LINKAGES BETWEEN FARM AND FINANCIAL MANAGEMENT

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The University of Minnesota is committed to the policy that all persons shall have equal access to its programs, facilities, and employment without regard to race, religion, color, sex, national origin, handicap, age, veteran status or sexual orientation.
A first impression upon reading the title to this paper might be "Is there much to say about this topic that we don't already know?" Maybe not, we will let the reader decide after reading further. Certainly it is common knowledge that finance is an integral part of management as described by most business management and recent farm management textbooks. We have come a long way from the days when the most sophisticated approaches to including finance in farm management analyses were incorporating capital constraints and credit activities in farm firm linear programming models. In fact, some of the more recent advances in modeling and understanding farm firm behavior, particularly with respect to considerations of risks, have come from those in the profession with a finance orientation.

So, what is new? Our goals in this discussion are modest. We will introduce and/or review two theoretical concepts that are not new, but, in our judgement, have been under-utilized in farm and financial management research. We then will discuss two topic areas that could use these and other concepts and merit further analyses. Our goal is simple: to stimulate further dialogue so that the frontiers of the interface between farm and financial management can be pushed out further.

Theoretical Constructs

Two theoretical constructs will be reviewed briefly: (1) the integration of production theory and financial theory as proposed by Vickers and applied to farm firms by Lowenberg-DeBoer and Lowenberg-DeBoer and Boehlje; and (2) the balancing of business risk and financial risk as suggested by Gabriel and Baker, among others.
Integrating Production and Financial Theory

A theoretical model that encompasses a number of the characteristics of the modern production environment for the farm firm is summarized in the following set of equations. Ideally, the model should maximize expected utility considering price, production, and financial risks. This approach has been used elsewhere with a specific focus on survival (Robison and Lev). The approach used here is a simpler lexicographic model which maximizes the expected value of the firm subject to a probabilistic constraint on firm continuance.

As suggested by Vickers, the entrepreneur is assumed to maximize wealth, which can be stated as:

\[
V = \frac{E[\pi]}{\rho} = \left(\sum_{t=1}^{\infty} E[\pi]/(1+\rho)^t\right)
\]

where \(V\) is the expected value of the firm, \(E[\pi]\) is the expected annual stream of income and capital gain, and \(\rho\) is the capitalization rate. The expected annual stream of income and capital gain is specific as:

\[
E[\pi] = E[(Pf(X, L) - \gamma_1 X - \gamma_2 L - r(L/K)D)(1-\tau) + \phi_1 \delta_1 L + \phi_2 \delta_2 X]
\]

where \(P\) is a vector of output prices; \(X\) denotes nondurable inputs or products that contribute to production and are consumed or sold during the production period; \(L\) denotes durable inputs that contribute to production over time and may increase (decrease) in value, resulting in capital gains.
(losses); \( f(X, L) \) is a strictly concave multiproduct production function with \( f'_X, f'_L > 0, f''_X, f''_L < 0 \) for all products;

\( \gamma_1 \) and \( \gamma_2 \) are the vectors of the cash prices of inputs \( X \) and \( L \), respectively (the price of nondurable inputs is easily determined; the price of durable inputs is calculated as the annualized cost of the services rendered and is frequently estimated as the explicit or implicit rental cost per unit of service); \( D \) is debt funds used to finance the production process; \( K \) is equity funds; \( r(\frac{D}{K}) \) is the debt supply function with \( r' > 0 \) and \( r'' > 0 \); \( \tau \) is the average tax rate; \( \delta_1 \) and \( \delta_2 \) are the rate of capital gain or loss on nondurable and durable inputs; \( \phi_1 \) and \( \phi_2 \) are the portion of unrealized capital gain or loss on nondurable and durable inputs substitutable for income. The formulation of equation (2) does not explicitly recognize the differential taxation of capital gains compared to ordinary income, although such a distinction has been accommodated elsewhere (Lowenberg-DeBoer).

