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**USE OF FIRM LEVEL AGRICULTURAL DATA
COLLECTED AND MANAGED AT THE STATE
LEVEL FOR STUDYING FARM SIZE ISSUES**

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Abstract

Individual farm financial data are collected in about two dozen states by colleges of agriculture, farm record associations and state vocational-technical school programs. A wide variety of methods are used by the various systems to calculate measures of profitability, making it difficult to make comparisons across states or to use data from several states to study farm size issues. This paper reviews some of the issues related to measuring profitability such as asset valuation, appreciation of assets, depreciation, interest changes, and value of operator and family labor and management. Data from three states are used to relate farm size to profitability. In general, larger farms have higher net returns regardless of the measure of profitability used, but this is not true in all states in all years.

**USE OF FIRM LEVEL AGRICULTURAL DATA COLLECTED AND
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George L. Casler¹

Data from individual farm financial records is available in at least two dozen states. These farm record programs are sponsored by three types of groups: (1) farm management associations, (2) departments of agricultural economics and Cooperative Extension and (3) vocational-technical school programs. In several states there is cooperation between the farm management associations and agricultural economists in the collection and analysis of data from individual farm records. A list of the organizations responsible for collecting and publishing the data in each state appears at the end of the chapter. Much of this effort is primarily related to extension farm management programs but in some cases the data is the basis for research studies. This paper is primarily concerned with (1) the use of this firm level data as a basis for studying issues such as farm size and structure, (2) whether the data could be made consistent to facilitate comparisons of net returns across states and (3) presentation of data from three states relating farm size to measures of profitability as an example of the use of farm record data in studying farm size issues.

The history of farm record data collection as part of an extension-type effort varies greatly among states. Some states appear never to have been involved in such activity while others have been continuously involved for several decades. A few states (universities) have started new data collection efforts in recent years but perhaps more significantly several (Purdue, Ohio State, Wisconsin) largely discontinued such efforts after 1983. However, Purdue restarted their efforts in 1987. Some of the farm record efforts have been in close cooperation with independent and largely farmer-financed farm management associations. The largest of these efforts is in Illinois. A combination of farm management fieldmen and college staff summarized and analyzed 7,269 records for 1989. It is probably fair to state that the farm records and analysis programs in most states are a blend of education and service to the farmers involved and a source of information to be used in extension programs with other farmers and in teaching programs at various universities and colleges. While the data have been used for research, probably in no state was that the original purpose for collecting the data.

Use of farm record data for research purposes lies on a somewhat shaky foundation: in no state are the records collected on a random sample basis. Rather, data is collected from farmers who voluntarily agree to participate in these educational-service programs. Nevertheless, researchers have used the data for a variety of studies, many of which relate to the relationship between various management factors or variables such as farm size and measures of net returns from operating the business. A purist could argue that the non-random sample negates or at least seriously impairs the validity of the results. However, many researchers argue or apparently believe that, even though the records, on the average, come from farms that are above average in size and are operated by above average managers, the results are useful and that the conclusions probably wouldn't be much different if the record data came from a random sample of farms of the same farm type.

With the exception of a few states such as Illinois and Kansas, the number of farm records available in any one year may be small enough that valid analysis

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is limited, particularly if the researcher wants to study farms of a particular type on similar soil resources or with a particular type of equipment or livestock housing system. In addition, because farmers do not necessarily participate on a continuous basis, numbers become even more limited if the desire is to study the same farms over a period of years. The numbers situation leads to the question of combining farms from several states to study issues such as costs or net returns by farm size. An immediate problem of such a data combination is that each state (really the data collectors therein) has its own idea of how the data should be collected and analyzed. For example, the measures of net returns and the way they are calculated are extremely variable among states. Whether such differences could be resolved so that every state uses the same procedures in the future is questionable.

The inconsistencies among states appear in several items such as methods of: (1) asset valuation, (2) handling appreciation of assets, (3) handling inventory changes, (4) calculating depreciation, (5) handling charges in accounts receivable and payable, (6) calculating "value of farm production," (7) calculating interest on assets and production expenses, and (8) calculating the value of operator's labor and management and non-operator family labor. In addition, some states publish data for the total farm business, including the landlord's share, while others publish only the data for the operator's share. Most of these inconsistencies are the apparent result of the notions of economists in the various states about these issues. It is clear that we have agreed upon neither what to measure nor how to measure it. Methods of charging depreciation, interest and operator and family labor and methods of asset valuation for several states are shown in Table 1. Some of this information can be ascertained from the publications, but some of it was obtained by personal communication with the authors.

The matter of publishing the data for the total business, including the operator and landlord shares vs. publishing only the operator share, appears to be a particular problem and is related partly to the prevalence of tenant operators in some states. Illinois has chosen to publish in the annual Summary of Illinois Farm Business Records the combined operator-landlord shares, although this is not clearly pointed out in the bulletin. The operator's share is published for only one item, which is net farm income. Operator and landlord shares are published in a separate publication (Scott), and operator-only data are presented in a third publication. These publications are less widely distributed. Minnesota (Olson) and Indiana publish only the operator's share. Missouri has chosen to publish in a two-column format the numbers for the operator and for the total business, with the difference being the landlord's share (Hein). This writer suggests that when a "management return" or "labor and management return" is being computed, the computation should be for the person who is managing the business and that in most cases it is the operator. However, in some share rental situations it is possible that the landlord or the landlord's representative exerts substantial (or even total) managerial control over the business. The Missouri procedure appears to solve the reporting problem by publishing both the operator share and total business -- the choice of which is the important data is left to the reader.

One problem in studying the data published by the various states is that the publications frequently do not fully describe the procedures used to compute the various measures of net returns. For example, it is not always clear whether assets are valued based on market value, book value (cost less depreciation) or something else. Some of the implications of asset valuation relative to computing net returns are discussed in the next section.

