FINANCIAL INTERMEDIATION IN AGRICULTURE: A SUGGESTED ANALYTICAL MODEL*

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Money and capital markets exist to provide an exchange system for debt and equity instruments–money substitutes with time dimensions[11]. This financial intermediation process is a two-way flow. The funds-flow originates with savers and terminates with the ultimate borrowers or users of the saved funds. The securities flow originates with ultimate borrowers and ends with primary savers. In addition to savers and borrowers, the principal participants are the financial intermediaries: those firms in which (a) claims on and to others dominate among assets and liabilities and (b) economic activities center upon the purchase and sale of such claims [2].

Generally, effectiveness of financial intermediation in American agriculture is evaluated from the standpoint of the farmer's demand for capital. When imperfections exist which prevent farmers from obtaining sufficient capital for optimum organization of their business, suggested revisions in the intermediation process arise. The evaluation of such revisions is often inadequate because it fails to account for the profit motivation and other objectives of the intermediaries. The asset and liability management of rural banks, for example, is conditioned by returns, risk, liquidity, and other relevant factors in the same fashion as the decisions of savers and borrowers. Hence the decisions of rural bankers and managers of other intermediaries, who are concerned with maximization of their objectives, exert a dominant influence on the flow of loanable funds to agriculture.

Our objective in this paper is to set forth a framework, or planning model, by which to evaluate farm lending alternatives with respect to optimizing behavior of an individual financial intermediary. The first step is to describe the external setting in which intermediation occurs: changing characteristics of savers and borrowers, and the overall environment of intermediation.

THE SETTING

Apparent Trends in Farm Based Securities

Basically, the farmers' demand for loan funds arises from the productivity and price of resources. Capital productivity reflects the expected marginal value products arising from loan funds as they are allocated among the farmer's various investment opportunities. Costs of capital reflect the interest rates associated with borrowed funds and the reservation prices on the farmer's unused credit capacity: a measure of his debt aversion [3].

Important changes have been occurring among farm borrowers which materially affect the demand for loan funds. Simple ratios help to tell the story. First the level of borrowing per farmer increased by nearly eight-fold from 1950 to 1969. This increase arose from both the larger capital investment per farm and from the changed ownership structure growing out of the decline in number of farms. The number of farm borrowers declined by more than one-third during this period while the average investment per farm increased to over five times the 1950 level. Perhaps more significantly, the ratio of total farm debt outstanding to net farm income increased from .737 in 1950 to 2.74 in 1969.

While capital investment per farm has increased, there appears to have been a reduction in the overall liquidity position of the farms' capital structure and general organization. This has occurred because of the

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increased investment in durable assets (machinery, equipment, buildings) which have increasingly specialized uses and longer payback periods.

Finally, substantial evidence indicates that the total demand for farm loans is increasing faster than the level of economic activity (e.g., deposit growth, local savings) in rural areas [6]. In addition, individual borrowing needs in rural communities may often exceed the lending limits of many local intermediaries [9]. These types of changes, together with projections of large farm capital and credit needs in the future [5, 10], give rise to the need for potential revision in financial policies from both the farmers' and the local intermediaries' point of view.

Trends in the Supply of Savings

The supply of loan funds stems from the original savers: individuals, governments, and private businesses. They save for a variety of reasons: variations in cash flows, wealth accumulation, large consumption expenditures, and highly liquid, contingency reserves. Furthermore, they may choose to save through a variety of financial instruments: bank deposits, insurance and pension contributions, stock or other ownership purchases, and direct lending through bonds or debentures. These financial instruments vary greatly in terms of their liquidity, yield, and risk as do the preferences of the savers. Hence the final decision of savings allocation rests with each individual's assessment of the importance of these factors to him.

Several interesting changes have occurred among savers. Of particular relevance to financial intermediation for agriculture is the increasing geographic concentration of savers, and their volume of savings, in metropolitan areas near the large money-market centers. A large portion of their savings are channeled through pension plans, social security, and other contractual savings plans. While these means of savings are quite risk-free, they are illiquid and only generate distant future returns. Over and above these "fixed savings," savers tend to save in relatively small amounts with a preference for a high degree of liquidity in the securities they buy. Needless to say this concentration of urban savings is not readily available to farm borrowers.

Even with the recognition of these types of changes, it is difficult to say how the preferences associated with savings compare with the securities farmers offer to obtain the loan funds. On balance, the securities which farmers have to sell are increasing rapidly in both their total volume and in the average size of loans per farm at a time when an increasing number of people are saving small amounts per person. Furthermore, farmers' securities are becoming less liquid while savers desire greater liquidity in their investment. And with the exception of direct negotiation between parties in financing farm land purchases, farmers must rely on some form of financial intermediary to obtain adequate loan funds.

In general there has appeared to be a reasonably good match-up of long-term savings plans (bonds, insurance) with long-term loan demand. Also the framework exists for a reasonable match-up of short-term savings (bank deposits) with short-term loan demands although the increasing loan sizes and separation of borrowers and savers may pose serious problems. Another significant problem area occurs with satisfactory financing of depreciable assets. The financial markets are still not providing farmer borrowers with loans which satisfactorily meet their intermediate term needs.