As Vickers specifies, the capitalization rate is a function of firm size and financial leverage:

\[
(3) \quad p = a - \theta_1 (K + D) + \theta_2 (\frac{D}{K})^2 ,
\]

where \( a \) is a constant, \( \theta_1 \) is the firm size parameter of the capitalization rate function, and \( \theta_2 \) is the leverage parameter of the capitalization rate function. The specification of equation (3) recognizes that as firm size increases, the marginal productivity of capital and thus the capitalization rate declines, but that increased leverage and thus higher financial risk results in an increase in the capitalization rate.
The value of the firm is maximized subject to the financing and survival constraints. The financing constraint is specified as:

\[
(4) \quad K + D - \alpha X - \beta L \geq 0
\]

where \( \alpha \) and \( \beta \) are the amount of financial capital absorbed in the acquisition of the nondurable and durable inputs, respectively. These parameters may not be equal to the purchase price of the input if special financing arrangements reduce the capital absorbed in the acquisition process. For example, leasing arrangements or concessionary financing used as a sales tool by farm equipment manufacturers can reduce the capital required to acquire such equipment. Equation (4) indicates that the acquisition of inputs requires and is constrained by the availability of equity (\( K \)) and debt (\( D \)) capital. Equity capital is comprised of proprietor’s contributions and retained earnings, as well as equity funds contributed by outside investors. Thus, the equity capital base is not presumed to be constant since the entrepreneur's equity can be augmented with outside equity.

The final constraint is a liquidity or survival constraint. It recognizes that assets have a net cash flow and/or a liquidity component that can be used to meet the firm's minimum requirement for cash. Given the uncertainty associated with the cash and the liquidity components, this is specified as a constraint which must be met with a specified probability:

\[
(5) \quad PR[(Pf(X, L) - \gamma_1 X - \gamma_2 L - r(D)D)(1 - \tau) + \lambda_1 \hat{x} + \lambda_2 \hat{L} - F - C \geq 0] \geq Z
\]
where $\lambda_1$ and $\lambda_2$ are the after-tax liquidity coefficients per dollar of nondurable and durable inputs, respectively; $\hat{X}$ and $\hat{L}$ are the amounts of nondurable and durable inputs, respectively, remaining at the end of the annual production cycle; $F$ is principal payments on debt, $C$ is operator withdrawals, and $Z$ is the minimum probability with which the constraint must be met. The after-tax liquidity coefficients can be viewed as one minus the percentage liquidation losses for each input.

Equation (5) might be termed the "survival function." It reflects the cash flow requirements that the firm must meet to continue in business. Typically, production inputs and capital assets contribute cash earnings, while others, such as stored grain awaiting sale, commonly contribute cash through liquidation. However, the constraint recognizes that durable and nondurable inputs can be liquidated to meet cash needs, even though such sales are expected to significantly impair the long run income-generating capacity of the firm. The formulation specified here assumes that assets are liquidated only at the end of the production cycle; however, such an assumption is not essential if the model included a more detailed time specification.

The decision variables in the model include nondurable inputs ($X$), durable inputs ($L$), debt ($D$), and equity ($K$). The multiproduct nature of the production function $[f(X, L)]$ implies that the optimal values of these decision variables will result in an optimal product mix as well as an optimal size of farm.
The comparative static properties of this model are complex to develop analytically, particularly given the probabilistic nature of the survival constraint (equation (5)). Lowenberg-DeBoer has derived comparative static properties for the model excluding the survival function. As a step in the development of a more general model, the discussion here will draw upon and augment that earlier work by examining the implications of adding the survival function to the model.

