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Current Issues in Agricultural Finance
Inflation, Risk, and Financial Instabilities

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William I. Myers (1891-1976) was one of the early agricultural economists who worked on problems of agricultural finance. He was appointed a full professor of farm finance at Cornell University in 1920. In 1932, Professor Myers was asked to prepare recommendations for a legislative program to solve the agricultural finance problems of those times. His proposals found approval from President-elect Roosevelt, and his ideas formed the foundation for the creation of the Farm Credit Administration and the present Federal Cooperative Farm Credit System. Then, at the request of President Roosevelt, he was granted a leave of absence from Cornell in March, 1933, to serve as assistant to Henry Morganthau, then chairman of the Federal Farm Board. Morganthau was appointed the first governor of FCA, and Myers became Deputy Governor. Then, when Morganthau became Secretary of the Treasury in September, 1933, Myers was appointed governor of the Farm Credit Administration. He served in that capacity until 1938 when he returned to Cornell University as head of the Department of Agricultural Economics. In 1943, he became Dean of the College of Agriculture serving until 1959.

The purpose of the W. I. Myers Memorial Lecture is to bring to this campus an outstanding agricultural finance economist to lecture on a timely topic. The lecture is sponsored by the Cornell University Department of Agricultural Economics as a part of its continuing emphasis in agricultural finance.

CURRENT ISSUES IN AGRICULTURAL FINANCE: INFLATION, RISK, AND FINANCIAL INSTABILITIES

Peter J. Barry*

As in previous decades, the 1980s are bringing new challenges for farmers and their lenders in designing financial programs that sustain and foster the financial performance of farming operations and the well-being of farm families. These new challenges primarily arise from the effects of high, volatile inflation that combines with other patterns of change to substantially alter the complexion of financial planning and analysis in agriculture. The recent surges in inflation and interest rates have further tightened the relationship between the farm sector and forces in the general economy, international markets, government policy, and financial markets. Especially relevant here is the sharp deinsulation of costs and availability of farm credit from national market forces caused in part by inflation-induced regulatory changes affecting both private and public lenders. These changes provide new sources of financial risk for investors and borrowers in agriculture.

My purpose in this paper is to highlight some of the important factors that affect the financial structure and performance of farming operations under the current inflationary environment, and to consider their implications for research and policy. I review the current setting and present several viewpoints about the long-term financial outlook for the farm sector. Major emphasis is then placed on how the effects of inflation and risk are transmitted to farmers through financial markets, and some possible courses of action for relieving the adverse effects on farmers' financial performance. I also consider inflation's effects on farmers' capital investments (especially farmland) and their financing, as well as the influence of several regulatory changes on farmers' access to financial services through private and public channels.

Current Setting

Since World War II, the farm story nationwide is one of structural adjustment toward an industry of fewer farm units that are larger in size, but still have a non-corporate family orientation. Considerable labor resources moved out of farming and from rural areas, often removing sizeable amounts of equity capital. Mechanization, modernization, and

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capitalization of crop and livestock operations accompanied the growth in farm sizes. Farmers became more market oriented as a result of greater reliance on purchased resources and greater volatility in commodity markets. Greater emphasis has been placed on managing market risks through marketing policies and inventory management. Liquidity management came to the forefront as a principal means by which farmers cope with variations in cash flows that arise from uncertain commodity prices, yields, and production costs. Household needs also increased significantly and became less sensitive to yearly swings in farm income.

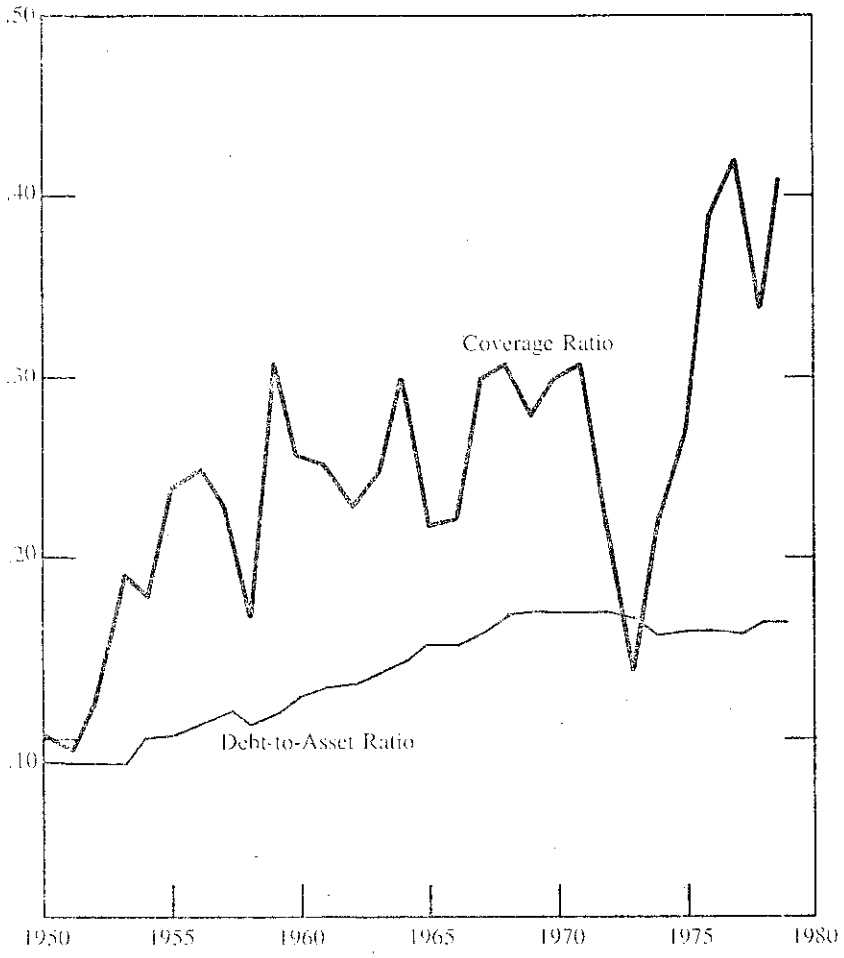
These factors, along with substantial increases in inflation, pushed up the use of debt capital in farming to far exceed earlier projections. At the national level, the annual growth rates for total farm debt increased from an average of 7.1% in the 1950s, to 7.9% in the 1960s, to 11.7% in the 1970s. From 1975 to 1980, the annual growth rate for total debt averaged 14.4% with non-real estate debt growing at more than a 16% rate and farm real estate debt growing at a 12% rate. These rates are substantially above the general inflation rates for the same periods, and since 1970, make farming the fastest growing sector in U.S. credit market debt. Only in 1980 and early 1981 has the growth in farm debt slowed due to the combined effects of low farm income and high interest rates.