Financial Intermediaries: Functions, Structure, and Performance

The functions of financial intermediaries are to assemble funds from savers, aggregate them into large units with uniform time dimensions, and channel them to borrowers who may be in different geographic locations. In addition, the intermediaries must modify the liquidity and risk properties of both the farmer's securities and/or the saver's preferences to make them compatible. By means of pooling the activities of large numbers of savers and borrowers, the intermediaries can reduce the expected variations associated with these activities and commit funds for longer periods of time. Moreover, the intermediary may use some type of insurance program or even its own financial strength to modify risk for savers and borrowers.

Significant structural differences exist between and within types of intermediaries which help to explain differences in performance. The intermediaries include varying numbers of privately owned firms, private individuals, agribusinesses, government agencies, and farmer owned cooperatives which specialize in agricultural loan policies. The structure of the banking system, for example, is quite heterogeneous and changing. State regulations vary with respect to unit and branch banking and combinations thereof. The flow of funds also varies within each structure. Even unit banking has been modified to approach the effect of branching through correspondent relationships, mergers, joint ownership, and formation of bank holding companies. Other types of market coordination between intermediaries have arisen in the form of bank-agribusiness agreements; mutual financing

ventures between the Farm Credit System, Farmer's Home Administration, and commercial banks; participation loans; and proposed formation of secondary markets for agriculturally based instruments. All these types of market coordination tend to mobilize the flow of funds.

The performance of the financial intermediation process can be assessed in terms of its overall efficiency in the allocation of funds and its ability to perform the other functions specified earlier. In terms of economic theory, maximum efficiency criteria specify that the productivity of capital must be equalized at the margin for all well-informed users and in all geographic areas. This criteria assumes, of course, that all lenders have equal knowledge, opportunity, and willingness to allocate funds where their returns to capital are highest (after adjusting for risk and differences in loan cost). Limited empirical research [9] has indicated that not all farm types, investment opportunities, or geographical areas in agriculture appear to be effectively linked to the money market. A study by the Federal Reserve Bank of Kansas City demonstrated that significant differences exist among areas in interest rates charged on farm loans for similar purposes, among farms of similar size and for loans with similar risk and asset security [7].

In addition there is some evidence that interest rates are rather inflexible relative to loan purpose, length, and risk [1]. While there may be some small fluctuations in interest rates from specific lenders for these loan characteristics, the rates generally change only as general economic conditions change. The primary way in which lenders respond to varying loan purposes and risks seems to be in varying loan limits for these characteristics. From the farmer's standpoint the rate may only show a large increase if he exhausts his conventional loan sources and must then move to higher cost sources.

Numerous legal, institutional, and behavioral impediments exist in the intermediation process. Also, numerous alternatives have been proposed for overcoming or removing these impediments in order to improve the functioning of the intermediation process. However, there has been little effort to develop models of financial intermediaries which will reflect real world decision-making situations and serve as testing grounds for measuring quantitatively the impacts of proposed changes in financial intermediation. Indeed, new proposals in financial intermediation may fall upon deaf ears or be regarded quite differently from the risk-return standpoint of the lender.

A DECISION MODEL

The elements of decision-making situation for a financial intermediary are similar to those of any other economic unit concerned with the efficient allocation of resources. The intermediary must consider its exogenous environment, its objectives, alternatives for achieving objectives, resource limits and other constraints, and technical rates of constraint use. Furthermore, the composition of these elements may differ with the planning horizon. We will illustrate this modeling process in the context of some recent research efforts with rural banks [4, 8].

The decision elements for the model bank are cast in terms of an N-period linear programming model which yields a mutually optimal solution for asset and liability management decisions. Components of the model are identified for two periods in Table 1. The annual periods may be divided into sub-periods to permit detailed intrayear cash flow. The columns and rows for respective periods represent blocks of activities or constraints. Hence the letters refer to submatrices of coefficients. Interperiod transfers are shown for relevant assets and liabilities. Appropriate data for these coefficients can be collected based on historical or projected performances of the individual bank and on its legal and behavioral constraints.

The objective to be maximized is specified as the present value of the bank's asset equity at the end of the planning period plus the present value of dividends paid to stockholders during the planning period. The objective is constrained by resource limits on assets and liabilities as well as tax, legal reserve, and internal policy requirements. Cash rows account for the cash flow of the business over time. Liability rows introduce the beginning debt structure and account for all factors influencing the level of the various deposits and equity flows. Asset rows introduce the bank's initial assets and account for all factors which influence the level and growth of the respective assets over time. For example, right-hand side values may indicate limits on external loan demand. Borrowing rows limit the bank's external borrowing. Tax bracket rows account for all activities which affect taxable income.

External requirement rows reflect the legal cash reserve requirements and the capital-liquidity position as assessed by bank examiners. Internal policy constraints reflect any of the bank's preferences regarding the disposition of its portfolio relative to its liability position.

