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AN UNSUCCESSFUL EXPLORATION INTO THE STRUCTURE OF THE INSTITUTIONAL NON-REAL-ESTATE FARM CREDIT MARKET

James S. Wehrly

An Unsuccessful Exploration Into The Structure Of The Institutional Non-Real-Estate Farm Credit Market*

James S. Wehrly**

Not all research is successful in terms of answering the question or solving the problem originally posed. This paper is a report of such an unsuccessful research attempt. While the research failed to obtain significant estimates for the parameters of the equations describing the credit market, it appears worthwhile to make the results available for two reasons.

First, it is in an area in which there is very little published research. With so little guidance from other sources, exploratory work, even though unsuccessful, may be useful to other researchers interested in the problem. While the results reported herein have only limited usefulness for dealing with policy problems, they may be useful in saving other researchers the time and expense of learning for themselves that the methodology and variable combinations used here do not "work".

Second, while the research did not result in satisfactory statistical results, some of the parameter estimates fall into consistent patterns. By inference from these patterns researchers may be able to gain some insights into the structure explored.

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* This project was initiated as a source of material for a term paper for the area seminar, The Capital Market, for which a preliminary report was prepared. Following the completion of the seminar the work was continued with assistance from Purdue Agricultural Experiment Station Projects 987 and 1180.

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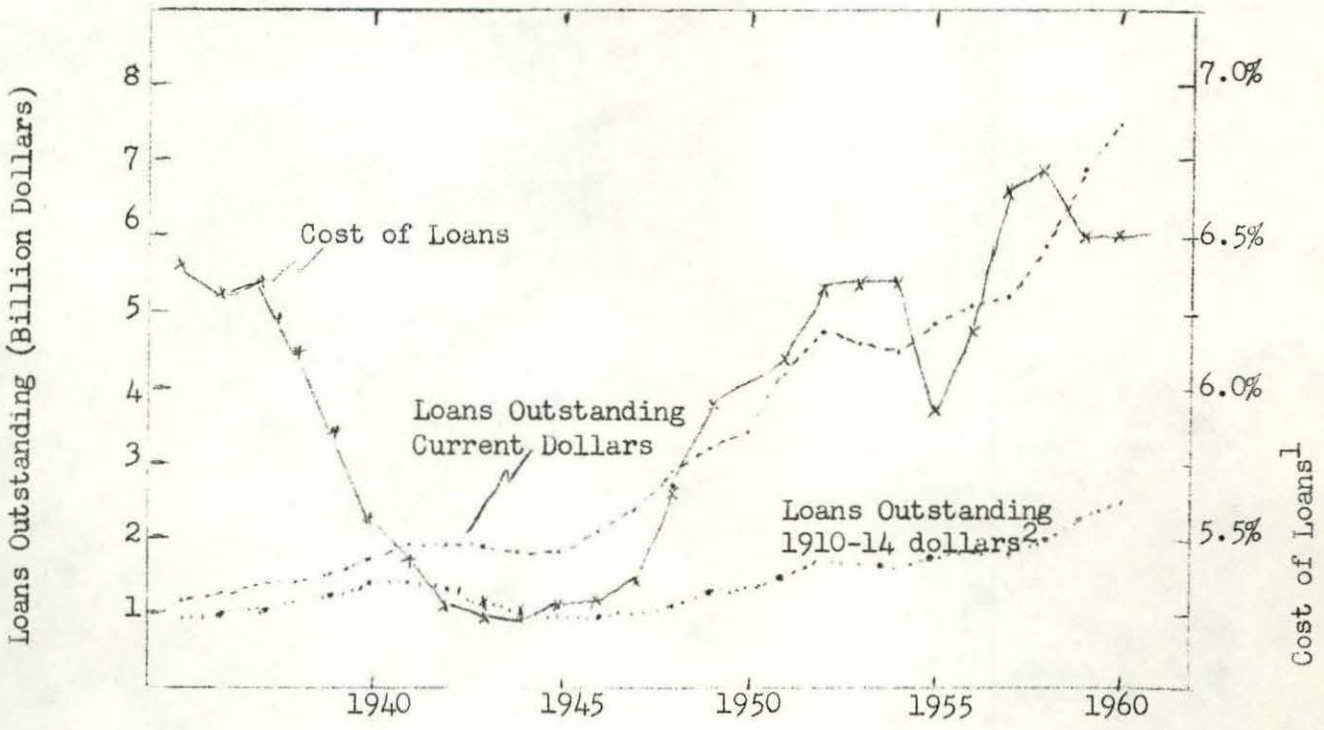
Background