The strong growth in farm loan demand along with substantial variability in farm incomes have increasingly tested the capacity of rural financial markets to provide the necessary loan funds. The stresses brought about by these conditions have fallen mostly on smaller banks that are heavily involved in farm lending, and on their farm and farm-related borrowers (Barry; Hughes, et al). Thus, the changing patterns for market shares of major farm lenders have indicated steady growth in lending by the Farm Credit System, fluctuation of market shares for banks and government lenders as farm income and financial market conditions change, and declining market shares for most other credit sources. Between 1975 and mid-1980, the liquidity pressures on agricultural banks increased sharply as evidenced by sharp declines in their market shares of farm debt. Those banks' shortfall in farm lending was more than displaced, however, by strong increases in farm lending by the U.S. Government, especially through various emergency loan programs. Thus, the balance in farm lending in recent years has shifted to heavy reliance on public channels.

The strong growth in farm debt implies that borrowing by farmers has become more aggressive, more sophisticated, more permanent, and more complex in credit evaluations. Loan losses in farming have been low and financial performance has been strong, finally reaching the point where the aggregate income generating capacity of farm units compares favorably to the nonfarm population on a per capita basis. However, much of farmers' total returns has occurred as capital gains on farm land and other assets. Thus, overall analysis of the financial position of farm businesses presents a paradox: a) a highly solvent industry due to unrealized capital gains on farm assets that collateralize the growth in debt; versus b) liquidity problems and cash flow pressures resulting from the low, volatile current rates of return.

Figure 1 demonstrates these contrasting positions by showing measures for stock and flow concepts of leverage based on aggregate U.S.D.A. data over the 1950 to 1980 period. The stock concept, measured by the debt-to-asset ratio, shows relatively low, stable leverage in the farm sector. The flow concept, measured by the ratio of interest paid to returns to farm assets, shows higher, more volatile leverage due to growing debt use, higher interest rates, and strong capital gains. Numerous limitations arise in using these aggregate data. Both measures exclude nonfarm income and assets; thus, additional funds from the sources may be available. They also combine the holdings of landlords and farm operators. And, these are leverage measures for all farmers, including those who are non-borrowers. Data for farmers who borrow from the Farm Credit System show higher leverage. Federal Land Bank borrowers in 1979 show an average debt-to-asset ratio of .33 for all borrowers, and an average debt-to-asset ratio of .40 for young farmers. Production Credit Associations show comparable leverage for their borrowers.

Figure 1. Annual Coverage Ratios and Debt-to-Asset Ratios, 1950-1980



These aggregate figures belie the distribution of farm debt among sizes and types of farms, as well as the concentration of commercial activity in the farm sector. Changes in the number, sizes, and capitalization of farm units mean that today (1979 estimates) about 30% of the 2.3 million U.S. farms--about 685,000 units--hold three-fourths of the farm debt and account for about 80% of the total income. In contrast, about one-third of the total farms had sales less than $5,000, making little use of debt and relying mostly on nonfarm income. The larger farming operations that hold most of the farm debt represent an additional paradox in their financial capacity and performance. They often experience bidding advantages for land, greater financial capacity for growth, greater debt servicing capacity, and possibly greater benefit from government programs. However, these larger, more highly-leveraged operations also become the most vulnerable to risks and have eventually needed, or at least sought, public assistance the most.

Financial Outlook

The overview of evolving issues in the farm sector omits other relevant factors, but it shows that farmers and their lenders have adjusted to a long series of events in recent decades that brought new types of management problems. A transition occurred from a heavy emphasis on production and productivity to include emphasis in the 1950s and 1960s on mechanization, growth in farm size, and the related financing needs; then to dealing in the early 1970s with more volatile commodity markets that, together with growing farm debt, brought substantially greater financial risks for many farmers; and now including the attendant problems of higher, volatile rates of inflation and interest.

The 1980s have begun with anticipations of high variability in farm income, especially from uncertainties about export demands for farm products and about the impacts of energy and transportation issues. In the national economy, there are uncertainties about how efforts to control an unacceptably high rate of inflation will affect financial conditions in the farm sector. In public policy, there are uncertainties about future directions of government price, income, and credit programs for farmers, although indications are that the credit and stabilizing components of these programs will have lower profiles than in the recent past. The near-term outlook indicates rather dismal prospects for farm income due to the combined effects of widespread drought conditions in 1980, strong production in 1981, mediocre livestock earnings, accumulations of indebtedness, and record high interest rates.

Prospects appear brighter in the long term, however. Most observers of the farm sector believe that the long period of pronounced structural change in sizes and numbers of farms in the U.S. has ended. This view was expressed recently by Dale Hathaway, a veteran analyst of agricultural policy and a high U.S.D.A. official in the Carter Administration. It also was a common theme that emerged from much of the discussion on "Structure Issues of American Agriculture" that marked Bob Bergland's term as Secretary of Agriculture. The outlook for the future (year 2000 and beyond)

suggests a slower-paced, but still prevailing movement toward a bi-modal distribution of farm sizes. According to U.S.D.A. projections, there will be many small farms, an ever-increasing proportion of large farms, and a declining proportion of medium-size farms (Lin, et al). For most types of farms, family operations should continue to predominate, although they will be more complex business organizations than in the past. Entry into agriculture may change to reflect the growing financial barriers, but once new operators are established the prospects for favorable financial performance should be strong. Part-time farmers with little farm output will dominate the small farm class. They will likely compete aggressively for small tracts of land, will continue to draw the attention of policy makers, and will have different types of financing requirements. The commercial component of future farms should have strong staying power, high quality management, and will be vigorous users of financial services.

Long-term projections point toward a strengthening of financial performance for the farm sector and more moderate growth rates for farm debt than occurred in the late 1970s. This set of projections is reported in the Agricultural Finance Review (1981) and was prepared by Dean W. Hughes, an economist with the Federal Reserve Bank of Kansas City and recently with the U.S. Department of Agriculture. He used a computer simulation model to evaluate how the financial performance of the farm sector would respond to several scenarios about future inflation and government involvement in agriculture. His baseline scenario assumes that the government's monetary and fiscal policies will reduce inflation from the double digit rates of 1980 to about 6% in 1990, and that the level of government involvement in agriculture (through commodity and food stamp programs) will be similar to 1980 levels in constant dollar terms. Other scenarios vary the government's involvement in agriculture and reflect continued high inflation.

