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The Use of Non-Deposit Funds by Rural Commercial Banks: An Application of Poly-Period Linear Programming

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Abstract
The past trends in capital and credit requirements of U.S. agriculture are well documented. While farm numbers and farm labor declined by more than fifty percent from 1950 to 1973, total assets for the U.S. farming sector increased from $132.5 billion to $385.5 billion and debt from $12.4 billion to $73.6 billion [14, p.1] During this period of substantial growth in the agricultural capital market, there has also been a significant change in the market share of debt held by various financial intermediaries. In the non-real estate debt market. Production Credit Associations have increased their share of the total outstanding debt reported by financial institutions from 13.7 percent in 1950 to 30.1 percent in 1973, Commercial banks’ share of this farm debt category has decreased from 72.3 percent to 65.2 percent during the same period. [14, p. 20] A similar shift has occurred in the real estate market. While the market share for Federal Land Banks increased from 16.2 percent in 1950 to 26.1 percent in 1973, the share held by commercial banks decreased from 16.8 percent to 13.9 percent. [U, p. 15]

Disciplines
Agribusiness | Agricultural and Resource Economics | Agricultural Economics

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THE USE OF NON-DEPOSIT FUNDS
BY RURAL COMMERCIAL BANKS: AN APPLICATION
OF POLY-PERIOD LINEAR PROGRAMMING

by

Michael Boehlje

No. 2

June, 1974
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Michael Boehlje*

Introduction

The past trends in capital and credit requirements of U.S. agriculture are well documented. While farm numbers and farm labor declined by more than fifty percent from 1950 to 1973, total assets for the U.S. farming sector increased from $132.5 billion to $385.5 billion and debt from $12.4 billion to $73.6 billion [14, p.1]. During this period of substantial growth in the agricultural capital market, there has also been a significant change in the market share of debt held by various financial intermediaries. In the non-real estate debt market, Production Credit Associations have increased their share of the total outstanding debt reported by financial institutions from 13.7 percent in 1950 to 30.1 percent in 1973. Commercial banks' share of this farm debt category has decreased from 72.3 percent to 65.2 percent during the same period. [14, p. 20] A similar shift has occurred in the real estate market. While the market share for Federal Land Banks increased from 16.2 percent in 1950 to 26.1 percent in 1973, the share held by commercial banks decreased from 16.8 percent to 13.9 percent. [14, p. 15]

Rural commercial banks face at least three serious problems in maintaining their market share of the agricultural debt capital market. First, the capital requirements of many farm firms are increasing faster than the government imposed limit on the amount that can be loaned to an individual borrower for many rural banks. Second, much of the expansion in capital and credit needs will involve investments in intermediate and long term assets, and traditionally commercial banks have not actively participated in this longer term debt market. Third, the

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loan demand in a number of rural areas has increased faster than the traditional source of loanable funds -- bank deposits. Consequently loan to deposit ratios have increased substantially causing critical liquidity problems for some rural banks. For example, the average loan to deposit ratio for U.S. commercial banks with at least 50 percent of their total loan volume in farm loans increased from 45.7 percent in 1961 to 54.6 percent in 1973. [9, p. 5]. Thus, conventional attitudes and regulations on the size and type of farm loans must be reevaluated for commercial banks to maintain their market share. In addition, traditional deposit sources of funds may no longer be adequate. Rural bankers may be forced to obtain funds from non-deposit sources outside the local community to maintain their market share and service the agriculture of the future.

The purpose of this discussion is to analyze the profitability of using various sources of deposit and non-deposit funds in the acquisition of loans and investments by a commercial bank. First, alternative non-deposit funds sources are identified and described. Then an analytical model that can be used to determine the optimal use of deposit and non-deposit funds in the acquisition of alternative loan and investment assets is presented. Finally, the results of applying the model to a case bank are described to illustrate the utilization and profitability of non-deposit funds sources.