The implications of this integrated model for optimal input use and product mix are significant. Lowenberg-DeBoer indicates that ignoring the survival constraint, the optimal mix of durable and nondurable inputs is not only a function of the relative prices \( (\gamma_1 \text{ and } \gamma_2) \), but also the finance charge coefficients \( (\alpha \text{ and } \beta) \) and the capital gains parameters \( (\phi_1 \delta_1 \text{ and } \phi_2 \delta_2) \). Using his approach, the marginal rate of input substitution is defined as:

\[
\frac{f_X}{f_L} = \frac{[\gamma_1 + \alpha (r + r'(B/K))(1-\tau)] - \phi_1 \delta_1}{[\gamma_2 + \beta (r + r'(B/K))(1-\tau)] - \phi_2 \delta_2}
\]

where \( f_X/f_L \) denotes the ratio of marginal products of durable for nondurable inputs.

As is typical of the Vicker's formulation, the marginal rate of substitution is equal to a factor or input cost ratio which includes after-tax relative input prices, plus relative "finance charges." These relative finance charges reflect the interest payments on funds borrowed to buy the inputs, as well as the implicit or explicit collateral constraints imposed by lenders, as reflected in specific lending limits that restrict the use of credit in acquiring various inputs. Because these lender-imposed collateral and funding constraints are more a function of cash flow and the liquidity
characteristics of various inputs rather than relative prices, it is typically the case that the relative finance charges will not be equal to relative input prices.

Unlike the usual Vicker's model, the input cost ratio also includes an argument reflecting differential capital gains or losses on durable and nondurable inputs. Typically, capital gains or losses on durable inputs will exceed those on nondurables; in fact, the capital gains or losses for nondurables will frequently be zero. Assuming that capital gains on nondurables are zero ($\delta_1 = 0$), but that capital gains on durables are positive ($\delta_2 > 0$) and that part of these gains are substitutable for current income ($\phi_2 > 0$), the capital gains will tend to offset part of the cost of acquiring the durable inputs. Capital losses would have the opposite affect; they would tend to increase the cost of durable inputs. Thus, the optimal input mix is not only a function of relative factor prices, but also relative finance charges and relative capital gains or losses. This clearly impacts the structure of the firm.

The recognition of capital gains and losses and finance charges will also have an impact on the choice of outputs. Lowenberg-DeBoer introduces two production functions \(g(X, L)\) and \(f(X, L)\) into the model; when input prices are the same for both enterprises, the marginal rate of substitution equation is as follows:

\[
\frac{f_X}{f_L} = \frac{gX}{gL} = \frac{(\gamma_1 + \alpha [r + r' \frac{D}{K}]) (1 - r) - \phi_1 \delta_1}{(\gamma_2 + \beta [r + r' \frac{D}{K}]) (1 - r) - \phi_2 \delta_2}
\]

Both the marginal rate of substitution for the \(f\) production function (MRS\(_f\)) and marginal rate of substitution for the \(g\) production function (MRS\(_g\)) will be larger than is traditionally the case
because of the presence of capital gains on durable inputs. But, if one production function has a lower marginal product of durable inputs than the other, the output and use of durables in the production of that commodity will be curtailed. For instance, assume $g$ describes the production of fruit and vegetables such that at some relatively small amount of land $g_L$ becomes small compared to $g_X$. That is, the marginal product of land becomes small compared to the marginal product of other inputs such as fertilizer, labor, pesticides, etc. Assume $f$ describes the production of grain; the marginal product of land in grain production can remain relatively high even if a substantial amount of land is already in use. Under these conditions, $MRS_g$ would be equal to the input-cost ratio at some low level of land input, but a much larger level of land input would be required to equate $MRS_f$ and the factor-cost ratio.

As capital gains increase, the input cost ratio increases and the output which lends itself to land-extensive production assumes a larger share of the output mix. It may be the case for some levels of capital gain and some production functions that the land input for $g$ must be made so small to achieve equality (7) that the production of output $g$ drops to zero. It should be noted that this does not suggest that the most land-extensive output is always favored. Rather, it indicates that the favored output in the presence of capital gains is one in which the production process is relatively land-extensive and the marginal product of land remains relatively high even when the firm uses large amounts of land. For capital losses, the opposite effect occurs and enterprise choice tends toward land-intensive options. The size and structural implications are, again, apparent.