American farmers are using more than seven billion dollars worth of non-real-estate credit from institutional lenders. The amount used has shown an increasing trend since the mid-thirties with a rapidly increasing trend since the war (Figure 1). The amount has more than doubled since

Figure 1. Non-real-estate Loans to Farmers by Principal Lending Institutions. Amount Outstanding July 1, and Cost of Loans.



1. Cost of loans at Production Credit Associations.

2. Current dollar amount deflated by index of prices of all goods and services purchased by farmers.

farmers began to feel the "cost-price" squeeze in the late forties. In addition to this institutional credit, farmers are using about three and a half billion dollars in non-institutional non-real-estate credit and about thirteen billion dollars worth of real estate credit.

In addition to involving large sums of money, credit is important from a policy standpoint. The practice of making government credit available on easy terms has been used as a relief measure during times of economic depression and following disasters. The Farmers Home Administration attempts to use credit to preserve and encourage the "family type farm". The possibility of credit control as a method of agricultural production control has been discussed in academic circles. General credit control is a recognized tool of the monetary authorities for implementing fiscal policy.

Despite the importance of farm credit, from the size of the resource bundle it represents and the real or fancied values of its use as a policy tool, little is known about the forces affecting the credit market. The purpose of this study is to examine the effect of selected variables on the supply of and demand for farm credit, in one segment of the credit market, and to attempt to estimate some of the structural parameters of that market.

Knowledge of the structure of the credit market could serve as a guide to policy makers. Monetary authorities would have some idea of the expected effects of credit policies on expenditures by the agricultural segment. Agricultural policy makers would have some basis for evaluating credit control as a means of controlling production or influencing

allocation of resources to or within agriculture. Social planners could use this structural knowledge to evaluate credit programs as means of implementing various social programs.

Models

Two basic models were employed in this study. The first was a single equation explanatory model with the quantity of loans outstanding as the dependent variable. This model assumes the supply of agricultural credit to be infinitely elastic on the grounds that agricultural credit is only a small part of the total credit advanced. In 1960 agricultural credit was about $24 billion of $846 billion total debt, or slightly less than three per cent. It assumes further that interest rate considerations are not important in determining the amount of short-term credit used in agriculture.

The second model was a system of two simultaneous equations to estimate supply and demand. Quantity of loans and price of credit were taken as the endogeneous variables, with both equations normalized on the quantity variable.

The first model was estimated by ordinary least squares and the second model by two-stage least squares. Several variants were estimated for both models.

Theoretical and Empirical Concepts of Variables

In any empirical study there is a two-fold problem in selecting the variables: (1) the choice of theoretical concept for the variable, and (2) the choice of an empirical data series that quantifies the theoretical concept.

In the choice at the conceptual level, one of the problems is the stage at which we wish to consider a variable. For example, should income

be measured as gross income, net income, or at some arbitrarily selected intermediate stage? Should a stock variable be measured at a specific point in the time period of the analysis or as an average for the period? If the specific point approach is used, should it be a "high","low", or "normal" point if seasonal variations are important?

A second theoretical problem is the degree of aggregation to use. Should the whole economy approach be used, or should the economy be divided into segments? Should a variable such as credit include all types of credit, or should a specific type of credit be studied more or less independently of other types?

Many economic variables are expressed in terms of dollars. A third theoretical problem, especially in time series work, is whether to use the data as generated by the economy or to use a "real" concept obtained by "deflating" the original data. If the "real" concept is chosen the choice of a deflator and the base period become additional problems.