Non-Deposit Funds Sources

Proposals to facilitate and encourage rural banks to utilize funds from non-deposit sources are not new. In fact, a number of aggressive rural banks have been using correspondent arrangements with city banks to augment deposit sources of funds for years. However, when correspondent relationships became strained and correspondent balances increased during the "credit crunch" of 1966
and again in 1969, some rural bankers began to investigate the potential of other funds sources.  

A Task Force was appointed in 1971 by the American Banker's Association to evaluate alternative bank and non-bank sources of funds for rural areas. The ABA Task Force indicated that it does not support branch or multi-bank holding companies as a means of mobilizing bank funds for rural areas. [7; 11, p. 15] The role of the Fed discount window as a source of seasonal and emergency credit was acknowledged, but its ability to provide development and expansion capital for farm firms was questioned even with the seasonal borrowing privilege. [11, p. 14] The Task Force noted that the correspondent system had been successfully used by aggressive rural banks, but it also recognized that the system was not an effective mobilizer of funds into rural areas in times of tight money. 

The ABA Task Force recommended that a new regional or national organizational structure was needed to facilitate the flow of funds to agriculture. This structure would be capitalized by the participating banks and would mobilize funds from surplus to deficit areas as well as "compete nationally in the sale of debt instruments and the interchange of assets." [11, p. 16] The Task Force also recommended that "steps should be taken to strengthen the position of banks in discounting loans with Federal Intermediate Credit Banks," including legislation that would enable banks to join in establishing agricultural credit corporations. [11. p. 26]

Two methods are available for commercial banks to use agencies of the Farm Credit System as a means of acquiring additional loanable funds - discounting loans with the Federal Intermediate Credit Bank (FICB), or Production Credit Association (PCA) participations. Regulations regarding the use of these two methods are specified in the Farm Credit Act of 1971. [13] Commercial banks can discount loans with the District FICB on a direct basis or through an other financial institution (OFI) formed by the bank, typically known as an agricultural
credit corporation. Direct line discounting with the FICB is limited to twice the commercial bank's paid-in and unimpaired capital and surplus, whereas OFI's are limited to ten times the paid-in and unimpaired capital and surplus. In addition, the following criteria must be met to use the discount privilege [4]:

1. The commercial bank involved as an applicant for direct discounting or as parent of an OFI shall have not less than 25 percent of its total loan portfolio in agricultural loans.

2. The gross loan to deposit ratio of the bank shall not be less than 60 percent at the seasonal peak.

3. The participation approach with the Production Credit Association is either unavailable or would not be of assistance to the institution in serving the credit needs of its borrowing farmers and ranchers, but the failure of the institution to participate with a Production Credit Association shall not of itself be cause for denial or revocation of borrowing or discount privileges.

The 1971 Farm Credit Act also allows Production Credit Associations (PCA) to lend funds to farmers jointly with commercial banks through a participation agreement. The PCA participation is similar in concept to the correspondent arrangement that many rural banks utilize with larger city banks. The details of PCA participations are specified by each district FICB, but in general the participation agreement must define the provisions for disbursement and repayment, sharing of collateral, the loan service plan, sharing of losses, etc. Usually, only one note is required. Like any other borrower, the farmer using a PCA participation must also purchase PCA stock in proportion to the amount of the loan.

The Analytical Model

To analyze the utilization of deposit and non-deposit sources of funds, a poly-period linear programming model of a rural commercial bank was developed. Early applications of linear programming by Chambers and Charnes [2], Waterman and Gee [15] and Cohen and Hammer [3] illustrated the usefulness of this procedure in evaluating the asset and liability structure of metropolitan commercial banks. Recent work by Frey [6] and Benjamin [1] utilized linear programming
procedures to analyze similar issues for rural banks.

