{i=1}^n (C_i - A_i)}{n}$$

and mean absolute difference is defined as:

$$\frac{\sum_{i=1}^n |C_i - A_i|}{n}$$

where C is cash income for farm i, A is accrual income for farm i, and n is the number of observations.

The mean absolute difference best illustrates the magnitude of difference between cash and accrual income. Results here show this difference to be quite substantial -- an average of \$20,142.36 annually over the four year period. Thus, farmers using the cash method of accounting could expect to misrepresent true net farm income by \$20,142.36 annually -- an error equal to 88 percent of average accrual income. Note that some farm operators would over state accrual net farm income and some will under state accrual net farm income. By using absolute terms, the direction of misrepresentation is not shown. Rather, only the magnitude of misrepresentation is illustrated.

Conversely, the mean difference in cash and accrual income in non-absolute terms provides insights on the direction of misrepresentation while giving little evidence of the magnitude of misrepresentation. When the mean difference is negative (as it is during 1981 and 1982), average accrual income is greater than average cash income. Thus farmers using the cash accounting system as a whole tend to under-state true net farm income. However, when the mean difference is positive (as during 1983 and 1984), farmers using a cash accounting system tend to over-state true farm income.

To further test for a significant difference between cash and accrual income, a regression analysis was performed. The regression equation was specified as:

$$\text{Accrual Income} = a_0 + b_1 \text{ Cash Income}$$

The null hypothesis is that $b_1 = 1$ and $a_0 = 0$. The alternative hypothesis is $b_1 \neq 1$ and $a_0 \neq 0$. If $b_1 = 1$, and $a_0 = 0$; cash and accrual income are identical. If we reject the null hypothesis, cash income is significantly different from accrual income.

Results are as follows:

$$\begin{aligned} \text{Accrual Income} &= 8050.1 + .68884 \text{ Cash Income} \\ &\quad (1289.3) \quad (.0287) \end{aligned}$$

Standard errors are reported in parenthesis. The T-statistic associated with the slope coefficient is calculated at -9.97, telling us to reject the null hypothesis and accept the alternative that b_1 is significantly different from 1.0. Likewise, the intercept term is significantly different from zero. Results support the conclusion that cash income is significantly different from accrual income.

Will Cash and Accrual Income Average Out Over Time?

To answer this question, both accrual and cash income were averaged over the four year period. The absolute difference between average annual cash income and average annual accrual income was then calculated. A mean over all observation was then calculated and found to be \$8,164. That is:

$$\frac{\sum_{i=1}^n \left| \frac{\sum_{j=1}^4 C_j}{4} - \frac{\sum_{j=1}^4 A_j}{4} \right|}{n} = 8,163.72$$

where C is cash income, A is accrual income, and n is the number of observations (158).

It is useful to compare \$8,164 with the mean difference in cash and accrual income in absolute terms -- \$20,142 (Table 2). By comparing these two figures, we can see that cash and accrual income do indeed average out to some extent, but not fully. Results here show that cash and accrual income converge by approximately 60 percent when considered over a four year period. An annual average of \$8,164, or 36 percent of average accrual income, is still a substantial error when measuring true net farm income.

Several extreme differences in four year average cash and accrual income have been isolated from the 158 observations. One farm, for example, had an average annual cash income of \$18,500, while having an average annual accrual income of -\$13,500. If this farm manager used the cash accounting method, true farm income would have been over-estimated by an average of \$30,000 annually, or by \$120,000 over the four year period. Other extreme cases are common.

Allocating Difference Between Cash and Accrual Income

Table 3 identifies the mean value of each accrual adjustment item. Also listed is the percentage that accrual income is over/under stated when the corresponding accrual adjustment is deleted. For example, in 1984, farmers in the sample population reduced inventories by an average of \$1,282. Farmers that failed to include "Change in Inventory" on their accounting records would then have over-stated true net farm income by an average of 8.3 percent in 1984.

Analyzing the accrual adjustment items in non-absolute terms gives us an indication on the direction (positive or negative) of misrepresentation when these items are excluded. However, since positive and negative values cancel each other out when a mean is calculated, a mean in non-absolute terms fails to provide evidence on the magnitude of misrepresentation.

Table 4 identifies the mean values of each accrual adjustment in absolute terms. Also listed is the percentage fluctuation (increase or decrease) in accrual income when the corresponding accrual adjustment is deleted from the accounting records. In 1984 for example, the average absolute "Change in Inventory" is recorded at \$20,619. If "Change in Inventory" were not included on the income statement, accrual income fluctuates an average of over 133 percent.

Based on the "total" figures in Table 4, "Change in Inventory" clearly is most responsible for the large differences in cash and accrual income. Over a four year period, farmers that excluded "Change in Inventory" have misstated true net farm income by an annual average of 87.8 percent. This is followed by changes in: Prepaid Expense, Accounts Payable, Accounts Receivable, Farm Products Used, and Farm Produced Inputs.

To further evaluate the accrual adjustments responsible for cash-accrual differences, a series of regression estimates were made. Six ordinary least square regressions were run. In each case, the dependant variable is the difference in cash and accrual income. The R^2 of each regression indicates the proportion of variation between cash and accrual income "explained" by the accrual adjustment. The initial regression has only one independent variable -- "Change in Inventory". Then in each regression that follows, one accrual adjustment item is added to the right side of the equation so that by the sixth regression, there are six independent variables. (See Table 5.) Since the six accrual adjustment items (independent variables) make up the entire difference in cash and accrual income, the sixth regression should have an R^2 of 1.0, an intercept of 0.0, and all slope coefficients of either 1.0 or -1.0.