Another problem in selection of theoretical variable concepts is the cause and effect relationships between variables. Is the relationship we have postulated correct for the context and the length of the time period in which we are working? Is the direction of causality in one direction only, or are the variables mutually interdependent? While this is not intended to be an exhaustive listing, it does serve to point up some of the problems faced by researchers in selection of theoretical concepts.

Selection of empirical concepts to fit the theoretical concepts of variables presents a new set of problems. Some of our theoretical concepts may be unmeasurable in practice. For others, no statistical collection

agency has been sufficiently impressed with their importance to compile data series. Many data series are in part, or totally, estimated from fragmentary or incomplete data. In all series human frailties introduce some degree of error. The problem facing any researcher is to find some type of data series, with a tolerable degree of error, that approximates the theoretical concept. In some instances the researcher is faced with the decision of compromising the character of the theoretical model or omitting variables from the empirical analysis.

Endogeneous Variables

In this study the quantity of institutional non-real estate credit and the price of that credit are used as the endogeneous variables. The quantity of non-real-estate credit may be divided into two general classifications: institutional and non-institutional. The latter classification includes credit extended by individuals, merchants, dealers, acceptance corporations, etc., for which no data series are available. Institutional credit is defined, for this study, as credit extended by principal lending institutions--all operating banks, Production Credit Associations, Federal Intermediate Credit Banks, and Farmers Home Administration.

Data series on institutional credit appear to be adequate for empirical work. Detailed accounts by lenders and by states are available. Of the nearly seven billion dollars of this credit outstanding on July 1, 1959, about 70 per cent was supplied by commercial banks, 22 per cent by PCA, 2 per cent by FICB, and 6 per cent by FHA. Less information is available on the types of loans made to farmers. The only information of this type available is from occasional surveys, such as the one made by the Federal Reserve Bank in 1956.[1/]

1/ "Farm Loans at Commercial Banks," Federal Reserve Bulletin, Vol. 42, 1956, pp 1163-7.

This survey showed a total of about five billion dollars of agricultural bank credit outstanding as of June 30, 1956, represented by three and one-half billion notes. The average note size was $1,400 while the average total bank debt per farm borrower was $2,227. More than half of the borrowers had bank debts of less than $1,000 and one-tenth had bank debts in excess of $4,000. Bank debt was closely related to the net worth of the borrower. One-third of the dollar volume of these loans outstanding had been renewed on a "planned" basis or for other reasons.

Of the slightly more than $5 billion outstanding agricultural bank credit about 73 per cent or $3.7 billion was non-real-estate credit. About half of this $3.7 billion was borrowed for current expenses, 38 per cent for intermediate term investments, 3 per cent for real estate purchase, 5 per cent to repay other debt, and 4 per cent for other purposes.

Maturities on 45 per cent of all agricultural bank credit were 6 months or less (including 8 per cent payable on demand), 26 per cent matured in 6 to 12 months, 9 per cent in one to two years, 9 per cent in two to five years, while 11 per cent ran for longer than five years.

While lack of data is the primary reason for omitting the non-institutional credit, it may be argued that much of this credit is a different type of credit which farmers would not or could not obtain from institutional lenders. As such it would be subject to separate supply and demand forces. Loans made or guaranteed by the Commodity Credit Corporation are excluded on the assumption that farmers tend to consider CCC loans as final sales.

The data on institutional loans are published as the total outstanding on January 1 and July 1. The data show a consistent seasonal pattern

with the peak on July 1. The peak date was selected to represent the maximum amount borrowed during the year in order to include short term loans for seasonal production expenses.

Selection of a data series to represent price also presented problems. Interest rates are published for FICB and FHA loans to farmers. However, both of these sources are relatively minor as sources of credit, both are atypical as representatives of farm loans sources, and FHA rates are administered and subsidized. Consequently, neither of these interest rates was considered for this study. Information on farm loan interest rates at banks is available only from occasional surveys such as the Federal Reserve Bank Survey of 1956.

The series used in this analysis is the PCA cost of loans, which includes the interest rate plus an estimation of costs for title searches, filing fees, stock ownership, etc., expressed as a per cent of the loans. For 1956 this rate was 6.2 per cent, compared with 6.1 per cent for all farm loans by banks and 6.4 per cent for non-real-estate farm loans by banks, reported by the Federal Reserve Survey.