Table 1a. Methods used for depreciation, asset valuation, interest charges and unpaid labor charges, Corn Belt States and New York

	Illinois 1989	Iowa 1988	Michigan 1988	Minnesota and Indiana 1989	Missouri 1988	New York 1989
No. of farms	7269	3000	404	Minn. = 261	313	406
Years of data	65	62	<u>3/</u>			36
Depreciation						
Real estate	tax	10% of C.V.	tax	Indirect	tax	tax
Machinery	tax	10% of C.V.	tax	Indirect	tax	tax
Interest						
Interest paid	For oper- ator NFI	Yes	for NFI	Yes	Yes	Yes
Interest on equity	No	6%	8.5%	6%	No?	5% real
Interest on total						
Land	4.5% <u>1/</u>	No	8.5%	No	8%	No
Other	10% <u>2/</u>	No	8.5%	No	8%	No
Asset valuation						
Land	Market	Market	Market (agr.)	Market ^{4/}	Market	Market ^{6/}
Buildings	Cost-	Cost-	Cost-	Cost-	Cost-	Market ^{6/}
Equipment	tax depr.	econ. depr.	tax depr.	tax depr.	tax depr.	Market ^{6/}
Dairy & Breeding						
Livestock	Market	Market	Market	Market	Market trend	Market ^{6/}
Labor						
Operator	1250/mo.	1200/mo.	5.00/hr.	15,000/yr.	<u>5/</u>	<u>7/</u>
Family	1250/mo.	700/mo.	5.00/hr.			750/mo.

1 Land charge-net rent, revised annually based on average landlord net rents.

2 Revised annually.

3 Continuous set of records since 1928. Computer readable tapes of data since 1983.

4 The Southwestern Association uses a conservative market value. The Southeastern Association uses original cost.

5 Operator labor is valued by each operator. Therefore, management return is included in return to capital.

6 Market values are used in calculating interest on equity. Year-to-year changes in market values of real estate, equipment and livestock are labelled appreciation and excluded from the calculation of labor and management income.

7 For calculating return on investment, each farmer estimates the value of his labor and management.

Table 1b. Methods used for depreciation, asset valuation, interest charges and unpaid labor charges, selected states

	Kansas 1989	Kentucky 1988	N. and S. Dakota ^{3/} 1988	Nebraska 1989	Pennsylvania 1988	Oklahoma 1989
No. of farms	1981	580	N = 343 S = 183	95	888	141
Years of data	60	26	16	14		
Depreciation						
Real estate	tax	tax	tax	tax	tax	Indirect
Machinery	tax	tax	tax	tax	tax	Indirect
Interest						
Interest paid	Yes	No	Yes ^{4/}	No	Yes	Yes
Interest on equity	10%	<u>2/</u>	<u>4/</u>	No	6%	No
Interest on total						
Land	No	5%	7%	6%	No	<u>6/</u>
Other	No	11%	7%	12%	No	<u>6/</u>
Asset valuation						
Land	Market	Conserv. market	Market	Market	Market	Market
Buildings	Cost-	Cost-	Cost-	Cost-	Cost-	Market
Equipment	tax depr.	tax depr.	tax depr.	tax depr.	tax depr.	Market
Dairy & Breeding						
Livestock	Market	Conserv. market	Market	Constant	Market	Market
Labor						
Operator	15000/yr. ^{1/}	1250/mo.	No	1100/mo.	1000/mo. ^{5/}	4.00/hr.
Family	1250/mo.	1250/mo.	20/day	750/mo.	3.55/hr.	4.00/hr.

1 In calculating return to capital, a management charge of 10 percent of gross farm income is added to the labor charge.

2 Interest paid is deducted from interest on land at 5 percent plus interest on other capital at 11 percent to obtain interest on equity.

3 Beginning in 1989, N. Dakota adopted the Minnesota system using Finpack.

4 In calculating returns to the operator, interest paid is subtracted from interest on total capital at 7 percent to obtain interest on equity.

5 A management charge of 5 percent of cash receipts is included in computing cost of producing milk.

6 For calculating return to unpaid labor and management, the rate on one-year treasury notes is charged on total capital.

Asset Valuation

The market values of farm assets frequently are quite different from the book values. For example, the market value of land is likely to be substantially greater than the book value (cost) if the land was purchased 20 or more years ago but less than book value if it was purchased in the late 1970s. Market values of machinery are likely to be higher than book values if rapid depreciation has been used for income tax purposes and inflation tends to make the divergence greater. Farmers who report on the cash basis for tax purposes have no basis or book value in raised livestock. Most farm record systems value raised animals at market or perhaps at some kind of modified market value in the case of breeding stock. This is done even in systems that use book value for assets such as land, buildings and machinery.

Asset valuation procedures affect the charge for equity capital and for total capital in systems that do not include interest paid in expenses. Asset valuation also affects the calculation of return on equity and return on total assets.

Those who argue for using market values as the basis for the calculation of interest charges and return on investment believe that the opportunity cost of equity capital should be based on the amount of money that is invested in the farm business that could earn a return if invested elsewhere.²

Appreciation of Assets

In recent years, many analysts have argued that appreciation of assets should not be included in calculating net returns from the year's operation of a farm business. For example, if the value of the land increases \$20,000 during the year, this \$20,000 should be considered ownership income rather than operating income. Similarly, if the value of a herd of breeding stock increases \$5,000 during the year due to a change in the general level of cattle prices, this \$5,000 should not be included in annual operating income. The same concept can be applied to depreciable assets such as machinery and buildings, but the mechanics are more difficult. For example, the depreciation on a tractor that is charged to the income statement should reflect using up a year in the life of that tractor. Take a simple example in which a machine has an initial cost of \$12,000 and is expected to provide services for 12 years. With straight line and no salvage value, each year's depreciation would be \$1,000. After six years, the adjusted basis or book value would be \$6,000. However, during a period where machinery prices were rising at 5 percent per year, a new machine at the end of year six would cost \$16,081 and the value of the used machine would likely be greater than if there were no inflation. Rather than reducing the depreciation to reflect the effects of inflation, "real" depreciation should be charged to the income statement and appreciation should be credited to the ownership account. The difficult part is to know how to calculate "real" depreciation. In practice, those who calculate appreciation on machinery use income tax depreciation as a proxy for real depreciation. A comparison of income tax adjusted basis with market value at both the beginning and the end of the year allows appreciation to be calculated. With rapid depreciation for income tax purposes, it is likely that both depreciation and appreciation are overstated.

² The amount that would be available for alternative investments should be adjusted for the tax that would be paid on the sale of farm assets, but seldom is.