The projections in Table 1 show that farmers' performance and credit needs respond more to inflationary conditions than to government involvement in agriculture. If government policies succeed in slowing inflation and expanding real output steadily over the next decade, the farm sector will likely be in excellent financial condition by 1980. After three or four years of low net farm incomes, real returns to farming should grow substantially later in the decade. This growth occurs from the combined effects of greater stability in livestock earnings, higher incomes of domestic consumers, lower inflation, and relatively stable, strong farm exports. Total farm debt for the baseline projection grows at an 11.3% annual rate over the decade, reaching $523 billion in 1990. The early 1980s should experience faster growth in debt (13.5% annually) with total farm debt reaching $341 billion in 1985. Farmers' aggregate debt-to-asset ratio eventually trends down as does the burden of interest payments from net farm income. Some of the increased farm income would be capitalized into higher real estate values causing the value of farm land to increase much faster (14% annually) than the value of non-real estate assets (7.8% annually). The need for government involvement in agriculture should be less, allowing it to focus on buffering fluctuations of commodity prices and providing farmers with inventory financing.

Table 1. Financial Projections for the Farm Sector

Model	1985	1990
I. Baseline		
Total farm debt, $ bill.	341	523
Debt growth, %/yr.	13.3	11.3
Debt-to-asset ratio	.193	.150
Net farm income, $ bill.	33.9	85.0
II. Low Inflation-Low Government		
Total farm debt, $ bill.	342	531
Debt growth, %/yr.	13.4	11.5
Debt-to-asset ratio	.194	.154
Net farm income, $ bill.	30.8	72.2
III. High Inflation-Low Government		
Total farm debt, $ bill.	378	919
Debt growth, %/yr.	15.3	17.2
Debt-to-asset ratio	.218	.273
Net farm income, $ bill.	22.3	3.2
IV. High Inflation-High Government		
Total farm debt, $ bill.	377	906
Debt growth, %/yr.	15.2	17.0
Debt-to-asset ratio	.217	.262
Net farm income, $ bill.	18.2	15.0

If, however, monetary and fiscal policies do not produce a healthy general economy, the farm financial situation will likely be very weak by the end of the decade. Slow growth and high inflation could create a severe cost-price squeeze that would reduce net farm income in both nominal and real terms throughout the decade. Total farm debt would rise to nearly $1.00 trillion by 1990 under poor economic conditions. Ratios of debt-to-assets and interest paid to net farm income would be much higher. Farmers' financing sources would shift toward increased government lending and other forms of public assistance. And the pace of structural change in farming would increase.

These projections are very sensitive to the farm sector's strong interdependence with conditions in financial markets, the general economy, and government policies, all of which are strongly influenced by inflation. A major point is the strong response of farm performance to nonfarm conditions that, in turn, are strongly influenced by inflation, and that are transmitted to the farm sector through both financial markets and other channels. The long-term trends appear favorable; however, the need remains to cope effectively with a near-term environment characterized by low farm income; uncertainty about farmers' costs and returns; high, volatile interest rates; inflation-induced liquidity problems on new farm investments; more complex financial planning; and instabilities in financial markets that are adjusting to new regulatory and market environments.

Inflation, Interest Rates, and Farm Financing

The deinsulation of farm credit markets from forces in national markets has strengthened and accelerated the transmission to farmers of high, volatile interest rates. Moreover, the revision of credit terms by lenders (shorter loan maturities, floating rates, more frequent rate adjustments) as their own response to inflation has contributed to this transmission. The general effects on farmers are adverse influences on profitability, risk and liquidity. These effects call for adjustments in farmers' portfolios" in order to restore an acceptable balance of profits, risk, and liquidity.

Inflation and Interest Rates

The relationship between inflation and interest rates has received much study, and it is commonly accepted that market interest rates reflect a premium for anticipated inflation that protects the lender's debt claim from loss in its purchasing power. Views differ about the degree of efficiency with which market interest rates reflect inflation (e.g. Wood); however, the general level of market interest rates does appear to track the national inflation rate fairly closely, when they are averaged over relatively short periods of time. Precisely measuring this track is difficult because published data on inflation are historic figures for a recent time period, while the inflation premium in market interest rates is considered an "anticipated" rate by the consensus of market participants for the future. Anticipated inflation need not equal historic inflation.

This close relationship between inflation and market interest rates means that much of the variation in market interest rates is due to variation in inflation rates and to related monetary actions of the Federal Reserve. The other components of interest rates--the real rate, a risk premium, and administrative costs--are considered more stable over time. Moreover, the Federal Reserve's shift in late 1979 from implementing monetary policy with an interest rate target to a target on growth in money supply has freed-up the short-term movement in rates. This change has increased the strength, speed, and efficiency with which financial markets transmit signals about inflationary conditions to farmers.

The form of this transmission of inflation through interest rates also differs from the effects of inflation on prices of other goods and services. Holding other factors constant, the level of interest rates only changes when the inflation rate changes. Thus, interest rates could remain constant at a high or low rate of inflation, if the inflation rate also remains constant. Interest rates may even decline in the presence of inflation, as long as the rate of inflation is declining. In contrast, prices of other assets, goods, and services may also change as inflation changes but, more importantly, they also continue to increase (in principle at least) at the new rate of inflation, even if that rate remains constant. Even if the rate of inflation declines, these prices will continue to increase, although at the lower rate.

To illustrate, if general inflation increases from a 5% rate to 10%, prices in general should increase by 10% rather than 5%. For interest rates, however, the 5% increase in general inflation is quickly added to the current market interest rate, thus yielding a much larger proportional increase which then holds at the new rate. If the original market interest rate is 5% and inflation increases by 5%, then the interest rate will increase to 10%--a doubling or 100% increase. If the original interest rate were 10%, a 5% increase in inflation would increase the market interest rate to 15%--a 50% increase.

These large proportional swings in interest rates mean that costs of credit exhibit relatively greater variation in response to high, volatile inflation than do other prices. This variation hampers financial planning especially for operations that make substantial use of debt capital. Thus, highly-leveraged farmers are strongly influenced by both the level and volatility of interest rates, both of which are strongly and uniquely influenced by inflation. Hence, efforts to reduce the level of inflation, or its volatility, or both will have important effects on farm financing and financial planning.

Interest Rates and Farmers' Financial Performance

Higher, more volatile interest rates have three major effects on the financial performance of farm businesses: a) higher interest rates reduce near-term profitability due to the narrowing of profit margins; b) more volatile interest rates increase farmers' financial risks because of uncertainties about the total debt obligation; and c) higher interest rates reduce liquidity by committing more of current cash flows to meeting financial obligations. Each of these interest rate effects is greater as a farmer's leverage is greater.