The discussion thus far has not recognized the impact of liquidity and cash flow
differences in the choice of optimal durable and nondurable input use as encompassed in the survival function of equation (5). If the lender's perception of cash flow and liquidity characteristics of durable and nondurable inputs, as reflected in the finance charges, are an accurate reflection of the actual values of these coefficients as experienced by the farmer, then explicit recognition of these characteristics, as in equation (5), will have little impact on the optimal input mix. However, if cash flow and liquidity characteristics, as actually faced by the farmer, differ from those of the lender, then the addition of these parameters will influence optimal input use. Specifically, nondurable inputs are typically more liquid and generate more cash flow on a per unit basis than durable inputs, which would suggest a larger quantity of nondurable inputs in the optimal input mix.

With respect to investment behavior, the optimal mix of durable and nondurable inputs, as well as the optimal type of durable input to acquire, is influenced by the net income, net cash flow, capital gains, collateral value, and liquidity parameters in the fashion noted earlier. The disinvestment behavior, as noted elsewhere (Boehlje and Eidman), is a function of the same parameters; the owner would prefer to sell those assets that possess the characteristics of high liquidity, low net income and cash flow, low capital gains, and limited collateral value.

Ignoring the survival constraint, the financial structure of the firm can be characterized by solving the first-order conditions for equity and debt to yield an expression in the discount rate and leverage ratio as:

\[ p - r^* \left( \frac{D}{K} \right) = r + r^* \left( \frac{D}{K} \right) \]  

The left-hand side of this equation is the marginal cost of equity capital. The right-hand side is the
marginal cost of debt capital, which generates the common financial result that, in the optimal financial structure, the marginal cost of all sources of capital are equal. Lowenberg-DeBoer indicates that, if equity is not fixed, capital gains and losses do not affect the financial structure or the optimal debt-equity mix. However, if equity is fixed, the optimal use of debt must be found simultaneously with input levels. The result in this case is that capital gains or losses do impact debt utilization; debt use increases (decreases) with higher levels of capital gains (capital losses).

In a more detailed specification of the model, D may be a vector of debt with various maturity and principal repayment characteristics. The optimal composition of debt is then a function of the cost of each debt source and its impact on the survival constraint through the debt servicing requirements. If debt servicing requirements are higher for short-term, compared to long-term debt (because of higher interest rates and larger scheduled principal reductions), the optimal debt composition will include a larger quantity of long-term and a smaller quantity of short-term (current) debt. Equation (5) also suggests that, because of relative liquidity and cash flow characteristics as noted earlier, an input mix that contains a higher proportion of nondurable inputs will improve the probability of survival. Clearly, lower levels of withdrawal and the substitution of entrepreneurial and investor equity for debt will reduce the cash requirements for debt servicing and also increase the probability of survival.

In summary, the implications of incorporating capital gains or losses and finance charges (including liquidity and collateral coefficients) in the analysis for the use of durable and nondurable inputs and structure and organization of the farm firm are important. Since real estate is the most important durable input used in
most farming operations, the farm size implications are also significant. In essence, the larger the capital gain on durable inputs (for example, the land price increase) or the smaller the finance charges--all other parameters constant--the greater the optimal use of durable inputs (farmland). Use of nondurable inputs

is reduced if capital gains on durable inputs are larger or the fraction of capital gains substitutable for current income is greater. Capital losses and higher finance charges have the opposite effect: they tend to increase the cost of durables (land), reducing the factor or input-cost ratio and hence reducing the use of durables (land) in the optimal solution while increasing use of nondurable inputs. Thus, in an environment of capital losses or higher relative finance charges, the decision maker would tend to economize on durables (land) to avoid those losses or costs.

With specific reference to capital gains or losses, it is important to separate the effects of the price level of durable inputs compared to the rate of change in durables prices. If the price of durable inputs is higher, the annualized cost of durable ownership will be higher; there will be a tendency to use fewer durables. The price change in durables can, however, either off-set or add to the cost of owning durable inputs, depending upon whether the price is rising or falling.