Using market values for all assets and including the change in inventory values in the calculation of measures of net return has the potential of distorting such measures because of fluctuations in asset values. The Coordinated Financial Statements procedure of Frey and Klinefelter seeks to separate the income from operating the farm from the gains (or losses) from owning the assets by using a two-column valuation procedure on the balance sheet. One column is market value and the other is a cost (or modified cost) based valuation. This procedure as currently used does not actually use the cost-based values for all assets. For example, raised breeding stock and a number of other assets are valued at market rather than at cost. In addition, use of adjusted basis from income tax records for valuation of depreciable assets and the accompanying depreciation as a charge on the income statement may overstate the depreciation charge in the early years of asset life if rapid depreciation is being used for tax purposes.

Of the farm record systems reviewed, only one (New York) explicitly calculates and publishes appreciation. It is likely that many of the other systems keep appreciation on land out of the net return calculations by not including the change in land values in changes in inventories. If market values are used or some of the net return calculations, the changes in market values are done "between years."

In the systems where machinery depreciation is calculated from the changes in market values of the machinery, any inflation in used machinery prices, which some people consider to be appreciation, results in the depreciation charge being lower than it otherwise would be.

Depreciation

The method used to calculate depreciation can affect the net income and other measures of profitability. The two common methods of depreciation used in farm record systems are (1) income tax and (2) net figure derived from (beginning inventory + purchases) - (ending inventory + sales) with inventories being at market value. A variation on the second method is to use a standard percentage, such as 10 percent, of beginning + new. One might think that distortion of income caused by the use of income tax rapid depreciation would be only temporary and minor -- depreciation can be taken only once. For example, five-year rapid depreciation under the accelerated cost recovery system (ACRS) would lead to a high depreciation charge in the early 1980s, but this would be offset by no depreciation on these items once the five-year period is over. However, particularly in an inflationary period, it is likely that use of income tax depreciation, whether rapid or straight line, will result in a higher depreciation charge than using a market value approach.

An example which illustrates the depreciation charges calculated by different methods is shown below, using the 1988 Cornell dairy farm business summary data:

- A. Average machinery depreciation from income tax = \$14,402
Appreciation on machinery = \$2,391

B. Decline in market value

Example:

Beginning	\$106,405	End	\$111,210
+ New	<u>17,303</u>	+ Sales	<u>487</u>
	\$123,708		\$111,697

Depreciation = \$123,708 - 111,697 = \$12,011

Note that appreciation equals the difference between depreciation calculated by methods A and B.

C. Standard percentage of market value, beginning plus new

Example:

123,708 x 10% = 12,371

Accounts Receivable and Payable

Most farmers report on the cash rather than accrual basis for income tax purposes. A true financial picture of a business requires accrual accounting. All of the farm record systems reviewed included changes in inventories in calculations of net returns. Some of the systems specifically list the changes in accounts receivable and payable and changes in prepaid expenses. It is not clear whether the remaining systems make these adjustments. To the extent that changes in these items are significant, net returns are distorted if such changes are not accounted for.

Value of Farm Production

The purpose of calculating value of farm production is unclear to this author. This measure is not calculated in the farm record systems of several of the states. For the systems where it is calculated, in general, value of farm production is total receipts minus purchased livestock and purchased feed.

Value of farm production apparently is intended to be some sort of "value added" concept. Its origin may go back to a time when purchased inputs such as fertilizer, pesticides and fuel were minimal and purchased livestock and feed were the major inputs acquired from off the farm. As currently calculated, value of farm production has little relevance as a value-added concept.

Interest

A few systems do not include interest paid as an expense, but charge interest at standard rates for all farms. One argument for using this procedure is that it allows comparisons among farms independent of debt levels. While debt level is subject to a measure of managerial control, debt level is at least partly a function of items such as a farm operator's stage in the life cycle of the business and how much was inherited from others.

Those who argue that interest paid should be a farm expense believe that a true measure of net income from operating the business can be obtained only by including interest paid in farm expenses. That belief is hard to argue against.

This writer would like to see both calculations, that is, a net income calculated by including interest paid and another measure calculated by using a standard interest charge on all the capital used by each farm business. The latter calculation would facilitate comparisons of managerial results that are not based on debt level, something that is partly a function of things over which the operator has no control.

Some states use interest actually paid and interest on equity at a standard rate for some of the profitability calculations while others use a standard charge on all capital, regardless of whether it is equity or debt.

The example below illustrates the varying interest charges that result, depending (A) on the level of debt and equity and (B) on using a standard charge on all capital. In (A), equity capital is charged at a real rate of 5 percent.

A. Debt and equity

Example: \$500,000 assets

"Net" before interest = \$60,000

	<u>100% equity</u>		<u>100% debt</u>
	\$60,000		\$60,000
Interest on \$500,000: @ 5% real =	<u>25,000</u>	@ 10% paid =	<u>50,000</u>
Net farm income	\$35,000		\$10,000

B. Standard interest charge on all capital rather than interest paid plus interest on equity.

Example: \$500,000 @ 8% = \$40,000

In (A) for a farmer with 100 percent equity, the interest charge is \$25,000 but \$50,000 if the farmer has all debt. In (B), with a standard charge of 8 percent, the interest is \$40,000.

Interest on Equity

There appears to be agreement that an opportunity cost charge should be made for the use of equity capital in the business. The disagreement is over the level of the charge. In the business summaries reviewed, charges ranged from around 5 percent to 12 percent. A variety of arguments, stated or implied, are used to support the level of interest rate used. Some are intended to be "real" rates while others clearly are intended to be nominal rates. For example, the Cornell system uses a 5 percent real rate on equity capital. This rate is intended to represent the long-term average rate of return, after removing the effect of inflation, that could be earned in non-farm investments of comparable risk. It is argued that in addition to this real rate, the farm operator benefits from appreciation of assets in a way similar to benefits from investing in the stock market. To charge a nominal rate based on current market interest rates would, in a sense, be double counting.

In reality, interest on equity could be charged at either real or nominal rates and the charge could be based on either market value or book value of assets. The varying combinations that could be used would lead to large variations in the charge for equity capital. There does not seem to be a compelling theoretical argument saying that any one procedure is the correct one. However, this author believes that market values of assets should be used as the basis for calculating equity and charging interest on equity, assuming that one believes in opportunity costs. He also believes that equity capital should be charged at a real rate rather than at a nominal rate.