Exogeneous Variables

In addition to the price and quantity variables a number of additional variables are hypothesized to enter into the supply and demand relationships. These variables can be summarized into a relatively few broad classes as follows:

On the demand side we have farmers' liquidity position as measured by a lagged income concept (3-7)[2/], size of the business to be financed (8-10),

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2/ The numbers in parenthesis indicate the empirical concepts from the list below that were tested as a measure of the theoretical concept.

farmers' expectations for returns (11-13), farmers' need for funds for current obligations (14-15), and farmers' other debt (16-17). On the supply side we consider the collateral farmers have to offer (8, 18), the loanable funds available to the whole economy (19-21), and the alternative opportunities open to investors (22-24).

As a group, farmers tend to invest a high proportion of their available funds in the farm business.[3/] Many farmers place a high utility value on being debt free. In addition, farmers do not overlook the fact that borrowed capital involves a transaction cost. Therefore, we assume that farmers, having a desired level of investment, will borrow only the portion they cannot provide from their own financing. The higher their income in the previous period the more liquid their financial position is likely to be.

Some farm expenses, primarily those associated with maintenance of physical capital, are "postponable" to a limited extent, but eventually the expenditure must be made. To make allowance for these "postponable" expenses, two of the concepts tested (3, 6) are combinations of two years' income.

3/ The balance sheet of agriculture has consistently shown less than 10 per cent of the total assets of farmers in the financial asset category, and at a time of year when many farmers have a larger than usual proportion of their operating capital in the form of cash balances. While no data is available on off-farm investments by farm operators, some indication of the magnitude of these investments can be gained from farm income surveys. For the group of farm families keeping Illinois Home Acount records in 1959 and 1960 the income from investments was 2-3 per cent of cash farm income. A 1946 survey of Illinois farmers estimated incomes from interest, dividends, royalties, and rents that amounted to about 1 per cent of cash farm income or 1½ per cent of net farm income. A United States Survey in 1955 estimated incomes from similar categories which were about 2 per cent of gross cash receipts from agriculture or 4 per cent of net income from agriculture.

It is an elementary fact that the larger the business the more financing required. The problem then becomes the selection of a suitable measure of the size of business. Since agricultural production is subject to wide variations, and inputs must be made before the uncertain outputs are known, output is a poor measure of size of business. Consequently, some measure of inputs must be used. For this analysis three concepts of asset value, excluding household goods and financial assets, were used (8-10) as a measure of size.

In theory, the entrepreneur will operate higher on the production function when expections are good than when they are poor. In this study only price expectations are considered, and it is assumed that farmers' expectations are based on some extension of past prices. Three concepts of "expected price" (11-13) were tested.

As a measure of the need for current obligations the models tested aggregate machinery shipments and planted acreage (14-15). Other debt quantified farm mortgage debt, both as an absolute amount and as a per cent of real-estate value (16-17).

On the supply side, it was assumed that investors will offer funds more freely if farmers can supply collateral to reduce the risk. Two concepts were used to measure collateral: value of farm assets and value of farmers' equity (8, 18).

Private money supply (19) was posited as a measure of loanable funds on the assumption that the ultimate limit to amount of money that can be loaned is the amount in existence. Total debt (20) recognizes that most of our money is merely evidence of someone's debt, and also indicates the amount of the money supply that is available for loan. The logic for using

government securities own by banks (21) is that banks tend to carry a higher proportion of the low yield government securities in their portfolios when alternate investment opportunities are poor. Therefore, when banks increase the proportion of government securities in their portfolios above the amount needed for secondary reserves, it indicates that good investment opportunities are scarce.

As a measure of alternative investment opportunites, the yield on 3-5 year government bonds (22) was used to approach the return on a relatively risk-free investment not subject to the very short fluctuations of treasury certificates. The FICB debenture rate (23) conceives of a capital market where agricultural borrowers obtain funds at as low a cost as possible. The debenture rate reflects the opportunity cost which they must pay. Business loans by banks (24) were tested as a "quantity" opportunity in contrast to the "price" opportunity of the other two concepts.