These effects are demonstrated analytically with a mean-variance portfolio model of a farm firm that yields a jointly optimal structure of assets and liabilities. By optimal, we mean that a farm's activities in production, marketing, investment, consumption, and financing are organized to yield the highest possible level of well-being for its decision makers as the unit moves through time in an uncertain environment. For analytical tractability, well-being is modeled in utility terms with expectations and preferences cast as expected utility maximization for a risk averse investor. Expected utility is thus a function of the desired trade-off (λ) in utility terms between the expected level ($\bar{r}_e$) and variance (σ_e^2) of returns to the equity holder.

$$1) \quad E\,[U(r_e)] = f(\bar{r}_e,\ \sigma_e^2,\ \lambda)$$

We formulate the portfolio model with an expected rate of return ($\bar{r}_a$) on farm assets (A) and an expected cost of borrowing ($\bar{i}$) on farm debt (D). Let the risk measures for asset returns and borrowing costs be shown

by their respective variances, σ_r^2 and σ_i^2, and by the covariance, $\sigma_{ri} = c\ \sigma_r\sigma_1$, between asset returns and borrowing costs, where c is the degree of correlation. For greater generality, let the relative proportions of assets and debt in the farm portfolio be expressed by P_a and P_d, respectively where $P_a - P_d = 1.0$. Thus, a balance sheet with \$200,000 of assets, \$100,000 of debt, and \$100,000 of equity would have $P_a = 2.0$ and $P_d = 1.0$.

The expected rate of return to equity ($\bar{r}_e$) for a leveraged farm business is then expressed as the expected returns to farm assets less the expected cost of borrowing, each weighted by their proportions in the portfolio.

$$2)\quad \bar{r}_e = \bar{r}_a P_a - \bar{i} P_d$$

Variance of returns to equity (σ_e^2) is the sum of variances on the returns to assets and the costs of borrowing less their covariance, with each weighted by the proportions of assets and debt in the portfolio.

$$3)\quad \sigma_e^2 = \sigma_r^2 P_a^2 + \sigma_i^2 P_d^2 - 2P_a P_d \sigma_{ri}$$

Thus, portfolio variance is inversely related to the correlation of asset returns and borrowing costs: the greater is the correlation, the lower is portfolio variance. In practical terms, returns to a farmer's equity will be stabilized by a positive covariance between returns to assets and borrowing costs. In contrast, opposite movements in asset returns and borrowing costs will destabilize returns to equity.

To illustrate numerically, consider the following values for these variables under different levels of leverage. Let the expected return on farm assets be 16% with a standard deviation of 6%, expected borrowing cost be 12% with a standard deviation of 3%, assume a zero covariance between borrowing cost and asset returns, and let the debt-to equity ratio range from .00 to 3.0. Measures of expected returns and risks are shown in Table 2 for the different levels of leverage. Higher leverage increases the expected returns to equity capital under these assumptions; but the standard deviation increases even faster, as indicated by the increasing coefficients of variation. The optimal portfolio provides the maximum expected utility, based on the trade-off between expected returns and risk for the relevant level of risk aversion (λ).

Table 2. Portfolio Measures for Risk and Returns for Alternative Leverage

Portfolio	Debt-to-Equity	P_a	P_d	Expected Returns to Equity	Standard Deviation	Coefficient of Variation
				%	%	
1	0	1.00	0.00	16	6	.38
2	.25	1.25	-.25	17	7.54	.44
3	.50	1.50	-.50	18	9.12	.51
4	.75	1.75	-.75	19	10.74	.56
5	1.00	2.00	-1.00	20	12.37	.62
6	1.50	2.50	-1.50	22	15.66	.71
7	2.00	3.00	-2.00	24	18.97	.79
8	3.00	4.00	-3.00	26	25.63	.99

Returning now to the effects of higher, more volatile interest rates on farm performance, suppose that the level of interest rates increases while all other factors stay constant. Moreover, the effects of income taxes are ignored. The effects on profitability are found by differentiating equation 2) with respect to a change in i. The result is

$$4) \quad d\bar{r}_e / di = -P_d$$

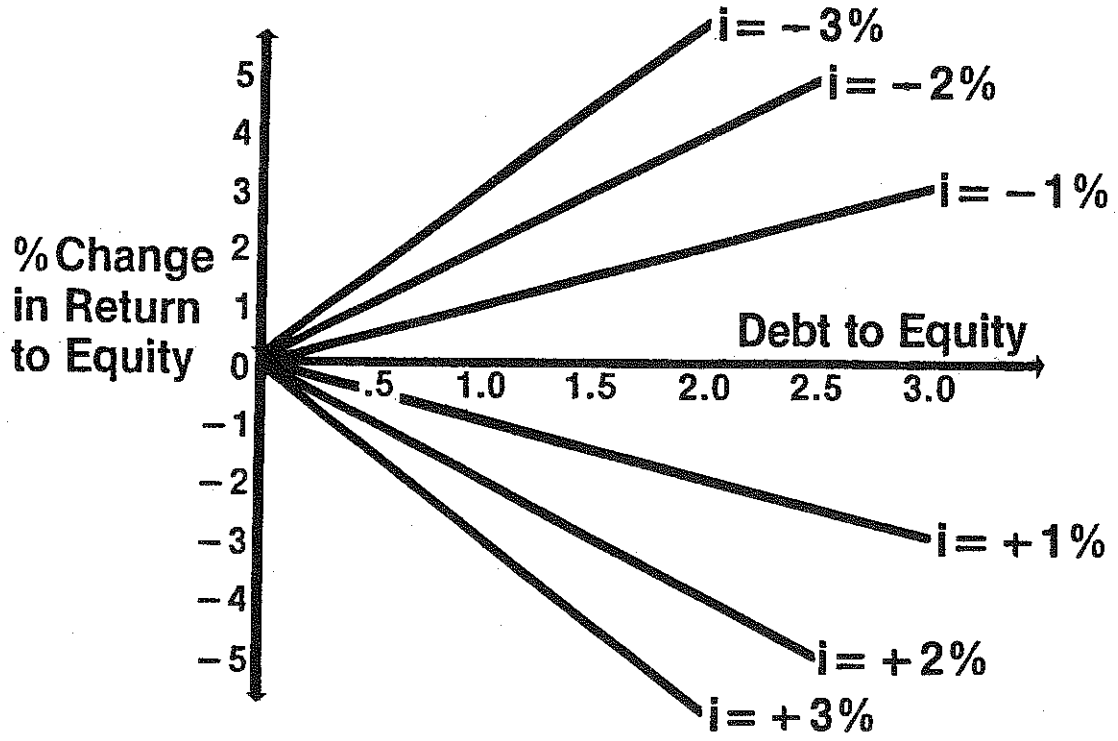
The negative sign indicates the decline in profitability at a constant rate. Moreover, since P_d is a direct indicator of the farm's debt-to-equity ratio, this result indicates a one-unit change in interest rates will cause a reverse change in the rate of return to equity by the amount of the debt-to-equity ratio. Thus, a general rule for the relationship between changes in interest rates and farm profitability is:

> The amount by which a farmer's rate of return to equity responds to changes in interest rates is equal to the negative of the product of the interest rate change times the farmer's ratio of debt-to-equity.