The analytical results suggest that at least part of the increase in the use of durable inputs and average farm size in the United States during the three decades prior to the 1980s may be a result of the almost continuous capital gains that occurred. It also indicates that, all other things being equal, if capital gains during the period had been smaller or if those gains had been less substitutable for wealth, farmers would have invested in more nondurable inputs such as labor, fertilizer, pesticides, and improved seed.
The analysis also suggests that farm size and the use of nondurable and durable inputs can be significantly affected by government policy. For instance, it is frequently argued that land prices are the capitalized value of expected future income from land ownership. If this expected future income is rising, capital gains are likely to occur. If a price support program increases the rate at which future income from land is expected to rise, the analysis suggests that there will be a tendency for farm size to increase and for land use to become more extensive. Conversely, a weakening of government price support commitments, which reduces income expectations and results in a lower rate of land price change, would tend to reduce the optimal farm size and encourage more intensive farming. Government tax and credit policies that have a differential impact on income, capital gains and finance charge coefficients for durable and nondurable inputs will impact the optimal input mix in like fashion.

Risk Balancing

Gabriel and Baker (1980) and Barry (1983) have developed useful frameworks to link production, investment, and financing decisions by use of a risk constraint. Their methods differ mainly in how business risk and financial risk are combined to determine total risk. Gabriel and Baker combine business risk (BR) and financial risk (FR) in an additive manner to calculate total risk (TR). Barry combines BR and FR in a multiplicative manner to determine TR:

(9) \( TR = (BR) \times (FR) \)

Barry (p. 120) expresses total risk as the coefficient of variation for equity holders:
(10) \[ TR = \frac{\sigma^e}{\bar{r}_e} = \frac{\sigma_a P_a}{\bar{r}_a P_a - i_d P_d} \]

where \( \delta \) is the standard deviation and \( \bar{r} \) is the expected returns for equity (e) or risky assets (a); \( i_d \) is the interest rate on debt;

\( P_a \) and \( P_d \) are the proportions of risky assets and debt, respectively. Business risk is the coefficient of variation for risky assets:

(11) \[ BR = \frac{\sigma_a P_a}{\bar{r}_a P_a} = \frac{\sigma_a}{\bar{r}_a} \]

and financial risk is the result of dividing total risk by business risk:

(12) \[ FR = \frac{TR}{BR} = \frac{\bar{r}_a P_a}{\bar{r}_a P_a - i_d P_d} \]

Either Barry's multiplicative relationship or Gabriel and Baker's additive relationship could be used in an objective function to minimize risk. Also, if a farmer's risk attitude could be measured, a risk constraint could be placed in an optimization problem such as is done in the Vickers model earlier in this paper.

Alternatively, since risk attitudes are not known with accuracy, the representative farm approach to prescriptive analysis could be expanded to include the trade-offs between profit and risk levels under different financing schemes. Results could be presented in a similar manner as
business risk alternatives are presented in some programs. In this use, the farmer, who is assumed to be concerned with total risk only, could see the impact of different alternatives in business size, structure, and operation and the interaction of financing alternatives.

This framework of describing total risk as a combination of business and financial risk allows us to see the process of how a manager or owner of assets will balance or trade one type of risk for another. Thus, we can see how a farmer (i.e., an equity holder) may finance a business differently for one set of enterprises with a higher business risk compared to a set of enterprises with a lower business risk. The effects of exogenous forces such as the impact of world market conditions on commodity prices or macroeconomic policy on interest rates on either business risk or financial risk can also be seen.

With a few exceptions, this framework has not been utilized as fully as it could be. As farm firms become more exposed to business risk and more dependent on debt capital and thus encounter increased financial risk, the concept of risk balancing becomes more important. Pederson and Bertelsen incorporate business and financial risk in their analysis by including both different enterprise choices and different financing instruments (i.e., ownership of land or share-renting land). Collins and Barry present a very useful approach to farm planning using a single-index portfolio model, but different financing options are not included; risk balancing is not endogenous. Atwood, Watts, and Helmers present a chance-constrained programming model of the farm financing decision but only one financing option was included.