EMPIRICAL MEASURES OF VARIABLES

Endogeneous Variables

1. Non-real-estate loans to farmers by principle lending institutions outstanding July 1, in billions of dollars.

2. Average cost of loans made by Production Credit Associations, U.S., for the calendar year, as a per cent of the loan. Cost includes interest plus estimated cost of title searches, filing fees, stock ownership, etc.

Exogeneous Variables

3. Farm income in 10 billions of dollars (sales plus government payments, deflated by the index of prices paid by farmers), using 2/3 of the immediately preceding year plus 1/3 of the second preceding year.

4. Farm income in billions of dollars (sales plus government payments) lagged one year.

5. Net farm income series in billions of dollars, lagged one year. (This series, developed by Leon Hesser, includes change in financial assets, sales, government payments, and non-farm income, less operating expenses, cash wages, property tax, interest, and income tax.)

6. Realized net income of farm operators plus non-farm income in 10 billions of dollars, weighted as income in variable 3.

7. Realized net income of farm operators lagged one year, in billions of dollars.

8. Total value of farm assets as of January 1, in 100 billions of dollars.

9. Variable 8 deflated by index of prices paid by farmers.

10. Value of non-real-estate farm assets, January 1, in 10 billions of dollars.

11. Ratio of index of prices received by farmers to index of prices paid by farmers.

12. "Expected" price ratio - 9 year weighted moving average of variable 11.

13. "Expected" price index - 5 year weighted moving average of index of prices received by farmers.

14. Value of new machinery shipments, U.S., for calendar year, in 10 billions of dollars.

15. Planted acreage of principal crops, U.S., in 100 millions of acres.

16. Farm mortgage debt outstanding January 1, in billions of dollars.

17. Farm mortgage debt outstanding January 1 as a per cent of the value of farm real estate.

18. Farmers' equity (assets less debt) as of January 1, in 10 billions of dollars.

19. Privately held money supply, U.S., average for first six months of the year, in 100 billions of dollars. (19a-in 10 billions of dollars).

20. Total debt, public and private, January 1, in 10 billions of dollars.

21. Government securities owned by banks, in 10 billions of dollars.

22. Average yield, for calendar year, on 3-5 year government securities.

23. Federal Intermediate Credit Bank debenture rate, average for the calendar year.

24. Total business loans outstanding at all banks, average for first half of year, in billions of dollars.

Empirical Results

The regression coefficients of the equations, with their standard errors, are summarized in Tables I, II, and III, and the correlation coefficients in Tables IV, V, and VI. It is immediately obvious that a high proportion of the regression coefficients were not significant, and that they were highly unstable for model variants.

The analysis failed to identify any significant relationship between price and quantity of this type of credit. For the expected demand-price relationship we would expect the price variable coefficient to have a negative sign. In five of the demand quations the price variable had a positive coefficient, four of which were significantly different from zero. None of the negative coefficients were significantly different from zero. In both variations of model II the price coefficient was noticeably numerically larger than in any of the other models. Model II was the only model which used a gross income concept--all others tried to estimate the "income not spent" during the previous period. In model III, the most closely related model, the absolute value of the "price" coefficient was much smaller. The main change between these models, other than the income concept, was to delete "size of business" from the demand equation and add a closely related "collateral" variable to the supply equation. On the supply side, the price variable turned up with the "right" sign more consistently, but the problems of coefficient stability and non-significance were still present.

TABLE I

SINGLE EQUATION MODELS, 1949-1960

Equation	Price[2]	Liquidity[3]	Size of Business	Other Debt	R^2
1		-3.719 (1.380)	5.201[8] (.479)	.006[16] (.055)	.995
2		-3.949 (1.456)	5.281[8] (.255)	-.009[17] (.257)	.994
3		-3.826 (.969)	5.257[8] (.138)		.995
4		-14.110	1.340[10]		.742
5		-7.354 (1.907)	2.102[9] (.111)		.981
6	.176 (.118)	-4.821 (1.129)	4.709[8] (.390)		.996

Footnote numbers refer to variables as listed in text.