Suppose, for example, that the debt-to-equity ratios for Farmer A and Farmer B are 0.5 and 1.0 respectively. If the lenders' costs of funds and thus farm loan rates, increase by 5% (500 basis points), Farmer A's expected return to equity capital will decline by 2.5% (5% times 0.5 leverage) and Farmer B's return to equity will decline by 5% (5% times 1.0 leverage). If interest rates decline, however, the reverse effect occurs. Farmer A's returns increase by 2.5% and Farmer B's by 5%.

Figure 2 charts the relationships between returns to equity, changes in interest rates, and level of leverage. The downward sloping lines in the Figure show how profitability declines as leverage increases for a given increase in interest rates. They also show how the rate of decline increases for larger increases in interest rates. The upward sloping lines show how profitability increases as leverage increases for a given decrease in interest rates. The widening gap between the upward and downward sloping lines show the greater swings in profitability, and thus risk, for given changes in interest rates as leverage increases. Those profit responses to interest rate changes are simply another way of showing the higher risk associated with higher leverage.

Figure 2. Profitability, Interest Rate Changes, and Leverage



Next, suppose that the cost of borrowing becomes more volatile while other factors remain constant. This condition is shown by changes in the variance of borrowing costs, and perhaps through changes in their correlation with asset returns as well. If the correlation remains constant, the effects of greater variance in borrowing costs on total risk are shown by differentiating equation 2) with respect to a change in σ_i^2. This result is

$$5) \quad \frac{d\sigma_e^2}{d\sigma_i^2} = \sigma_i P_d - P_a c \sigma_r$$

The direction of change can not be clearly established without knowing the correlation between r and i, and the level of leverage. Clearly, total variance will increase when $c \leq 0$. For $c > 0$, however, there is some value of c above which total variance would decline in response to an increase in σ_i^2. This result occurs when the second term in 4) exceeds the first term. The value of c that equates these terms is

$$6) \quad \hat{c} = \frac{\sigma_i P_d}{P_a \sigma_r}$$

Continuing the numerical example, for a debt-to-equity ratio of 1.0, $\sigma_i = .03$, and $\sigma_r = .6$, the value of $\hat{c} = .25$.

Developing appropriate measures of risk for costs of borrowing is a complex task. The sources of variation arise both from forces in financial markets and from lenders' responses to risks in agricultural markets and changes in farmers' credit worthiness. Moreover, lenders' risk responses to differences in farmers' credit worthiness primarily occur in non-price ways rather than through adjustments in risk premiums in interest rates. While this practice appears to be changing over time, much of lenders' risk responses still occur through differing loan limits among borrowers, and differences in security requirements, loan maturities, loan supervision and documentation, and other means of credit administration. A recent study by C. B. Baker, L. R. Sanint, and me demonstrated one approach to measuring lenders' non-price responses to changes in farm income, and found that the nature of these responses implies a negative correlation between farmers' costs of borrowing and farm income. Most of this response was associated with the costs of borrowing for capital expenditures rather than operating loans. The negative correlation indicates that increased variation in farmers' costs of borrowing should unambiguously add to farmers' total risk by virtue of both the variance and covariance terms.

The case is less clear for the interest rate risks that are attributed to forces in financial markets. These forces are primarily reflected in changes in interest rates, which provide clearly visible

signals to farm borrowers about changes in market conditions. Moreover, the growing emphasis on floating rates by farm lenders is accelerating the pace with which changes in interest rates are transmitted to borrowers. Changes in costs and availability of credit that originate in financial markets are far removed from the farmers' operating environment. They influence, but are not influenced by, farmers' financial performance. They add variance to farmers' total risk, but are largely independent of changes in financial performance in the farm sector. Hence, the correlation between returns to farm assets and financial market forces should be near zero.

Finally, high volatile interest rates also reduce a farmer's liquidity by causing his financial obligations on servicing debt to increase faster than the growth in income for meeting these financial obligations. This disparity between growth in income and financial obligations is attributed to two factors. One is the unique relationship between interest rates and inflation (cited earlier) in which the inflation premium in market interest rates serves to compensate lenders for loss in purchasing power in their debt claim. The other factor involves differences in the kind of compensation required by lenders (a cash payment) and experienced by equity holders (both current returns and capital gains). These points will be developed further in a later section.

Managerial Responses to Changes in Interest Rates

This portfolio model provides a useful setting for evaluating how changes in the level and volatility of interest rates influence the optimal structure of assets and liabilities for a farm business, and the kinds of portfolio adjustments to consider in restoring optimality when changes in interest rate occur. The portfolio adjustments comprise an important part of the farms' policies about risk management. In this framework, risk management strategies refer to the mix of risk responses that are utilized in order to maximize expected utility. Risk responses are specific actions taken in anticipation of business and financial risks that contribute to the risk-averting goal. Included are actions to reduce the likelihood of risk occurrence, to transfer risks to other economic units, and to increase a firm's capacity to bear the consequences of risk.

The implementation of risk management occurs in several phases. The first phase is the formulation of strategies for coping with anticipated risks as a part of the firm's optimal portfolio. These include non-financial strategies in production and marketing such as product diversification, informal insurance, organizational flexibility, avoiding high risk enterprises, inventory management, forward commitments on prices and quantities, and information management. Also important are financial strategies that place heavy emphasis on management of leverage and liquidity in which farmers seek methods of generating cash quickly and efficiently in order to meet cash demands. Some typical methods of providing liquidity include: a) holding liquid assets for sale to meet cash demands followed

by later reacquisition; b) by holding liquid credit reserves with commercial lenders; c) altering the composition of assets through sales of capital items and/or postponements of capital expenditures thus generating funds for other uses; d) using public credit programs in periods of distress caused economic or natural factors; and e) using formal insurance. Other financial strategies focus on managing proprietary withdrawals and use of leasing, especially for land, as a means of sharing business risks.