The structure of the linear programming model used in this study can be summarized as:

Maximize: Discounted Net Income

\[
\Pi = \sum_{t=1}^{T} \frac{N_t}{(1+r)^t}
\]

(discounted semi-annual net income)

where: Semi-annual Net Income

\[N_t = \sum_{j=a}^{f} (\alpha_{jt} - \beta_{jt}) X_{jt} + \sum_{j=g}^{k} (\alpha_{jt} - \beta_{jt}) Y_{jt} - \sum_{j=\ell}^{n} \gamma_{jt} D_{jt} + \]

(semi-annual net income) (net return from bank loans) (net return from investments) (cost of deposit funds)

\[
\sum_{j=0}^{Z} (\alpha_{jt} - \beta_{jt}) E_{jt} - F_t - T_t
\]

(net return from non-deposit funds) (fixed expenses) (taxes)

where: Bank (Deposit) Loans

\[
X_{jt} = X_{jt-1} + I_{jt} - M_{jt}
\]

(bank loans) (new bank loans on repayment) (repayment on previous loans)

where: Bank (Deposit) Investments

\[
Y_{jt} = Y_{jt-1} + U_{jt} - W_{jt}
\]

(bank investments) (new bank investments in maturing investments) (maturing investments)
subject to: New Investment and Loan Capability

\[
\sum_{j=a}^{f} I_{jt} + \sum_{j=g}^{k} U_{jt} \leq A_t - \sum_{j=l}^{n} \phi_{jt} D_{jt}
\]

(new bank loans) (new investments) (allocable funds) (cash and reserves)

where: Allocable Funds

\[
A_t = C_t + \sum_{j=l}^{f} G_{jt} + \sum_{j=a}^{k} M_{jt} + \sum_{j=g}^{W_{jt}}
\]

(allocable funds) (beginning cash) (net new deposits) (repayment on loans) (maturing investments)

where: Bank Deposits

\[
D_{jt} = D_{jt-1} + G_{jt} + \delta_{jt}(X_{jt} + E_{jt})
\]

(bank deposits) (net new deposits in previous period) (deposit expansion from loans)

subject to: Deposit Availability

\[
G_{jt} \leq \xi_{jt} Z_{jt}
\]

(net new deposits) (market share of total deposits)

where: Use of Non-Deposit Funds

\[
E_{jt} = E_{jt-1} + H_{jt} - B_{jt}
\]

(non-deposit fund's loans) (new non-deposit fund's loans) (repayment on non-deposit fund's loans)
subject to: Non-Deposit Funds Availability

(10) \( H_{jt} \leq Q_{jt} \)

(new loans with non-deposit funds availability)

subject to: Market Demand for New Loans

(11) \( I_{jt} + H_{jt} \leq \xi_{jt} R_{jt} \)

(new bank loans) (new non-deposit fund's loans) (market share of total loans)

subject to: Capital Adequacy Requirements

(12) \( \sum_{j=\lambda}^{f} \theta_{jt} X_{jt} + \sum_{j=g}^{k} \lambda_{jt} Y_{jt} + C_{t} + L_{t} \leq S_{t} + N_{t} \)

(direct capital requirement for support of investments) (direct capital requirement for support of loans) (capital and surplus) (capital and (net income retained in the previous period))

where: Capital Structure

(13) \( S_{t} = S_{t-1} + N_{t-1} \)

(capital and surplus in the previous period)

subject to: Liquidity Requirement

(14) \( L_{t} = \sum_{j=\lambda}^{n} \Delta_{jt} D_{jt} - \sum_{j=g}^{k} \psi_{jt} Y_{jt} - \sum_{j=a}^{f} \sigma_{jt} X_{jt} \)

(capital required by liquidity provided by liquidity provided by liquidity) (liquidity required by deposits) (liquidity provided by investments) (liquidity provided by loans)
**Coefficients**

\( \rho \) = the discount rate

\( \alpha_{jt} \) = the gross returns from a loan or investment of type \( j \) in period \( t \)

\( \beta_{jt} \) = the variable cost of a loan or investment of type \( j \) in period \( t \)