TABLE II

DEMAND EQUATIONS FROM SIMULTANEOUS MODELS

Model and Years	Price[2]	Liquidity	Size of Business	Expectation Variable	Need	R^2
I 1949-1960	1.177 (.125)	-10.475[3] (.764)	1.635[8] (.388)			.999
II 1941-1960	12.869 (5.253)	-.395[4] (.500)	2.274[8] (1.881)	-5.806[11] (8.282)	.320[14] (.224)	.996
IIa* 1941-1960	15.307 (5.028)	.306[4] (.756)	-1.633[8] (2.864)	-17.614[11] (9.966)	-.076[14] (.151)	.982
III 1941-1960	2.255 (.210)	-.048[5] (.046)		.650[12] (1.052)	.075[14] (.026)	.985
IV 1948-1960	-.147 (.522)	-.335[6] (.659)	5.944[8] (.648)	-.382[13] (.402)		.987
Va 1935-1947	.138 (.381)	-.142[7] (.129)	5.175[8] (2.855)		-1.110[15] (1.515)	.841
Vb 1948-1960	-.303 (.660)	-.038[7] (.047)	5.885[8] (.665)		-.512[15] (.959)	.986

* Model II with variables 1, 8, and 14, deflated by index of wholesale prices.

Numbered footnotes refer to variables as listed in text.

TABLE III

SUPPLY EQUATIONS FROM SIMULTANEOUS MODELS

Model and Years	Price[2]	Collateral	Loanable Funds	Alternate Investment Opportunity	R^2
I 1949-1960	1.090 (1.435)		2.022[19] (.476)	-.221[22] (2.473)	.971
II 1941-1960	18.622 (2.939)		.172[20] (.106)	-.262[22] (1.751)	.981
IIa* 1941-1960	14.923 (2.073)		-.112[20] (.097)	-.057[22] (1.535)	.962
III 1941-1960	2.043 (.424)	.164[18] (.071)	-.181[20] (.178)	-.0002[22] (.220)	.980
IV 1948-1960	.558 (.942)	5.065[8] (1.347)	.348[21] (.429)	.118[23] (.139)	.986
Va 1935-1947	-.518 (.349)	.078[8] (2.426)	-.027[19a] (.094)	5.451[24] (2.962)	.840
Vb 1948-1960	.047 (.658)	5.114[8] (1.013)	.004[19a] (.205)	.578[24] (1.941)	.986

* Model II with variables 1, 20 and 22 deflated by index of wholesale prices.

Numbered footnotes refer to variables as listed in text.

TABLE IV

Correlation Coefficients
Single Equation Models

Equation	Variables*	Price	Liquidity	Size of Business	Other Debt	Quantity of Loans
1	Liquidity			-.259	-.467	-.351
	Size of business			1	.937	.993
	Other debt				1	.954
2	Liquidity			-.259	-.628	-.351
	Size of business			1	.755	.993
	Other debt				1	.881
3	Liquidity			-.259		-.351
	Size of business			1		.997
3 (Partial Correlation Coefficients)	Liquidity			.779		-.794
	Size of business			1		.997
4	Liquidity			.049		-.329
	Size of business			1		.779
5	Liquidity			-.169		-.351
	Size of business			1		.972
6	Price	1	-.002	.911		.892
	Liquidity		1	-.259		-.351
	Size of business			1		.993

* Refer to Table I for empirical concepts of variables.

TABLE V

Correlation Coefficients

Demand Equations from Simultaneous Equation Models

Model	Variables*	Liquidity	Size of Business	Expec-tation	Need	Quantity of Loan
I	Price	.001	.960			.936
	Liquidity		-.259			-.351
	Size of business					.993
II	Price	.754	-.359	-.535	.578	.989
	Liquidity		.920	.041	.831	.793
	Size of business			-.315	.767	.965
	Expectation				-.044	-.513
	Need					.662
IIa	Price	.269	.935	-.544	.315	.979
	Liquidity		.577	.552	.257	.135
	Size of business			-.292	.315	.874
	Expectation				.058	-.659
	Need					.257
III	Price	.661		-.549	.581	.985
	Liquidity			.134	.846	.699
	Expectation				-.044	-.513
	Need					.662
IV	Price	-.595	.914	-.314		.902
	Liquidity		-.512	.498		-.538
	Size of business			-.439		.992
	Expectations					-.484
Va	Price	-.798	-.851		.229	-.818
	Liquidity		.988		.295	.766
	Size of business				.179	.833
	Need					-.188
Vb	Price	-.771	.928		-.870	.924
	Liquidity		-.710		.764	-.734
	Size of business				-.794	.992
	Need					-.808