A second phase of risk management involves the tactics used to implement these strategies when the distress conditions actually occur. The final phase is the restoration of the farm firm's capacity to implement these risk management strategies when the adverse conditions have passed. Especially difficult is the task of dealing with the emergence of new, unanticipated sources of risk that have no historic basis for measurement or assessment of feasible responses. The recent surges in levels and volatility of inflation and interest rates are vivid examples of new sources of risk.

To demonstrate the portfolio adjustment process, consider again the numerical example used earlier in which a farmer chooses an optimal portfolio based on a 16% expected return on farm assets with a 6% standard deviation, a 12% expected cost of borrowing with a 3% standard deviation, and a zero covariance between borrowing costs and asset returns. Let the optimal choice be portfolio 5. It has a debt-to-equity ratio of 1.0 and a coefficient of variation of .62.

Now suppose that changes in financial conditions increase the level of interest rates to 14% and the standard deviation of interest rates to 6%. The original portfolio becomes non-optimal. Its coefficient of variation increases to .75, indicating excessive risks for the expected rate of return. Thus, the composition of the previously optimal portfolio must be revised in order to restore optimality. Moreover, if the changes in interest rate parameters are considered permanent, so must be the portfolio adjustment.

How portfolio adjustments actually occur in farm businesses and how they are evaluated in the decision process are largely empirical questions. They depend heavily on the characteristics of farming operations, on their markets and legal environment, and on the responses of lenders and others who hold financial claims on the firm. Nonetheless, the general features of portfolio adjustment involve the implementation of financial and non-financial strategies of risk management that were previously discussed. One kind of portfolio adjustment focuses on changes in financial risk by modifying the claims that comprise the firm's liabilities. Another kind focuses on changes in the firm's assets which primarily influence its business risks. Reducing business risks appears to be independent of the firm's financial organization, although the possible responses of lenders and other financial claimants to changes in

non-financial activities need to be considered. Finally, trade-offs among risk responses in managing both assets and liabilities are also an important part of the portfolio adjustment process.

In the practical world of farm lending, the responses to the current environment of higher, more volatile interest rates involve the farmers and lender working together to design financially feasible business plans for the next production period. One approach is to build a wider safety margin in the farm's financial program in order to accommodate the higher, more volatile interest rates. The range of choices is essentially the same as those used to cope with many other types of farm risks. However, the recent emergence of the interest rate problem and its current urgency call for methods that can be quickly implemented without disrupting a farm business too severely. These methods can be categorized and evaluated in terms of their effects on the components of the portfolio model.

1. Variance of returns to farm assets

   Improved financial planning is essential in times of stress and instabilities. The quality of expectations is improved and the degree of uncertainty is reduced. Cash flow budgets and pro forma financial statements need careful documentation with sensitivity analysis to evaluate how changes in important parameters influence business performance. The payoff from many other choices in risk management become more important as well: forward and futures contracts, inventory management, public price support programs, cooperative marketing, and diversification. These are mostly long-term responses to risk, but they contribute to the development of improved management, and enhance the quality of expectations.

2. Level of returns to farm assets

   Improved productivity based on efforts to increase yields and production efficiency are valid points to consider; but their demands on time and management skills make them part of a long-term strategy rather than resolving a crisis situation. Improved cost control and reduced spending will reduce borrowing needs and conserve cash for other purposes. Shopping around, bargaining more vigorously, and considering used machinery are parts of this response. So is selection of enterprises with less cash demands for operating expenses. These may enhance short-term profitability, but also erode away the potential for long-term performance.

   Stronger control of proprietor withdrawals for consumption, taxes and other purposes is also important. Expenditures for farmers' family living can be closely monitored and reduced if necessary; but today's farmers have much less flexibility in adjusting family living than in the past.

3. Level of interest rate

The actions for lowering farm interest rates are limited. The relatively-wide rate spreads among farm lenders offer farmers some flexibility in choosing among lenders. However, the costs of sacrificing a sound long-term relationship with a lender in return for short-term savings in interest rates may be high.

Refinancing or restructuring heavy current or intermediate debt into longer-term debt for more orderly payoff at possibly lower rates warrants consideration, especially when long-term credit reserves have grown from land appreciation and the farmer's future profit prospects are favorable. Individual farm lenders cannot do much about the high levels of inflation and interest rates for their farm customers, unless they can effectively price discriminate among major types of loans or among individual customers. Searching for lower-cost sources of funds is appropriate. In 1981-1982, for example, commercial banks should benefit from the new "All Savers Certificate" with limited non-taxable interest to depositors and with 75% of these funds earmarked for agricultural and housing loans.

4. Variance of interest rates

Farm lenders should also be able to design loan pricing schemes that reduce the volatility of interest rates on farm loans. Setting rates based on average costs of anticipated funds is one type of price stabilization program. So is use of a pool of marginal funds rather than a single source in setting rates. Allowing a longer period for measuring loan performance is consistent with these practices. Even using fixed-rate loans with an additional premium to compensate for the lender's interest rate risk may be more preferred by farmers than highly volatile, floating rate loans. Other innovations in pricing also warrant consideration.

Use of financial futures for reducing variability of interest rates warrants consideration as well, although the managerial requirements are high and the relatively-large denominations and infrequent contract dates make financial futures less suited for most types of farming operations.

5. Structure of assets and liabilities

Reducing financial leverage and thus indebtedness will also reduce interest payments. However, reducing debt quickly requires other changes in the business organization to generate the cash for loan payments. Postponing capital expenditures, including asset replacements, is a favored

financial control mechanism that has the multiple effects of avoiding large financial outlays, building equity and reducing indebtedness, and strengthening productivity and profitability in a rapidly-growing operation. Thus, postponing capital expenditures is a high priority action under stress conditions.

Willingness to liquidate assets for partial or total debt repayment is another important risk response under crisis conditions. Drawing down financial reserves is the first step. Selling current business assets is also part of a business's ordinary operations. Selling part of the operation's capital assets is a last resort effort although depleting livestock herds often is a common part of their cyclical performance. Selling a tract of land is especially stressful. Nonetheless, asset sales can generate larger amounts of cash more quickly than do most other types of risk response.

Leasing rather than purchasing capital items, perhaps with an option to buy, could be less burdensome than ownership if rental rates compare favorably with credit terms. Using share rents rather than cash rents reduces farm risks and lets the landlord share in short-term financing as well. If cash leases are used, negotiations on advance payments and other rental terms are essential in reaching an equitable agreement between landlord and farm tenant.