Value of Operator Labor and Management and Family Labor

A variety of methods are used by the various systems to value operator labor and management. Several states use a standard hourly rate on all farms, sometimes explicitly based on something like the going rate for hired labor. The hours to which the rate is applied must be an estimate because few farmers keep records of hours actually worked. Some states use a standard charge per month,

such as \$1,000 or \$1,200³ as the management charge. New York does not use any of these standard charge procedures for valuing operator labor and management. Instead, each operator is asked to estimate the combined value of his/her labor and management. If there is more than one operator, a value is obtained for each.

The value of operator labor and management is used to help calculate measures of net return such as return on investment or return on equity. A higher charge for labor and management results in a lower total return to assets or equity and therefore a lower rate of return. One advantage of using a standard charge procedure is that every farm is treated the same way albeit an arbitrary way. In the Cornell procedure, each operator could influence the rate of return by the value assigned to labor and management.

The Importance of Imputed Costs

It is important to point out the methods used to calculate imputed costs (depreciation, interest on equity or total assets and value of operator labor and management) have a large impact on measures of profitability because these items make up a large proportion of total costs. For example, in the case of 1987 Illinois northern and central grain farms, in computing management returns (\$12,326 on average) the imputed charges for interest on non-land capital (\$16,284), land charge-net rent (\$56,818) and operator labor (approximately \$15,354) total \$88,456 or 85 percent as much as all other costs including depreciation. If depreciation, which is also an imputed or at least allocated cost, is included with imputed costs, the total of the imputed costs are 1.28 times all other costs, not including depreciation. Thus, in the computation of management returns in this example the imputed costs are nearly as important as, or if depreciation is included, more important than, the costs that can be accurately measured. If interest on land (land charge-net rent) was charged at 4 percent rather than 5 percent, the average management return would be \$23,684 rather than \$12,326. If the interest charge was 6 percent rather than 5 percent, the average management return would be \$968.

The intent here is not to say that Illinois is doing something wrong -- it is only to illustrate the importance of the imputed costs in some of the profitability calculations. Similar examples could be drawn from the calculations made in other states. (What is the appropriate interest charge on land? Clearly the interest rate on mortgage loans in most cases is above 5 percent.)

Perhaps there is one consolation if such data are being used to study farm size issues: if the procedures are used consistently on all farms being studied, the level of imputed charges may not affect the relationships between farm size and profitability.

Contrast of the Methods of Several States

Data from the 1988 New York dairy farm business summary (DFBS) are used in appendix tables 1 through 11 to illustrate the differing procedures and results obtained by using the procedures of several states. One difficulty in making the

³ In several systems all farms have one operator, according to the published data. Some of these farms must have more than one operator. Apparently, any operators in excess of one are counted as hired labor and such labor valued with a procedure not explained in the publication.

calculations was to know whether to include or exclude appreciation. Therefore, it was included or excluded in a somewhat arbitrary way, depending on this author's interpretation of how it was handled in the various state reports.

Not every state in the United States with a farm record program is included in the tables. Most of the North Central states with a farm record program are included, along with New York, which has attempted to identify appreciation, and Pennsylvania which has a substantial number of records.

The differences among the systems are numerous and it is probably not worthwhile to attempt to discuss all of them. Instead, comments will be made about the differences between the Cornell and Illinois systems.

While there are several differences in the two systems, only a few will be discussed here. In calculating Net Farm Income, Cornell includes interest paid as an expense but Illinois does not. In calculating Labor and Management Income, Cornell uses interest paid and 5 percent real interest on equity while Illinois uses 5 percent on land and 10 percent on all other capital. Cornell separates appreciation on land, machinery and livestock in making the profitability calculations. Net farm income and return on capital are calculated with and without appreciation. It is likely that appreciation is not included in the Illinois calculations, but neither is it shown separately.

Availability of Data

The data for the state-supervised farm record systems are collected on a confidential basis. Therefore, data must be handled in a way to maintain confidentiality. In many states, the data are available for use by researchers at the university but usually under rather strict procedural guidelines. Researchers from other states would be able to gain access to the data for research purposes only by making individual arrangements with the person in charge of the data gathering project. In some cases, access to the data is limited by the nature of the arrangements between the university and the farm business management associations.

Tentative Conclusions

Anyone who would like to combine data from two or more states to study issues such as farm size and structure is faced with a rather formidable task. In addition to obtaining permission to use the data, a researcher would be faced with the task of reformulating data to make it consistent in terms of charges for items such as depreciation, interest, operator labor and family labor. Some of this may be difficult or impossible because the necessary data may not exist in the record files.

Considering the non-random character of the data along with the inconsistencies among systems, perhaps researchers should seek another source of data. However, many of the record systems likely have a higher level of detail than the USDA data and would therefore be quite useful in studying details and cause-and-effect relationships related to farm size and structure. The data may also be more accurate because the record data are less dependent on recall than are survey data such as those collected by the USDA. In cases where data are needed that are not part of the record system, participants in the record system could be surveyed to obtain the missing data, and the large amount of data already available on the record systems would not have to be re-collected. The nonrandom nature of the collection of the record system does not make the data unusable. Moreover, much information can be obtained from the data, even if the

data are not randomly selected. Results from research based on farm record data may be considered hypotheses to be tested using data that are collected by means of random sampling. Use of data that are already available is less expensive than collecting new data, and results based on the farm record data may be used to guide the collection of data from random samples, therefore lowering the costs of collecting those data.

A number of people believe that a standard procedure for farm business summaries should be used by all groups who sponsor farm record systems. A standard procedure would facilitate making comparisons among states and systems as well as allowing research using data from more than one state. Conversations with persons involved with the data in several states suggest that it will not be easy to get the various states to conform to a standard procedure. One reason for not changing is to maintain continuity with past data. Another is difficulty of getting agreement on a "correct" procedure to handle items such as imputed costs and asset valuation procedures. One person suggested that it might be easier to get the various systems to agree to apply a standard set of procedures to the data stored in the computer than to change the published data. Published data for each state would continue to follow past procedures, but there would also be a data set consistent across states that could be used for research purposes. If this could be done by just changing items such as the interest rate charged on equity capital, conformance could be easily achieved. However, some changes likely would require changes in the basic data collection. For example, if the standard procedure was to use market values of assets, a system that used book values would also need to collect market values. Nevertheless, the merit of this approach should be studied.