* Refer to Table II for Empirical concepts of variables.

TABLE VI

Correlation Coefficients

Supply Equations from Simultaneous Equation Models

Model	Variables*	Collateral	Loanable Funds	Alternative Opportunity	Quantity of Loans
I	Price		.172	.912	.936
	Loanable Funds			.888	.940
	Alternative Opportunity				.910
II	Price		.951	.938	.989
	Loanable Funds			.915	.957
	Alternative Opportunity				.931
IIa	Price		.846	.939	.979
	Loanable Funds			.873	.797
	Alternative Opportunity				.913
III	Price	.922	.963	.953	.986
	Collateral		.960	.850	.942
	Loanable Funds			.951	.957
	Alternative Opportunity				.931
IV	Price	.914	-.698	.736	.903
	Collateral		-.486	.848	.992
	Loanable Funds			-.580	-.468
	Alternative Opportunity				.850
Va	Price	-.851	-.899	-.746	.924
	Collateral		.984	.910	.992
	Loanable Funds			.922	.947
	Alternative Opportunity				.958
Vb	Price	.928	.862	.900	.924
	Collateral		.941	.953	.992
	Loanable Funds			.992	.947
	Alternative Opportunity				.958
Vb (Partial Correlation Coefficients)	Price	.420	-.242	.271	
	Collateral		.270	-.043	
	Loanable Funds			.952	

* Refer to Table III for empirical concepts of variables.

The coefficients for the "other debt," "expectations," and "need" variables in the demand equations were consistently not significantly different from zero, had the "wrong" sign, or both. The single exception was "machinery shipments" (need) in model III, and in this instance there was a question of whether a theroetical cause-effect relationship existed between this variable and quantity of loans. In the supply equations the coefficients for "loanable funds" and "alternate opportunity" were not significant or had the "wrong" sign.

The analysis gives some basis to expect that the demand for loans is related to "liquidity" and "size of business". Coefficients for both were significantly different from zero and had the "right" sign in all the single equation models. The statement also applies to "size of business" in all simultaneous models covering only the latter portion of the period studied. While the "liquidity" coefficient was significantly different from zero in only one of the simultaneous models, we note that it has the "right" sign in five of the other six models. On the supply side, the "collateral" variable showed some promise as an "explainer" for the later years, but no significance for the earlier years.

Conclusions

This study has failed to identify any significant relationship between the amount of credit demanded and the price. During the period studied the cost of PCA loans varied only from 5.2 per cent to 6.7 per cent. This narrow range is hardly enough to test farmers' reaction to price on quantity demanded. As Heady observed:

> "Interest rates stand to be less important than uncertainty in restricting the use of capital in agriculture. Few firms characterized by single proprietorships press the use of capital or credit to a point where its marginal cost is equal to its marginal return ... The Iowa study indicated that few if any farmers in the sample considered changes in interest rates by 1 or 2 per cent to have any bearing on the amount of capital used."4/

4/ Heady, Earl O., Economics of Agricultural Production and Resource Use, Prentice-Hall, Inc., 1952, p. 555.

The analysis did get some significant coefficients for price on the amount supplied. Both variants of model II and model III have highly significant coefficients. However, the lack of significance in the rest of the models and the coefficient instability between II and III gives us reason to place little confidence in these estimates. Thus we may conclude that the data does not reject the hypothesis, treated as an assumption in the single equation models, of infinite elasticity of supply with respect to price.