\( \gamma_{jt} \) = the cost (including interest) of a deposit of type \( j \) in period \( t \)

\( \phi_{jt} \) = the reserve requirement on deposit type \( j \) in period \( t \)

\( \delta_{jt} \) = the feedback coefficient or new deposits of type \( j \) generated from local loans in period \( t \)

\( \xi_{jt} \) = the market share of deposit or loan type \( j \) in period \( t \)

\( \theta_{jt} \) = the capital requirement for loan type \( j \) in period \( t \)

\( \lambda_{jt} \) = the capital requirement for investment type \( j \) in period \( t \)

\( \Delta_{jt} \) = the liquidity requirement for deposit type \( j \) in period \( t \)

\( \psi_{jt} \) = the liquidity provided by investment type \( j \) in period \( t \)

\( \sigma_{jt} \) = the liquidity provided by loan type \( j \) in period \( t \)

**Decision Variables**

\( I_{jt} \) = new loans of type \( j \) made with deposit funds in period \( t \)

\( U_{jt} \) = new investments of type \( j \) purchased with deposit funds in period \( t \)

\( G_{jt} \) = new deposits of type \( j \) acquired in period \( t \)

\( H_{jt} \) = new loans of type \( j \) made with non-deposit funds in period \( t \)

**State Variables**

\( \Pi \) = discounted net income of the bank for all periods

\( N_t \) = semi-annual net income for period \( t \)

\( X_{jt} \) = total volume outstanding of bank (deposit) loans of type \( j \) in period \( t \)

\( Y_{jt} \) = total volume of investments of type \( j \) in period \( t \)
\[ D_{jt} = \text{total volume of deposits of type } j \text{ in period } t \]
\[ E_{jt} = \text{total volume outstanding of non-deposit fund's loans of type } j \text{ in period } t \]
\[ F_t = \text{fixed expenses in period } t \]
\[ T_t = \text{taxes in period } t \]
\[ M_{jt} = \text{the repayments made on loans of type } j \text{ in period } t \]
\[ W_{jt} = \text{the maturing investments of type } j \text{ in period } t \]
\[ A_t = \text{the volume of allocable funds available in period } t \]
\[ C_t = \text{the cash available at the beginning of period } t \]
\[ Z_{jt} = \text{the change (increase or decrease) in market volume of deposits of type } j \text{ available in period } t \]
\[ B_{jt} = \text{the repayment on non-deposit funds loans of type } j \text{ in period } t \]
\[ Q_{jt} = \text{the total quantity of non-deposit funds of type } j \text{ available in period } t \]
\[ R_{jt} = \text{the total market demand for loan type } j \text{ in period } t \]
\[ S_t = \text{the capital, surplus and undivided profits of the bank in period } t \]

The model is structured to handle six time periods with each period being of six months duration. Thus, equation (1) describes the objective function of the model as maximization of the present value of the semi-annual net income stream. Semi-annual net income is defined by equation (2) as the net return from bank loans plus the net return from investments plus the net return from loans made with non-deposit sources of funds minus the cost of deposits, fixed expenses and income taxes. The alternative loan categories incorporated in the model include six month, one year, two year, three year and ten year agricultural loans, two year installment loans and two year commercial loans. The quantity of a particular type of loan that is outstanding in any period is defined by equation (3) as the quantity outstanding in the previous period plus new loans minus the volume of loans that matured or were repaid (all or in part) during the period. Investment alternatives include an eight year municipal bond and six month, one
year and three year government securities. Equation (4) indicates that the quantity of investments outstanding in any period is equal to the quantity outstanding in the previous period plus new purchases minus maturing securities or bonds.\(^5\) Equation (5) indicates that the ability of the commercial bank to use deposit funds to make new loans and purchase additional bonds and government securities is restricted to the quantity of allocable funds available minus the cash reserves that are required by the Fed to implement monetary policies. Allocable funds are defined by equation (6) as equal to beginning cash in each period plus new deposits, cash received from payments made on amortized loans and cash received from maturing government securities and municipal bonds. Beginning cash is equal to cash at the end of the previous period plus after tax income in the previous period.