Activities in the model can be designated as choices in liability management, asset management,

Table 1. OUTLINE OF LINEAR PROGRAMMING MODEL USED IN ASSET AND LIABILITY MANAGEMENT OF A RURAL BANK

	LIABILITY MANAGEMENT				ASSET MANAGEMENT				CONSTRAINT		
Constraint	Deposit transactions	Deposit transfer	Capital surplus transfer	Borrow and repay	Buy securities	Sell securities	Transfer securities	Make loans	Pay taxes and dividends	Relation	Level
Objective			$\frac{C_N}{(1+R)^N}$						$\frac{Cn}{(1+r)^n}$	E	Max.
Period n[a]											
Cash	±A			-1	AFi	-A		AFi	DT	E	B
Liabilities	±A	1	1		F			-F	1-DT	E	B
Assets					-A	A	1	-A		L	B
Borrowing				1						L	B
Tax and profit	A			i	-i	±G		-i	1	L	B
External Cash	±A	A			F			-F		E	B
Capital-liq.					A			A		L or G	B
Internal policy	±A				A	-A		A		L or G	B
Period n+1[a]											
Cash				1+i			-i	-(A+i)		E	B
Liabilities		-1	-1							E	B
Assets							-1	A		L	B
Borrowing										L	B
Tax and profit				i			-i	-i		L	B
External Cash		-A								E	B
Capital-liq.							A			L or G	B
Internal							A			L or G	B

[a]n = respective period (1 . . . . N).

and payment of income taxes and dividends. Traditionally banks viewed their liabilities largly as fixed with primary emphasis on asset or portfolio management. More recently, alternatives in liability management have become significantly important in their contribution to bank objectives. In fact there is likely to be a "feedback" from some types of asset allocations and the growth of sources of funds or liabilities for the bank. Bank deposits, for example, depend on both the activities of the bank and on the level of business activity in the community. Also, the level of business activity depends upon the bank's behavior. In effect, this involves a trade-off between immediate rate of return and increased volume of business. Thus a banker might be inclined to allocate funds to loans which have a lower net yield than municipal bonds, for example, if he feels the loans will lead to increased bank deposits and volume of business over time. As will become evident, coefficients reflecting these "feedbacks" are an integral part of the model.

Liability management alternatives include all activities related to deposit transactions, liability transfers, and borrowing. A variety of deposit alternatives exist, some of which are highly liquid with only administrative costs; others are time constrained, with interest as well as administrative costs. Thus coefficients in the deposit activity reflect the influences of expected receipts, withdrawals, and deposit costs on cash flow, taxable income, required reserves, and bank policy constraints. Vectors are provided to transfer liabilities from season to season and period to period and, in the case of capital and surplus, to the objective function at the end of the planning period. Borrowing activities reflect the acquisition of funds from the "Fed," correspondent banks, federal-funds, FICB discounts, certificates of deposit, and other relevant borrowing sources.

Asset management alternatives include investment in government or corporate securities and loans to farmers, farm-related firms, non-agricultural business loans, consumer installment loans, etc. Securities are characterized by a wide variety of instruments (e.g., bonds, debentures, secured and unsecured notes) with varying maturities. Each alternative has risk, returns, and liquidity attributes associated with it. The purchase of a security adds to assets, reduces cash and reserve capacity, and through interest received, adds to cash and taxable income. In addition, the feedback effect (F) of the purchase of

securities reduces the inflow of deposits, liabilities and cash reserve requirements. The sale or maturation of securities increases cash, reduces assets, and modifies the policy constraints. In addition capital gains or losses (G) from the sale of securities will affect taxable income. Unsold securities are transferred to the subsequent period.

Loans may also be designated in several ways: by clientele (e.g., farm, non-farm, bank, consumer), by maturity, by type of security, etc. Lending reduces cash, adds to assets, and modifies reserve and policy requirements, while interest received (i) adds to cash and taxable income. In subsequent periods, loan repayment adds to cash and reduces assets.

Taxable income is divided among dividends (D), taxes (t), and retained capital and surplus. The dividend rate may be specified as a function of income or determined by the model on the basis of observed time-preference rates for stockholders. The respective period's dividends are reflected in the value of objective function entries.

CONCLUDING COMMENTS

Research to date indicates that efforts to model the decision-making situations for financial intermediaries appear quite promising [8]. Further work is needed to portray more comprehensively the relevant alternatives and constraints for particular intermediaries under study, to link these micro-models to aggregate flows of funds, to reflect risk, and to obtain empirical measures on the extent, timing, and method of estimation of the feedback relationships. So far we have only succeeded in bracketing the apparent range within which this feedback relation is likely to fall for a small rural bank.

In a larger view we hope that these initial modeling efforts will highlight the need for consideration of the behavioral properties of financial intermediaries as new agricultural finance policies are considered. The consequences of these policies–whether they be redirections in flows of funds, changes in interest rates, new financial instruments, joint ventures, changes in internal loan policy, or even the creation of new public financial intermediaries–can be more completely evaluated in a resource-allocation framework.

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