Farm Financial Standards Task Force

Currently, a Farm Financial Standards Task Force (FFSTF) sponsored by the American Bankers Association with a membership of nearly 50 persons from the academic community, financial institutions and other interested groups is working toward a set of standard procedures for farm financial reports. A report containing the recommendations of the task force was issued in May 1990. Comments on the report were requested. The recommendations are too numerous and long to include here, but a brief review is presented below. This author believes that no state farm record system produces reports which are consistent with the task force recommendation. When this effort is concluded, groups who sponsor farm record programs should seriously consider adoption of the standard procedures resulting from the task force.

The FFSTF recommendations relate to some, but not all, of the issues raised in this chapter. The task force made recommendations on asset valuation, depreciation, value of operator and family labor (or family living withdrawals), calculation of net farm income but not on appropriate imputed charges for equity or total capital. One must recognize that this task force is primarily interested in financial reporting to lenders and therefore may have little interest in some measures of net return such as labor and management income that are of interest to workers in research, extension and teaching.

The FFSTF tried to move toward GAAP accounting but stopped short in several areas. With respect to asset valuation, it recommended, in general, that market values be used but that cost (less depreciation) also be used for land, depreciable assets and marketable securities (similar to the Coordinated Financial Statements Approach). The underlying objective is to be able to separate changes in net worth into (1) the portion earned from operating the business (retained earnings) and (2) the portion due to valuation changes.

The FFSTF did not specify a single method of depreciation, such as tax depreciation. It recognized that tax depreciation methods available in the early 1980s allowed depreciation at a much more rapid rate than economic depreciation and that currently available methods are less likely to do this. It recommended that any method that aims to distribute the cost over the estimated life in a systematic and rational manner be used. It rejected methods that use a percentage, such as 10, of the current market value because of the potential for the total depreciation to exceed the original cost of the asset.

Net farm income was defined as return to "Operator and Unpaid Family Labor, Management and Equity Capital." Interest paid is included in the calculation.

The FFSTF did not recommend that standard charges be used for operator and family labor (or labor and management). It recognized that a charge must be made for this resource in order to calculate return on assets or return on equity and that, from an economic viewpoint, the charge should be the opportunity cost. For a financial analysis, it recommended that withdrawals for family living be used as the value of operator and family labor and management.

The Relationship of Farm Size to Profitability

This section presents data from several state farm record systems which show the relationship between farm size and several measures of net returns from the farm operation. The data are taken from the farm record systems in Illinois, Michigan and New York.

The Illinois data presented here are for northern and central Illinois grain farms with soil ratings of 86 to 100 (Table 2). Therefore, these data represent a relatively homogeneous group of farms in terms of type and soil quality. The total number of farms represented ranges from 757 in 1984 to 883 in 1989.

Six measures of net returns are shown in Table 13 because no one measure of profitability is necessarily superior to other measures. Each measure is described below. All measures are for the total farm business, including the landlord's share unless otherwise noted.

Net farm income includes the return to the farm and family for unpaid labor, the interest on all invested capital and the returns to management. The 1984-89 data clearly show that, on the average, larger farms in this set have larger net farm incomes than smaller farms. However, one must recognize that larger farms have larger interest charges and that interest has not been deducted in computing net farm income. The 1985-89 data also clearly indicate that the operator's share of net farm income is greater, on the average, on the larger farms. One should recognize that this is a per farm number and that larger farms are more likely to have more than one operator than are smaller farms.

Labor and management income per operator is total net farm income, less the value of family labor and the interest - including net rent - charged on all capital invested. This figure, as the residual return to all unpaid operator's labor and management efforts, is then divided by the months of unpaid operator labor and multiplied by 12 to reflect income for one operator on multiple-operator farms. The data tend to indicate that the labor and management income per operator is greater on the larger farms in this group. However, in a "poor" year such as 1988 the labor and management income per operator bears little relationship to farm size.

Table 2. Measures of farm profitability by farm size, northern and central Illinois grain farms with soil rating of 86-100, 1984-89.

	1984	1985	1986	1987	1988	1989
Acres	Net Farm Income (before interest)					
180-339	29,505	31,587	27,439	38,090	26,652	41,991
340-799	64,565	76,243	64,500	81,618	55,403	89,885
800-1199	122,104	144,578	125,138	143,643	92,452	153,699
1200 & over	212,103	245,645	179,149	235,475	167,818	258,584
	Net Farm Income, Operator's Share					
180-339	NR	16,370	8,004	18,645	9,951	21,769
340-799	NR	29,447	18,297	33,729	19,221	38,586
800-1199	NR	49,386	35,369	53,156	22,628	59,133
1200 & over	NR	83,940	38,755	79,911	47,245	102,622
	Labor and Management Income per Operator					
180-339	-7,636	7,348	-6,384	8,145	-5,860	8,802
340-799	-4,497	22,384	783	21,115	-6,842	26,001
800-1199	-11	44,750	13,836	37,284	-15,090	43,382
1200 & over	3,451	75,780	2,471	51,228	-7,889	58,320
	Management returns					
180-339	-20,330	-9,365	-19,168	-5,303	-19,341	-4,917
340-799	-17,722	5,389	-12,652	6,984	-21,588	11,638
800-1199	-12,801	29,966	-429	23,924	-30,983	29,469
1200 & over	-2,907	62,036	-16,372	51,236	-25,739	58,723
	Rate earned on Investment					
180-339	2.07	4.25	2.40	4.59	2.22	4.40
340-799	3.39	5.66	4.46	6.21	3.60	6.09
800-1199	4.06	6.40	5.55	6.87	3.94	6.55
1200 & over	4.50	7.33	5.07	7.32	4.71	6.87
	Management returns per acre					
180-339	-76.32	-37.35	-71.38	-20.23	-72.54	-18.21
340-799	-34.81	10.41	-24.37	13.14	-40.79	21.56
800-1199	-14.16	32.94	-.47	25.92	-33.82	31.77
1200 & over	-2.03	39.60	-11.36	35.15	-17.65	39.40

Management return is the residual surplus after a charge for unpaid labor and the interest or land charge on capital are deducted from net farm income. The unpaid labor charge includes operator as well as other family labor. Interest on land is charged at a rate that represents the long-run rate of return on land (4.5 percent in 1989, but the rate varies from year to year). Interest on non-land capital is charged at a rate (11 percent in 1989) that represents the cost of operating capital.

The 1984-89 data do not show a clear relationship between farm size and management returns. In 1985, 1987 and 1989 there was a rather dramatic positive relationship. In 1984, there was also a positive relationship, despite the fact that the average management return for all groups was negative. In 1986 and 1988 management return was not related to farm size.