These last two studies are cited, not to be critical of their inadequacies, but to show that the concept of risk balancing could be added with relative ease to many existing models. Future efforts could include both business and financing activities within the same model. Alternative
business activities would include different enterprises and investments. As will be discussed later, alternative financing activities should include ownership, leasing, renting, and debt with different financial terms. By including both of these types of activities, a model could link production, marketing, and financing decisions and analyze the impacts of changes in not only the riskiness of ventures, but also the impact of differing levels of risk aversion.

**Researchable Issues**

In this section, we focus our attention on two basic areas which we feel merit additional emphasis in the farm and financial management research agenda: (1) resource control and use, and (2) financial measurement and control.

**Resource Control and Use**

The topic of resource control and utilization is at the core of farm and financial management, but the research focus in the past has been relatively narrow. Much of the past research has been on optimal investment strategies with special consideration for what assets to purchase and how to obtain adequate debt and equity funds to finance the purchases.

Ownership is one method of obtaining the control and the rights to use productive assets. But there are other methods including leasing. There has been some work done on renting and leasing, particularly of real estate, but the emphasis has been on evaluating traditional cash or crop share leases and the implications of such leasing strategies for optimal resource allocation (Pederson and Bertelsen; Apland et al.; Pederson; Perry et al.). Alternative real estate leasing arrangements which include variable payments as a function of commodity yields or prices are
discussed in extension programs, but have received little research attention. The implications of
different lease terms (e.g. multiperiod lease arrangements; sharing of outlays for and benefits of
the permanent improvements; and the sharing of costs, risks, and responsibilities for soil erosion
and environmental degradation) merit further analysis. The optimal strategy and terms to obtain
control of real estate over time through purchase and lease options for different interest, tax,
inflation, appreciation and earnings rates are also of interest.

Leasing of other capital assets (e.g., machinery, equipment, buildings, and breeding
stock) has not been particularly popular in agriculture, but may have more potential than we now
perceive. An interesting question is, "Why is leasing used more frequently in the business sector
generally, and increasingly, for personal as well as corporate automobiles and trucks as compared
to the agricultural sector?" More generally, the costs and benefits of diversified financing, such
as using the optimal mix of farm and nonfarm equity; debt with various rates, terms, and repayment
characteristics; and various forms of real estate and capital asset leasing arrangements, are worthy
of detailed investigation.

But studies of the merits and problems of ownership and leasing would not adequately
exhaust the options available for resource control. Some farmers obtain certain machine services
by exchanging labor or other machine services for them. Various schemes for joint ownership of
"extra" power or harvesting capacity to obtain timeliness benefits without incurring excessive costs
have been discussed. One such scheme is to have "extra" capacity jointly owned by geographically
dispersed farmers who are not subject to the same rainfall pattern and who bid for the use of the
"extra" capacity on a weekly or daily basis. Acquiring machine services through "custom hire"
(whether for individual activities such as harvesting or for the full set of cropping activities, such as with custom farming) is increasingly popular in some geographic regions. Budgeting analysis suggests that custom farming is frequently a lower cost cropping alternative for a landowner than cash or crop share renting. One possible explanation is that the hourly return for labor is typically relatively low in crop production and that custom operators frequently price their services based on marginal costs and cash flow needs, which are typically lower than the full costs of machine ownership. Rigorous analysis of this and/or other possible explanations for custom farming and machine sharing and the potential role of these less traditional methods of resource control would be of interest.

A parallel in the livestock sector to the leasing and custom farming options in crop production is custom feeding and contract production. Limited research has been done on the optimal strategy for a cattle feeder or hog producer with livestock facilities with respect to owning the livestock fed in those facilities, custom feeding in those facilities, or feeding livestock in someone else's custom feedlot. In some circumstances, the optimal strategy may include a combination of all three options.