Since it is known a priori that the six independent variables will account for the exact difference in cash and accrual income (the dependant variable), each independent variable's slope coefficient is restricted to either 1.0 or -1.0. By observing and comparing the R^2 of each regression, we can then pinpoint which independent variables make the most contribution toward "explaining" the dependant variable.

Table 5 reports the results of the regression analysis. Since Regression 1 has an R^2 of .93, we conclude that on average "Change in Inventory" explains approximately 93 percent of the difference in cash and accrual income. Changes in Prepaid Expense and Accounts Payable are shown to increase R^2 to some extent, and are therefore considered to make moderate contributions to differences in cash and accrual income. Results also show that changes in Accounts Receivable, Farm Products Used, and Farm Produced Inputs have little impact on cash-accrual differences.

Implications and Conclusions

This article provides evidence of a substantial difference between cash and accrual income. Farmers that use the cash method of accounting as a measure of profitability are likely to inaccurately interpret the true performance of their farm business. Inaccurate profitability estimates can lead to unwise management decisions. Also, agricultural lenders base lending and loan pricing decisions on the farmer's ability to generate acceptable levels of current returns. Lenders must seek an accurate measure of accrual income in order to make appropriate decisions.

Results of this study show that the difference between cash and accrual income is somewhat less dramatic when income is averaged over a four year period. However, this difference still represents a substantial amount -- an average of over \$8,000 or an average annual error of about 36 percent. Thus, lenders that use annual average cash income over a 3 to 5 year period can still obtain grossly inaccurate measurements of farm profitability.

The accrual adjustment item having the most potential in causing cash-accrual discrepancies was found to be "Change in Inventory"; it is estimated to represent 93 percent of the difference in cash and accrual income. Adjusting cash income by only "Change in Inventory" is significantly better than using straight cash income. However, this can still lead farmers and lenders to inaccurately estimate true net income as other accounting items, namely Prepaid Expense and Accounts Payable, have been shown to account for moderate differences in cash and accrual accounting. Also, it should be recognized that many of the potentially important adjustments needed to move from cash to accrual income measures were not available for this study. Consequently, differences between cash and accrual income could well be greater than shown in this study.

Table 2. Mean Cash and Accrual Income, and Mean Difference (Cash Minus Accrual) Absolute and Non-Absolute Terms.

	Mean Income		Mean Difference	
	Cash	Accrual	Non-absolute	Absolute
	-- dollars --			
1981	23,431.69	23,815.67	(383.98)	18,114.80
1982	25,234.25	27,436.51	(2,202.27)	20,255.78
1983	31,315.63	25,130.70	6,184.92	21,971.98
1984	15,470.68	15,441.09	29.59	20,226.92
TOTAL*	23,863.06	22,955.99	907.07	20,142.37

* Average annual results over the four year period.

Table 3. Mean values of specified accounting items, and the percent that accrual income is over-stated (+) or under-stated (-).

	Changes in Inventories	Changes in Accounts Rec.	Farm Products Used	Farm Produced Inputs	Changes in Prepaid Expense	Changes in Accounts Payable
1981	235.02 -0.99%	1.70 -0.01%	481.11 -2.02%	222.17 0.93%	84.56 0.36%	27.11 0.11%
1982	2,534.19 -9.24%	(102.96) 0.38%	484.91 -1.77%	197.13 0.72%	773.32 2.82%	(256.58) -0.84%
1983	(9,055.22) 36.03%	278.08 -1.11%	476.82 -1.90%	203.89 0.81%	(1,597.65) -6.36%	(721.62) -2.87%
1984	(1,281.99) 8.30%	3,249.58 -21.04%	474.24 -3.07%	283.80 1.84%	1,298.75 8.41%	888.86 5.76%
TOTAL	(1,892.00) 8.24%	856.60 -3.73%	479.27 -2.09%	226.75 0.99%	139.74 0.61%	(15.56) 0.07%

Table 4. Absolute mean values of specified accounting items and percent fluctuation in accrual income when accounting item is excluded.*

	Changes in Inventories	Changes in Accounts Rec.	Farm Products Used	Farm Produced Inputs	Changes in Prepaid Expenses	Changes in Accounts Payable
1981	18,134.97 76.15%	129.25 0.54%	481.11 2.02%	222.17 0.93%	3,278.38 13.77%	391.42 1.76%
1982	19,938.24 72.67%	360.57 1.31%	484.91 1.77%	195.89 0.71%	2,967.91 10.82%	1,021.33 3.72%
1983	21,932.61 87.27%	427.26 1.70%	476.82 1.90%	203.89 0.81%	4,060.31 16.16%	1,874.85 7.46%
1984	20,618.73 133.53%	3,972.08 25.72%	503.17 3.26%	283.80 1.84%	3,830.44 24.81%	1,845.66 11.95%
TOTAL	20,156.14 87.80%	1,222.29 5.32%	486.50 2.12%	226.75 0.99%	3,534.26 15.40%	1,284.93 5.60%

* The percent fluctuation is calculated as:

$$\text{mean absolute accounting item} / \text{mean accrual income} \times 100$$

Table 5. Regression results; dependant variable equals cash minus accrual income.

Regress- ions	Inter- cept	Restricted Independent Variables					R-square
		Changes in Inventories	Changes in Accounts Receivable	Farm Products Used	Farm Produced Inputs	Changes in Prepaid Expense	
(1)	984.92	1.00					.93
(2)	128.33	1.00	1.00				.93
(3)	-350.94	1.00	1.00	1.00			.93
(4)	-124.19	1.00	1.00	1.00	-1.00		.93
(5)	15.55	1.00	1.00	1.00	-1.00	-1.00	.98
(6)	0.00	1.00	1.00	1.00	-1.00	-1.00	1.00