Only two basic types of deposit funds are available, time deposits and demand deposits. The quantity of time and demand deposits available in any period is described by equation (7) as equal to the deposit volume in the previous period plus new customer deposits (can be positive or negative) plus an increase in deposits that results from the economic expansion and profitable utilization of money loaned in the community from both internal and external funds sources. New customer deposits are limited by the bank's market share of the supply of new deposits as indicated in equation (8).\(^6\)

Four non-deposit sources of funds are included in the analysis, the agricultural credit corporation, direct line discounting of loans with the Federal Intermediate Credit Bank, the participation agreement with the local Production Credit Association and the correspondent arrangement with the city bank.\(^7\) Equation (9) indicates that the volume of non-deposit funds utilized is equal to the volume in the previous period plus new loans made with non-deposit funds minus repayments and maturing loans. As indicated in equation (10), the available supply of non-deposit funds is limited by the loan policies of the various financial intermediaries such as the local PCA, the district FICB or the correspondent bank.
In addition to the limits imposed by the availability of funds, the volume of the various types of loans that can be made is also limited by the loan demand in the community. This market demand restriction is defined by equation (11) which indicates that the volume of new loans made with deposit and non-deposit funds is limited to the share of the market demand held by the particular bank. 8/

As an additional means of protecting depositors and reducing the probability of bank failures, capital and liquidity requirements are imposed on commercial banks by both state and federal regulatory agencies. [5] The purpose of these regulations is to guarantee that the bank is sufficiently capitalized to support its asset structure. These regulations are summarized in general form in equations (12), (13), and (14). Equation (12) indicates that the sum of the "direct capital" requirements for the various loans, investments (government securities and municipal bonds), cash and near cash assets plus the "additional capital" required for liquidity purposes cannot exceed the actual capital, surplus and undivided profits of the bank this period plus the after tax income forthcoming during the period. The capital structure of the bank this period is defined by equation (13) as the capital, surplus and undivided profit account at the beginning of the previous period plus the portion of the after tax income reinvested in the firm. The "additional capital" requirement is based on the bank's liquidity structure. The underlying assumption of the liquidity analysis is that as the liquidity of the assets decreases the bank faces increasing risk and the liability structure must be altered or a larger capital structure is required. The liquidity calculation which indicates this need for "additional capital" is defined by equation (14) as the liquidity required by the various deposits in the bank minus the liquidity provided by the investments and loans.
Application of the Model

To determine the most profitable utilization of deposit and non-deposit sources of funds in the acquisition of loans and investments, the poly-period linear programming model was applied to a representative nationally chartered commercial bank in a progressive rural community of 1200 people. The bank had an initial capital and surplus account plus undivided profits of $500,000 and total assets of $7,210,406. At the time of the analysis a correspondent arrangement was being utilized to handle a number of farm customers because local deposits were insufficient to handle loan demand. Current loan volume of the bank was slightly in excess of $5 million. The banker estimated that if funds were available, he could loan a total of $7 million during the upcoming year with a growth rate of $250,000 a year during the following three years of the planning horizon. The banker estimated that deposits would only grow at an annual rate of $55,000 per year. These market relationships, along with the financial statements, legal constraints and the various cost coefficients were obtained from the case bank and incorporated in the poly-period linear programming model for the empirical analysis. For details of the application and results, see [8].

Sources and Uses of Funds

Deposit Funds

In general, the numerical results indicate that time and demand deposits are utilized completely during all time periods. There are no transfers of unused deposit funds at any time during the planning horizon. The availability of time and demand deposits increases during the planning horizon because of both market growth and the 'feedback' effect from loans. Deposit funds are used to acquire or make six month, one year, two year, three year and ten year agricultural loans, two year installment loans, two year commercial loans and eight year
municipal bonds. Government securities are not purchased in any of the situations analyzed. The bank is able to derive required liquidity for regulatory purposes from municipal bonds, government securities in beginning inventory and capital and surplus.