Contract production has become increasingly important in the swine industry. Resource providing contracts where the contractor supplies important inputs, such as feed or feeder pigs, appear to be of the most interest. They can assume various subforms that vary in the costs and risks shared by contractors and producers. The farmer may find contracting attractive because it provides him with expensive inputs, utilizes his facilities and technical skills, and assures him a reasonable return. The reduced risk with contract production may be a major advantage when the
producer is negotiating with a lender to borrow funds for expansion or new facilities. In fact, some resource providing production contracts are not all that different than leasing arrangements in terms of the cash flow and financing implications for the farm business. Yet, we know little about the terms and conditions of this method of resource control and use and where it fits into the optimal farm and financial management strategy.

Undoubtedly, using some of these nontraditional (as well as the traditional) means of acquiring control of resources will impact the structure of the farming sector: including the size distribution of farms, the level of specialization or diversification, resource ownership and financing patterns, and the inter- and intra-sector linkages, including horizontal and vertical integration (Boehlje). Use of the concepts of the integrated production and financial model and the balancing of business and financial risk discussed earlier may help us understand these structural implications as well as the optimal strategies for resource control for individual firms.

Financial Measurement and Control

Within the farm management literature, the three basic functions of management (i.e., planning, implementing, and controlling) have received different emphasis. Planning is the most discussed, implementing is the most neglected, and, until recent texts, controlling was the most misdirected. Controlling had been discussed only as financial control or, even more specifically, only as "keeping the books." Recent efforts (e.g., Boehlje and Eidman) have expanded the control topic within farm management to areas other than just accounting. But this expansion and recent work have shown that many of the financial measures may not be good predictors of financial success, both within a year and between years.
There is a need for a new set of control measures which can capture the essence of what is happening concurrently and which are directly related to success at the end of the year. This "success" can be described generally as accomplishing a farmer's goals: profit maximization, survival, debt reduction, etc. The current set of control measures are mostly feedback mechanisms measured at the end of a cycle. The recent ABA Task Force on Financial Standards agreed upon a set of consistently defined measures. However, most of these are feedback, year-end measures. Even the cash flow deviation statement may provide information too late--even though this statement is extremely useful.

Furthermore, most financial performance measures provide little information about the adequacy of financing decisions. To be sure, they measure financial performance, but these measures are typically at an enterprise or total farm level and reflect the totality of production, marketing, and financial decisions. Little information is available on how effectively the manager has been in making financing decisions--i.e., negotiating interest rates and financing terms, obtaining adequate equity from farm and nonfarm sources as well as debt from various lenders, structuring repayment terms on capital purchases to adequately match asset cash flow, maintaining adequate insurance and/or asset (cash or inventories) liquidity to meet unexpected contingencies, negotiating real estate and capital asset leases and other methods of resource control. As to leases and other methods of asset control, even the overall financial performance measures are ambiguous as to how such transactions are to be handled.

What farmers need is a new set of operational or concurrent financial control measures which would provide a farm manager with early signals of the need to make management changes
to cope with both internal and external deviations from the plan. Ideally, these early control signals would (1) provide enough time for corrective actions to be made within the production and marketing phases, (2) indicate which areas of production and marketing need attention in the midst of the cycle, and (3) measure separately performance in the financing, marketing, and production functions.

The need for these new measures is also shown by two recent studies which evaluated how well financial measures could predict success. Tvedt, Olson, and Hawkins used beginning financial measures and within year measures to explain the ending rate of return on assets. Duarte used a financial analysis expert system to combine three years of data to explain performance in the fourth year. Let us look at these two studies more closely.