Rate earned on investment is net farm income minus unpaid labor divided by total farm investment. For this group of farms in the 1984-89 period, larger farms earned a greater average rate of return on investment than did smaller farms.

Management return per acre is the total management return divided by tillable acres. During the time period studied, the average management return per acre was clearly greater on the larger farms than on the smaller farms.

The six measures presented here, in general, indicate that larger farms have greater net returns than smaller farms.

Data from approximately 400 New York dairy farms are used to illustrate the relationship between farm size, as measured by number of cows, and several measures of profitability (Table 3). These farms are scattered throughout the state. Farms on which the operator owns no real estate are excluded as are farms with crop sales greater than 10 percent of milk sales. Measures of net income are described below.

Net farm income is the return per farm to operator and unpaid family labor, management, and equity capital. Interest paid has been included in expenses. Note that this definition of net farm income is different from the one used in Illinois. The 1984-89 data for this group of New York dairy farms clearly indicate that there is a strong positive relationship between farm size (number of cows) and net farm income. If the net farm income was adjusted for operators per farm, the relationship would be somewhat less dramatic.

Labor and management income per operator is the return to operator labor and management after deducting a charge for non-operator unpaid family labor and a five percent real interest charge on equity capital from net farm income. The relationship between farm size and labor and management income per operator is not as consistent as the farm size-net income relationship. However, there is considerable evidence that, on average, the larger farms have higher labor and management incomes than the smaller farms.

Percent return on equity capital without appreciation is the return to equity capital (net farm income minus a charge for operator and unpaid family labor) divided by the average equity capital for the year.

Percent return on equity capital, including appreciation is calculated as above except that changes in the values of assets due to price level changes are

Table 3. Relationship of farm size to measures of net return, New York dairy farms, 1984-88.

	1984	1985	1986	1987	1988	1989
<u>Number of Cows</u>	<u>Net Farm Income, without Appreciation</u>					
Under 40	5,235	5,569	6,845	11,140	12,875	13,766
40 to 54	11,673	9,759	7,644	15,546	15,005	20,201
55 to 69	12,657	12,975	16,164	17,099	19,823	29,428
70 to 84	16,405	16,637	15,600	26,024	30,326	31,871
85 to 99	18,049	23,932	19,361	34,773	38,682	43,983
100 to 149	27,465	28,491	39,080	41,411	47,404	59,493
150 to 199	31,715	33,028	33,630	52,589	52,624	70,376
200 to 299	46,305*	51,786	42,881	81,414	69,533	109,814
300 and over	155,011**	131,638	123,246	208,798	233,809	291,433
	<u>Labor and Management Income per Operator</u>					
Under 40	-3,778	-3,689	-2,533	1,228	2,119	1,828
40 to 54	560	-508	-2,186	4,429	2,782	5,646
55 to 69	-1,395	-541	1,361	1,362	2,415	8,055
70 to 84	-874	-320	-1,372	6,573	8,313	8,459
85 to 99	-389	2,911	378	12,999	13,710	12,705
100 to 149	2,429	3,464	8,981	10,501	13,886	21,038
150 to 199	912	4,355	3,696	12,244	10,480	18,259
200 to 299	4,663*	10,367	4,803	27,968	17,676	43,897
300 and over	52,247**	48,423	42,319	99,693	110,437	149,485

- continued -

*200 to 250 cows.

**250 and more cows.

Table 3, continued.

	1984	1985	1986	1987	1988	1989
<u>Number of Cows</u>	<u>Percent Return on Equity Capital, without Appreciation</u>					
Under 40	NR	-6.6	-8.8	-4.6	-4.3	-4.6
40 to 54	NR	-6.4	-8.6	-3.2	-4.0	-1.6
55 to 69	NR	-4.0	-3.7	-2.8	-2.6	0.3
70 to 84	NR	-2.3	-2.8	0.4	0.5	0.7
85 to 99	NR	-0.6	-2.1	2.5	2.9	2.9
100 to 149	NR	0.0	1.5	1.7	2.8	4.4
150 to 199	NR	0.6	0.7	2.8	2.5	4.2
200 to 299	NR	2.8	1.8	6.2	3.9	7.9
300 and over	NR	8.7	7.1	12.7	13.4	15.1
	<u>Percent Return on Equity Capital, including Appreciation</u>					
Under 40	NR	-7.1	-3.2	1.8	0.0	1.4
40 to 54	NR	-7.0	-2.1	5.3	2.8	5.7
55 to 69	NR	-5.3	0.1	2.4	2.2	6.4
70 to 84	NR	-1.4	2.5	6.3	5.2	6.4
85 to 99	NR	-1.8	4.2	8.8	9.1	8.3
100 to 149	NR	0.1	7.3	6.5	7.6	10.3
150 to 199	NR	-1.1	5.3	11.4	9.4	9.0
200 to 299	NR	1.8	5.1	11.3	7.2	12.2
300 and over	NR	7.7	10.6	18.2	16.8	20.6

included in the return to equity capital. There is a strong relationship in this set of New York dairy farm data between farm size and rate of return on equity capital, with or without appreciation.

Data on net returns by farm size for Michigan dairy farms are shown in Table 4. Descriptions of the measures are presented below.

Labor income is the return to the operator for the year's labor and management after deducting an interest charge for all the capital owned. Labor and management income would be a more descriptive label. The evidence on the relationship between dairy farm size (number of cows) and labor income is mixed. In 1987, 1988 and particularly 1989, there was a strong positive relationship. However, in 1984, 1985 and 1986 the average labor income for all groups was substantially negative and there was little difference among the results for the three larger herd size groups.

Rate earned on owned capital is the return to owned capital, after deducting a charge for the operator's labor (but not management) divided by the total capital owned. There was a strong positive relationship between farm size and rate earned on owned capital in all years.

In general, the 1984-89 data from Illinois, New York and Michigan presented here indicate that large farms are more profitable than small farms. However, the 1984-86 Michigan labor income data and the 1988 (severe drought year) Illinois data on management returns do not support this statement.

Table 4. Relationship of farm size to profitability, Michigan dairy farms, 1984-89.