Though supply may be infinitely elastic with respect to price, the analysis indicated that it is not unlimited. In equations 1, 2, 3, and 6 from the single equation models, and the demand equation from the first simultaneous model we have the same "liquidity" and "size of business" variables. In the first three equations the coefficients were stable, both in magnitude and significance, despite the fact that there was some multicollinearity with the "other debt" variables. However when supply-related variables were brought in, first only as "price" in equation 6, and then as a simultaneous system in Model I, these coefficients shifted both in magnitude and level of significance.

The analysis failed to give any very satisfying answer as to what might be the factor limiting supply. Model I suggested loanable funds may be the answer, but six successive failures in succeeding trials leaves us with little confidence in this hypothesis. It may also be noted that the correlation coefficients between "loanable funds" and "alternate opportunity" were near 0.9 or higher for every model except IV. Even the partial correlation coefficient, as calculated for model Vb was above 0.9, while all of the other simple correlations in the equation were substantially reduced by removing the effects of the other variables. In effect, these two variables were essentially the same variable.

Model Va suggested a possibility that the general monetary market may have had some influence on supply of agricultural credit in the earlier years, but other models indicate that whatever influence there may have been has disappeared in more recent years. This may be due to the improved development of agricultural lending agencies or to the acceptance of agricultural property as a good store of value (inflation hedge) so that credit flows to agriculture independently of the rest of the monetary market.

"Collateral" was included as a supply variable in four of the models, with a significant coefficient in the three that included the more recent years. This consistency, especially between models IV and Vb where different variables with different correlation coefficients were used, lets us conclude with some confidence that "collateral" is related to the amount of credit supplied.

As shifters of demand for credit the "other debt," "farmers' expectations," and "need" variables tested showed no relationship to the amount of credit demanded. Both "liquidity" and "size of business" were significant throughout the single equation models and the first simultaneous model. In the subsequent models the results for "liquidity" were inconsistent with those from the first models. However, models IV and Vb also gave highly significant coefficients for "size of business". The pattern which emerges is a significant effect from "size of business" in all models where the earlier years are not included. Thus, from the evidence of the analysis we conclude that the demand for credit is primarily a need for a regular source of funds to finance a business of a given size.

A word of warning is in order concerning the acceptance of "size of business" and "collateral" as shifters of demand and supply of farm credit. As indicated in Tables IV, V, and VI, these variables were involved in severe

multicollinearity problems. Thus there is no assurance that we have really isolated the effects of these variables. We can accept the conclusions only on the basis of these variables falling in to a somewhat consistent pattern with respect to different time periods and different model variants, while other variables with the same multicollinearity problems failed to do so.

Limitations of the Model and Analysis

The models used in this analysis were highly abstracted and highly aggregated. Because of the lack of appropriate data series an important part of the non-real-estate credit was necessarily left out of the model. By using all institutional credit in the United States the model aggregated some very different types of credit, ranging from small, risky loans to very large, almost riskless loans.

There are quite likely measurement errors in many of the data series used. The information on institutional credit outstanding can be accepted with a high degree of confidence. However, all other credit data, and any measure of interest paid on agricultural credit is necessarily an estimate, aggregated from fragmentary evidence.

Data on income, farm assets, expected prices, machinery shipments, acreage planted, loanable funds, and investment opportunities are also estimates, based on varying amounts of evidence. In addition, it is difficult to find empirical concepts that agree with the theoretical concepts. This latter problem manifested itself in this analysis in the form of many different data series being tried for some of the theoretical concepts.

Finally, multicollinearity was a serious problem throughout the analysis. The calculation of partial correlation coefficients for equation 3 and the supply equation for model Vb indicated that while much of the correlation problem resulted from the effects of the variables on each other. There is still correlation among the independent variables.

Summary

The structure of the market for institutional non-real-estate farm credit has been explored by use of single equation models and simultaneous equation supply and demand models. In both the demand and supply equations it was not possible to obtain significant coefficients for the price of loans that agreed with a priori expectations. As an exploration into the structure of the short-term credit market the research cannot, therefore, be judged a success. It is hoped that the empirical results and brief analysis presented herein will be useful to other researchers dealing in this area, especially in preventing them from following down blind alleys.