Finally, additional pledges of collateral, use of government loan guarantees and other insurance programs, and co-signees on notes are examples of other actions that reduce the lender's uncertainty about loan repayments and thus moderate the cost of borrowing.

The feasibility of implementing these risk responses will vary with the characteristics and problems of individual farming operations. However, considering these options gives a broad framework for adapting them to specific farm situations.

Inflation, Capital Investments, and Long-Term Financing

Inflation has also brought unique effects on farmers' capital investments, especially in farm land, causing cash flow pressures and severe liquidity problems on occasion for farmer and lender alike. The asset structure of farming is uniquely characterized by the dominance of farm land and the tendency for farm income to be capitalized into land values that appear high relative to current earnings. Thus, profitability in farming has long been characterized by relatively low rates of current returns to farm assets, and a tendency for land values and net worth to increase substantially over time. This situation has made farm land appear "over-priced" relative to its current earnings. It also makes highly-leveraged investments in land appear financially infeasible when expected cash returns

in early years fell short of debt servicing requirements. In response, numerous defensive practices are followed by farmers to cover the financing gap: postponing investments to build additional equity, lower family living, generating cash from other earnings, occasional sales of assets, periodic refinancing, use of government programs, and borrowing from short-term lenders to meet long-term payments. Older, well-established operators or nonfarm investors are usually better able to use these approaches than are younger operators.

However, new understanding of valuation concepts under inflation and new empirical evidence are coming forth to suggest that farm land likely is more reasonably priced relative to its recent patterns of earnings' growth than is commonly believed. These developments indicate that unrealized capital gains in land (and other assets) should logically be treated as part of the total returns to farm assets. In addition, Martin Feldstein has shown how current practices in income taxation--cost based depreciation and ordinary income versus capital gains--may cause values of non-depreciable assets like land, gold, and housing to rise faster than values of other assets when inflation rates are rising. These relationships between earnings' growth, inflation, and capital gains mean that modifications of financing programs and debt repayment plans to more formally account for the effects of inflation may be very appropriate responses to inflation-induced liquidity problems. The concepts involved here are similar to the "growth stock" phenomenon in equity markets, and are rather complex. However, the fundamentals can be illustrated in a simple capitalization model. The basic approach to asset valuation is to estimate an asset's current market value by capitalizing its flow of expected future earnings at an appropriate interest (or capitalization) rate. The procedure is expressed in the following formula.

$$8) \quad V = \frac{P}{i-g}$$

where V is the asset's current market value; P is an estimate in today's (current) dollars of the net earnings attributed to the asset in each future period; i is the nominal capitalization rate; and g is the annual rate of earnings growth, considered here to be the same as the inflation rate.

The asset value is found by dividing the asset's real earnings by the difference between the capitalization rate and the inflation rate. If, for example, an acre of farm land is expected to yield a real rent of $120 in perpetuity, the capitalization rate is 14%, and the growth or inflation rate is 10%, then the land value is $3,000 per acre. The effect of inflation is to partition the investor's total return, i, into two parts--a current return, P/V, and a capital gain g. To see this, we solve the preceding formula for total return i

$$9) \quad i = P/V + g$$

In the numerical example, the investor earns a total return of i = 14%. However, the total return consists of a current return of 4% = (120/3,000) and a capital gain of 10%. Moreover, as growth in earnings increases resulting in real growth, the capital-gain portion of the total return increases and the current-return portion decreases. Finally, if the valuation process is repeated a year later, the asset value V is found to increase at the annual inflation (growth) rate. Thus, these unrealized capital gains caused by inflation or other factors that cause growth in earnings, should be treated as part of the total return to farm assets.

These concepts about asset values and earnings growth lead to a perplexing paradox about efforts to increase earnings in agriculture. Suppose, for example, that a technological breakthrough in productivity caused real farm earnings to grow at a faster rate. Or, earnings' growth could accelerate as a result of changes in government policies or more substantial international trade agreements. The following effects might occur: 1) the total rate of return on farm assets will increase; 2) the faster growth of farm earnings is capitalized into higher asset values; 3) current rates of return to farm assets decline; 4) capital gains increase; and 5) liquidity problems are worsened, especially on new investments by highly-leveraged farmers.

What does the empirical evidence show about past rates of earnings' growth for farmers? E. O. Melichar, an agricultural finance economist with the Federal Reserve Board of Governors, gives an excellent comprehensive view of the situation. He uses the capitalization model approach to contend: a) that farmers' returns to assets experienced real growth of about 4% per year over the past two decades; b) that farm land prices increased to reflect this real growth plus the general inflation rate; and c) that liquidity problems may occur for highly-leveraged farmers because growth in farmers' real income makes more of their return occur as capital gains relative to current income.

Similar evidence in Illinois comes from comparing growth rates for various types of farm earnings with data from the Illinois Farm Business Farm Management Association. In this case the data are for FBFM grain farms that fell in the 340 to 500 acre size class over the 1960 to 1980 period. Table 3 reports geometric means of annual growth rates for four measures: 1) current returns to farm assets; 2) current returns to farm land; 3) values of Illinois farm land; and 4) general inflation as measured by the Consumer Price Index. "Asset returns" is a residual figure found by subtracting charges for the farmers' management returns from the FBFM published figure for "capital and management earnings per acre." "Land returns" go farther by deducting from "asset returns" a charge for returns to non-real estate assets, figured at the U.S. Treasury Bill rate. Changes in land values are based on USDA data. The important comparisons are between the growth rates for land values and the growth rates for asset returns and land returns. These growth rates match up fairly closely, on a before-tax basis. The average annual growth rate for land values was 9.98% over the 20 year period, compared to an average growth rate of 8.15% for asset returns and 6.13% for land returns.

All three figures exceed the average annual inflation rate, thus showing real growth in their respective series. These same relationships occur for the 1970s, but with a greater margin between the growth rates for land values and current returns. As was expected, the annual changes in the series of current returns showed much more variability than the annual changes in land values.

Table 3. Annual Growth Rates, Illinois Data, 1960-1980

Time Period	Land Values	Returns to Farm Assets	Returns to Farmland	Consumer Price Index
		Percent		
1960-1980	9.98	8.13	6.13	5.25
1960-1970	4.19	4.46	2.49	2.74
1971-1980	16.09	11.93	10.00	7.82

Consider now the liquidity problems that arise under inflation. Two types of liquidity problems may arise for leveraged investors who purchase farmland subject to expected earnings' growth. One liquidity problem occurs because current earnings are a smaller proportion of the return-to-equity compared to capital gains. The other liquidity problem arises from differences in the kind of compensation required by lenders and experienced by equity holders (farmers). Lenders require all of their scheduled compensation--interest and principal--in a cash payment, of which part is a real return and part is an inflation premium needed to compensate for anticipated loss of purchasing power. The borrower, however, experiences only part of his return as a current payment; the rest is capital gain. Thus, he experiences a financing gap in having insufficient cash from the assets' early earnings to meet the debt payments. This liquidity problem arises even when anticipated inflation actually occurs. The borrower's equity position grows favorably, but not his cash position. Thus, he resorts to one or more of the defense practices cited earlier in order to resolve the liquidity problem.