	1984	1985	1986	1987	1988	1989
<u>Number of Cows*</u>	<u>Labor Income</u>					
Less than 50	-12,262	-16,047	-7,433	-82	963	8,453
50 to 74.9	-33,779	-28,645	-19,957	2,882	649	28,640
75 to 99.9	-26,936	-29,342	-12,087	10,321	6,678	37,496
100 or more	-49,808	-29,053	-12,429	22,114	10,845	74,551
	<u>Rate Earned on Owned Capital</u>					
Less than 50	-1.02	-3.07	-3.19	-.41	-.16	4.31
50 to 74.9	-1.15	-.85	-1.66	3.95	3.35	9.88
75 to 99.9	0.56	.50	1.28	6.00	4.86	10.12
100 or more	1.91	3.96	3.69	8.18	6.55	12.17

* For 1989, the four size groups are: less than 65; 65 to 99.9; 100 to 149.9; and 150 or more.

Organizations Responsible for Collecting and
Publishing State Farm Record Data

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Iowa: Iowa Farm Business Associations (data collection) and Iowa State University Cooperative Extension Service (compilation and publication).

Kansas: Kansas Farm Management Associations and K-Mar-105 Association, Department of Agricultural Economics and Cooperative Extension Service.

Kentucky: Department of Agricultural Economics, Cooperative Extension Service and Kentucky Farm Management Groups, Inc.

Michigan: Department of Agricultural Economics, Michigan State University.

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Missouri: Department of Agricultural Economics and Missouri Extension Division.

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New York: Department of Agricultural Economics, Cornell University.

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75 to 99.9	-26,936	-29,342	-12,087	10,321	6,678	37,496
100 or more	-49,808	-29,053	-12,429	22,114	10,845	74,551
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50 to 74.9	-1.15	-.85	-1.66	3.95	3.35	9.88
75 to 99.9	0.56	.50	1.28	6.00	4.86	10.12
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New York: Department of Agricultural Economics, Cornell University.

North Dakota: Farm Analysis Center, Bismark State College in cooperation with North Dakota State Board for Vocational Education.

Oklahoma: Oklahoma Department of Vocational-Technical Education, Agricultural Education Division.

Pennsylvania: Data collected by Pennsylvania Farmers Association, publication prepared by Pennsylvania State Cooperative Extension.

South Dakota: State Office of Adult Vocational-Technical Education and State Department of Agriculture.

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APPENDIX A

Table 1. Calculation of Measures of Net Returns, Average for 1988 New York Dairy Farm Business Summary

	<u>Without Appreciation</u>	<u>With Appreciation</u>
Total Accrual Receipts	262,510	282,795
Total Operating Expense	199,127	
Expansion livestock	2,259	
Machinery depreciation	14,402	
Building depreciation	8,213	
Total Accrual Expenses	<u>224,001</u>	<u>224,001</u>
Net Farm Income	38,509	58,794
Less: Unpaid family labor @ \$700 per month	<u>1,950</u>	<u>1,950</u>
Return to operator labor, management and equity	36,559	56,844
Less: Real interest @ 5% on 409,571 equity	<u>20,479</u>	
Labor and management income	16,080	
Labor and management income per operator (1.35 operators)		11,911

Return to operator labor, management and equity	36,559	56,844
- Value of operator labor and management (1.35 operators)	<u>27,133</u>	<u>27,133</u>
Return on equity capital	9,426	29,711
+ Interest paid	<u>17,603</u>	<u>17,603</u>
Return on total capital	27,029	47,314
Rate of return on equity capital (409,571)	2.3%	7.3%
Rate of return on total capital (624,841)	4.3%	7.6%

Table 2. Calculation of Measures of Net Income, Illinois System, Using 1988 New York Data.

Value of farm production (net of purchased feed and livestock)	194,093
- Total operating expense, except feed, livestock and interest	115,366
- Depreciation	<u>22,615</u>
Net farm income	56,112
- Unpaid family labor, 2.79 mos. @ \$1,225/mo.	3,209
- Interest on all capital (land @ 5%, all other @ 10%)	<u>55,113*</u>
Labor and Management Income	-2,210
- Value of operator labor (16.2 mos. @ \$1,225)	<u>18,630</u>
Management Return	-20,840

Net farm income	56,112
- Operator and family labor @ \$1,150/mo.	<u>21,839</u>
Capital and management earnings	34,273
÷ Total investment (624,841)	
Rate earned on investment	5.5%

*An assumption was made that one-half the real estate on the average NY dairy farm is land.

Note: In the Illinois system the calculations include the landlord's as well as the operator's share. The New York data do not include any share-rented farms.

The data used are the New York "without appreciation" numbers.

Table 3. Calculation of Measures of Net Income, Iowa System, Using 1988 New York Data.

Gross Product (Receipts minus purchased feed and livestock)	194,093
- Operating expenses (except feed)	105,498
- Fixed expenses (including interest paid)	<u>44,249*</u>
Accrual net farm income	44,346
- Operator labor, 16.2 mos. @ \$1,200	19,440
- Family labor, 2.8 mos. @ \$700	1,960
- Charge for 409,571 equity capital @ 6%	<u>24,575</u>
Return to management	-1,629

Accrual net farm income	44,346
+ Interest paid	17,603
- Value of operator and family labor	<u>21,400</u>
Return to capital owned	40,549
÷ Total assets owned	624,841
Percent Return to capital owned	6.5%

*Includes depreciation at 10% of machinery value plus 4% of estimated building value, which is assumed to be 1/2 the real estate value.

Table 4. Calculation of Measures of Net Income, Michigan System, Using 1988 New York Data.

Value of production (Receipts less purchased feed and livestock)		194,093
Expenses except feed, livestock and interest paid	137,981	
+ Interest on all capital @ 8.5%	53,111	
+ Value of operator and family labor	<u>23,730*</u>	
Total costs		214,822
Management income		-20,729
+ Value of operator labor		<u>20,250</u>
Labor income**		-479

Management income		-20,729
+ Interest at 8.5%		<u>53,111</u>
Return on owned (total) capital		32,782
+ Average owned (total) capital		624,741
Rate earned on owned capital***		5.3%

*Operator labor 3,000 x 1.35 = 4,050 hrs. @ \$5.00 = \$20,250.

Family labor 696 hrs. @ \$5.00 = 3,480

**Conceptually equal to NY's labor and management income.

***Return on capital includes management.

Note 1: The Michigan system does not calculate appreciation. It is not clear whether price changes on livestock are included in inventory changes. It is assumed here that Michigan calculates depreciation the same way Cornell does and that appreciation of livestock and real estate is excluded from the income calculations.