Tvedt, Olson, and Hawkins (1989) looked at how well the ending rate of return on assets (ROA) was explained by the traditional financial measures and other variables from the same year. Data from the Southwestern Minnesota Farm Business Management Association for 1985 were used for the initial analysis. Data for 1986 and 1987 were used to verify the results from the 1985 data. There were seven variables found to be significantly related to the rate of return on assets. The number of acres farmed, corn yield (relative to county averages), asset turnover rate, beginning debt-to-asset ratio, and dummy variables for cash rent and for beef finishing had a positive correlation. The gross ratio (i.e., total cash expenses divided by the value of production) had a negative correlation. The signs on these relationships are as expected except for the beginning debt-to-asset ratio. This ratio was expected to have a negative effect but had a significant, positive
effect in all model specifications. The adjusted R-squared for the regressions were in the 0.55-0.63 range.

These seven significant variables were proxies for the general measures of size, production efficiency, asset use efficiency, solvency, financial efficiency, enterprise selection, and renting versus ownership. One measure which is missing from this list is liquidity, a measure often used in lending decisions. In their study, the beginning current ratio was used as the liquidity measure. Liquidity’s lack of significance may be due to its true lack of significance, the reliance on borrowed operating capital instead of equity capital or the possibility that all the Association farmers having sufficient liquidity levels so that it is not significant in explaining differences in this group’s rates of returns.

Duarte used the Texas A&M Agricultural Financial Analysis Expert System (AFAES) to evaluate a panel of 50 farms from the Southwestern Minnesota Farm Business Management Association in the years 1984-1987. AFAES can estimate both a financial condition score based on three or more years and an operating year score. In one part of his work, Duarte evaluated the ability of the financial condition score to predict the operating year score of the next year. In the first test, both the original financial condition scores and the rankings were significant but R-squared values of .21 and .23, respectively, indicate that the financial condition score does not contain sufficient information to explain next year’s operating year score.

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1 This deviation from expected results may be due to two reasons. First, rather than avoiding farmers with high debt loads, creditors may allow farmers with high rates of return to borrow more and, thus, raise their debt ratios. Second, a few farmers under severe financial stress were not paying interest costs and, thus, their net income was overstated.
In a second test, Duarte divided the 50 farms into three groups based on their 1986 financial score and found that the 1987 ranking based on operating scores were different between the three groups. However, using the Bonferroni multiple comparisons procedure, Duarte was able to show that only the farms with the lowest 17 financial scores in 1986 had average operating performances in 1987 that were worse than that for farms with the highest 17 financial scores in 1986. That is, the highest and middle groups in 1986 were not statistically different in 1987 and the middle and lowest groups in 1986 were not statistically different in 1987. Only the highest and lowest groups in 1986 stayed far enough apart in 1987 to show up significantly. Thus, the ranking based on the financial condition score in 1986 did provide some, but not sufficient, information to explain the ranking based on 1987 operating scores.

In the third test, Duarte calculated a polychotomous logistic regression on the three groups categorized by 1986 financial score to obtain confidence intervals for the different odds ratios of moving between groups from 1986 to 1987. These results were similar to those before--the highest scoring farms in 1986 will likely be those which will have higher scores in 1987 and the lowest in 1986 will most likely be lowest in 1987. However, there was still a large portion of unexplained movements between groups.

These two studies and general observations of the present and future economic environment point to the need for new financial measures for operational and concurrent control. Farmers need to know the impact of production, marketing, and financing decisions on financial performance. They need separate and unique performance measures that will reflect how well they are making and implementing production, marketing, and financing decisions. They also need to
know the impact of changes in the external and internal financial environment and how they need to adapt their production and marketing plans. It is this latter need especially that calls for a new set of concurrent financial control measures.

Conclusion

We have attempted to identify and review two concepts and two areas of work that may contribute to a more complete understanding of the linkages between farm and financial management. The concepts recognize the importance of incorporating risk considerations and financial dimensions in our traditional theory of the firm. The areas of work we identify that merit further analysis are strategies for resource control and financial measurement and control. Our judgment is that there still remains much to be done in understanding the farm and financial management decision environment and the important role that planning, implementation, and control play in that environment.
References


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