Most of these defense practices disrupt the business in some fashion, and alter its leverage and reinvestment policies. An alternative approach under inflation is to modify payment policies on debt so that over time the investor can maintain a target leverage while still paying appropriate interest on debt. At one extreme, this could be accomplished by using the proceeds of new borrowing to compensate the lender and to maintain the firm's target leverage in response to the growth in equity from inflation-induced capital gains. In effect, the principal and interest portions of the loan are indexed to inflation with the increase in loan balance

offsetting the inflation premium in the loan rate. In the process, debt obligations are fully met, liquidity problems are resolved, and the real financial positions of lender and borrower remain the same. There is no need to divert other earnings to meet loan payments; there is no need for short-term loans to meet long-term payments; and there is no "bail-out" of the farm operation.

An alternative to inflation-indexing is to specify full amortization of long- or intermediate-term debt according to an inflation-adjusted repayment scheme. Most such schemes are designed to alleviate cash deficits and financing gaps early in the repayment period. Numerous schemes are possible: graduated payments, purchasing power mortgages, partial amortization, interest only, variable maturities, and combinations thereof.

These plans may be more administratively feasible to lenders, since they involve full amortization of the loan instead of permanent indebtedness. They also can be tailored to selected types of borrowers, and tied to loan insurance or other kinds of risk protection for the parties involved. Even equity participation loans are under consideration by some long-term lenders in which loan compensation occurs in part by sharing the appreciated value of the property being financed.

These financing programs involve liquidity responses to inflation that warrant careful consideration. They depart sharply from traditional amortization methods based on fixed-payment or declining-payment loans. They also shift the emphasis in credit evaluations more toward evidence of managerial skills and financial progress, and away from repayment history and strict reliance on cash flows. But, these innovative financing programs warrant consideration because they are natural phenomenon to expect in inflationary times. They contribute to the development of skills in financial management. Finally, these financing programs are relevant to banks and other non-real estate lenders not only because they are appearing on the scene, but because they transfer some of the risk and liquidity bearing functions back to the long-term lender where the problems originated.

Concluding Comments

The effects of inflation, and instabilities in financial markets have added substantially to the complexity of financial planning and analysis in agriculture. Moreover, the pattern of deregulation in financial markets and its pro-competitive effects on financial institutions should continue to bring relatively high volatility in interest rates and greater precision in loan pricing in the future. Some relief should occur if the Reagan Administration's policies are successful in reducing the nation's inflation and stimulating steady output growth over the next decade. However, whatever are the outcomes of these public policies, inflation will probably continue to hold a more prominent profile in the U.S. economy than occurred in the distant past. Thus, we must be more aware of how inflation impacts on farm financing and how to respond to it.

The dominance of real estate and other capital investments in the asset structure of farming along with anticipated growth in farm income over the long term should continue to bring much of farmers' total returns in the form of capital gains. This condition along with the customary swings in farm income from year-to-year will sustain the habitual liquidity problems in farming and continue the reliance on credit reserves and debt management to see farmers through periodic liquidity crises as well as to support their ongoing operations. The needs will increase to bring financial management and innovations in financing programs more to the forefront in countering business and financial risks in agriculture. Permanency in debt use by farmers may better be regarded as the rule than the exception, with financing programs increasingly designed to accommodate the combined effects of capital gains and variable current returns. Whether to expand farm size by owning or renting land will remain a critical choice, although the important role of long-term credit reserves generated by growth in land equity tends to favor at least partial ownership as an important strategy for growth and risk bearing.

The balance is also shifting away from the use of credit reserves provided by government programs. This balance is an unstable one, however. The last decade witnessed a withdrawal of public programs in the early years, followed by substantial growth in the U.S. Government's share of farm debt especially through various emergency loan programs. Now, the Reagan Administration is seeking to reduce the volume and degree of subsidy in FmHA programs, and largely return its role to a lender of last resort for farmers. Interest rates will be tied more closely to the Government's costs of funds. These changes in Government's credit programs are based on several factors: a) the need to reduce taxpayer's costs; b) a stronger long-term financial outlook for farmers; c) expanded use of new Federal crop insurance for disaster protection; d) more effective use of loan guarantee programs; and e) greater innovation by commercial lenders in acquiring loan funds and countering risks in agriculture.

The net result is a pull-back of the public safety net for farm lending, and greater concern about problem credit situations when FmHA cannot step in. In contrast, credit supplied by the Commodity Credit Corporation likely will not change much. Their programs represent a sophisticated financial control system that combines buffering of price fluctuations for many commodities with valuable liquidity from inventory financing and greater flexibility for farmers in marketing their crops.

Clearly, these are challenging, unique, and even exciting times in agricultural finance.

REFERENCES

Barry, P. J. "Prospective Trends in Farm Credit and Fund Availability: Implications for Agricultural Banking." Future Sources of Loanable Funds for Agricultural Banks, Federal Reserve Bank of Kansas City, 1981.

Barry, P. J., C. B. Baker, and L. R. Sanint. "Farmers' Credit Risks and Liquidity Management." Amer. J. of Agr. Econ., 63(1981):216-227.

Hathaway, D. "Government and Agriculture--A Review of Two Decades of Change." Amer. J. of Agr. Econ., 63(1981):forthcoming.

Hughes, D. W. "An Overview of the Farm Sector Capital and Credit Needs." Agr. Fin. Rev., 41(1981):1-19.

Lin, W. G., G. Coffman, and J. B. Penn. U.S. Farm Numbers, Sizes, and Related Structural Dimensions: Projections to Year 2000. TB-1626, U.S. Department of Agriculture, Economics, Statistics and Cooperative Service, July 1980.

Melichar, E. O. "Capital Gains vs. Current Income in the Farming Sector." Amer. J. of Agr. Econ., 61(1979):1085-1092.

Structure Issues of American Agriculture. U.S. Department of Agriculture, Economics, Statistics and Cooperative Service, Agr. Econ. Report 438, 1979.

Wood, J. "Inflation and Interest Rates." Economic Perspectives, Federal Reserve Bank of Chicago, August 1981.