Note 2: The above calculations are the standard procedure used for all types of farms in the Michigan system. For dairy farms only, the Michigan system also calculates Net Farm Income about the same way that Cornell does except that appreciation is not specifically separated.

Table 5. Calculation of Measures of Net Income, Missouri System, Using 1988 New York Data.*

Value of farm production	194,093
- Operating costs (including interest paid, depreciation and unpaid family labor)	159,084
= Net operating profit (which is return to operator's labor and management and equity capital)	35,009
+ Interest paid	<u>17,603</u>
= Return to land, labor, capital and management	52,612
- Value of managerial labor (\$5.00 x 3,000 x 1.35 operators)	<u>20,250</u>
= Returns to capital and management	32,362
- Interest on capital (624,841) @ 8%	49,987
= Return to management	-17,625

Returns to capital and management	32,362
÷ Total capital	624,841
= Percent return to capital and management	5.2%

*The measures described here are for the operator. In the Missouri system, each measure is also calculated for the total business, including the landlord's share. Appreciation is excluded.

Table 6. Calculation of Measures of Net Income, North and South Dakota System, Using 1988 New York Data.*

Total farm receipts (including capital sales and inventory increase)	287,357
- Total farm expense, including capital purchases, unpaid family labor and interest @ 7% on all capital	261,599
= Return to operator labor and management	25,758
+ Unpaid family labor	1,950
+ Interest on equity (which is 7% of avg. total capital minus interest paid)	<u>24,498</u>
= Return to capital and family labor	52,206

*Operator share. Return to operator labor and management for the total farm including landlord's share, is also calculated. It is not clear how they handle appreciation, but in the calculations here appreciation is included.

Table 7. Calculation of Measures of Net Income, Oklahoma System, Using 1988 New York Data.*

Total farm receipts (includes capital sales)	255,314
- Total farm expenses (includes capital purchases)	<u>234,730</u>
= Net cash income	20,584
+ Adjustment for changes in accounts receivable and payable	<u>2,139</u>
= Net farm earnings	22,723
+ Change in inventories	<u>31,134</u>
= Net farm income (return to operator and unpaid family labor, net worth and management)	53,857
+ Interest expense	<u>17,603</u>
= Return to unpaid labor, total capital and management	71,460
- Interest on total capital @ treasury note rate (6.46% in 1988)	40,365
= Return to unpaid labor and management	31,095

Return to unpaid labor, total capital and management	71,460
- Value of unpaid family labor @ \$4.00/hr.	<u>2,800</u>
= Return to operator labor, total capital and management	68,660
- Value of operator labor @ \$4.00/hr.	<u>16,200</u>
= Return to total capital and management	52,460
- Interest on total capital	40,365
= Return to management	12,095

Return to total capital and management	52,460
+ Average total capital	624,841
= Rate of return on capital and management	8.4%

Return to equity capital and management	34,857
÷ Average equity capital	409,571
= Percent return to equity capital	8.5%

*It is not clear how the Oklahoma system handles appreciation, but in the calculations here appreciation is included.

Table 8. Calculation Measures of Net Income, Kansas System, Using 1988 New York Data.

Gross farm income, including inventory change	262,510
- Cash operating expense (including interest paid)	201,386
- Depreciation	22,615
= Net farm income	38,509
- Interest on 409,571 equity @ 10%	40,957
- Unpaid family labor	1,950
= Return to labor and management	-4,398
= Return to labor and management (per operator)	-3,258

Net farm income	38,509
+ Interest paid	17,603
- Charge for operator labor (\$15,000 per operator)	20,250
- Value of unpaid labor	1,950
- Management charge (10% of gross income)	26,251
= Return to capital	7,661
‡ Total capital managed, including the value of rented land*	
= Rate earned on total capital	1.2%

Return to capital	7,661
- Interest paid	17,603
= Return on net worth	-9,942
‡ Net worth	409,571
= Percent return on net worth	-2.4%

*This calculation is made based on total capital owned because the value of rented land is not known in the New York System. Appreciation is not included.

Table 9. Calculation of Measures of Net Income, Nebraska System, Using 1988 New York Data.

Gross farm returns	262,510
- Total operating expenses	201,386
- Depreciation	<u>22,615</u>
= Net farm income (return to operator and family labor, management and equity capital)	38,509

Note: Appreciation of assets is excluded.

Table 10. Calculation of Measures of Net Income, Pennsylvania System, Using 1988 New York Data.

Total farm receipts (cash)	253,379
- Cash farm operating expenses	202,613
Net cash operating income	50,766
+ Livestock inventory change	3,735
+ Feed inventory change	3,717
+ Supply inventory change	837
- A/P change	492
+ A/R change	2,631
- Other adjustments	70
- Depreciation	<u>22,615</u>
Net farm income	38,509
9% on 624,841 investment less interest paid*	<u>38,633</u>
Family labor and management income	-124

*It appears that in the Pennsylvania system assets are valued at book value rather than at market value. The \$624,841 is market value from the N.Y. data. The interest charge would be lower and the labor and management income higher if book values were used as the basis for the interest charge. Appreciation is excluded.

Table 11. Calculation Measures of Net Returns, Minnesota and Indiana Systems, Using 1988 New York Data.*

Gross cash farm income (not including breeding livestock)	237,098
- Total cash expense, except breeding livestock	198,406
= Net cash farm income	38,692
- Changes in inventory and accounts receivable and payable	<u>6,625</u>
= Net operating profit	45,311
+ Change in breeding livestock inventory	15,807
- Depreciation and other capital adjustments	<u>22,615</u>
= Profit or loss (return to operator labor and management, family labor and equity capital)	38,509
- Interest on \$409,571 net worth @ 6%	24,574
= Labor and management earnings	13,935

Profit or loss	38,509
+ Interest paid	17,603
- Operator labor and management (1.35 operators @ \$15,000)	20,250
= Return to farm investment	35,862
÷ Average farm investment	624,841
= Rate of return on investment	5.7%

Profit or loss	38,509
- Operator labor and management	20,250
= Return to farm net worth	18,259
÷ Average farm net worth	409,571
= Rate of return on net worth	4.5%

*The calculations were made by excluding appreciation of assets. It is not clear in the Minnesota (FINAN) procedure whether or not appreciation on breeding cattle and depreciable assets is excluded from the calculations.

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