Non-Deposit Funds

The utilization of the four non-deposit sources of funds identified earlier is summarized in Table 1. The Agricultural Credit Corporation could be utilized to make six month, one year, two year and three year agricultural loans. As can be determined from Table 1, the bank utilizes the ACC to its fullest extent in all periods to make six month agricultural loans. By forming the ACC, the bank is able to satisfy a total of $1,995,000 of loan demand which would not have been satisfied otherwise. In addition the bank receives a total contribution to profit of $12,810 from these loans during the three year planning horizon.

The correspondent arrangement could be used to make both six month and one year agricultural loans. The correspondent arrangement is used to make $1,600,000 of six month agricultural loans and $1,600,000 of one year agricultural loans during the planning horizon (Table 1). The total profit contribution from these loans amounts to $6,860.

Direct line discounting with the district FICB is included in the model to supply non-deposit funds for making a six month, one year, two year and three year agricultural loans. The FICB direct line discount is utilized to make $9,825 of three year agricultural loans and $5,360,699 of six month agricultural loans during the three year period. It should be noted that the profit margin for direct line discounts is identical to the margin on ACC loans. Thus, this non-deposit source of funds generates an additional $29,856 of profit for the bank during the planning horizon.

Even though the PCA participation arrangement does not generate a direct
TABLE 1
NON-DEPOSIT SOURCES AND USES OF FUNDS

<table>
<thead>
<tr>
<th></th>
<th>YEAR 1 PERIOD 1</th>
<th>YEAR 1 PERIOD 2</th>
<th>YEAR 2 PERIOD 1</th>
<th>YEAR 2 PERIOD 2</th>
<th>YEAR 3 PERIOD 1</th>
<th>YEAR 3 PERIOD 2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Agricultural Credit Corporation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Six Month Loan</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volume</td>
<td>$332,500</td>
<td>$332,500</td>
<td>$332,500</td>
<td>$332,500</td>
<td>$322,500</td>
<td>$322,500</td>
</tr>
<tr>
<td>Profit Contribution</td>
<td>2,135</td>
<td>2,135</td>
<td>2,135</td>
<td>2,135</td>
<td>2,135</td>
<td>2,135</td>
</tr>
<tr>
<td><strong>Correspondent</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Six Month Loan</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volume</td>
<td>706,010</td>
<td></td>
<td>93,990</td>
<td></td>
<td></td>
<td>800,000</td>
</tr>
<tr>
<td>Profit Contribution</td>
<td>1,003</td>
<td></td>
<td>133</td>
<td></td>
<td></td>
<td>1,136</td>
</tr>
<tr>
<td>One Year Loan</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volume</td>
<td>93,990</td>
<td>800,000</td>
<td>800,000</td>
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<tr>
<td>Profit Contribution</td>
<td>256</td>
<td>2,176</td>
<td>2,176</td>
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<tr>
<td><strong>FICB Direct Line</strong></td>
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<tr>
<td>Six Month Loan</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Volume</td>
<td>89,175</td>
<td>890,175</td>
<td>890,175</td>
<td>890,175</td>
<td>900,000</td>
<td>900,000</td>
</tr>
<tr>
<td>Profit Contribution</td>
<td>575</td>
<td>5,735</td>
<td>5,735</td>
<td>5,735</td>
<td>5,978</td>
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<tr>
<td>Two Year Loan</td>
<td></td>
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</tr>
<tr>
<td>Volume</td>
<td>9,825</td>
<td></td>
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<tr>
<td>Profit Contribution</td>
<td>120</td>
<td></td>
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</tr>
<tr>
<td><strong>PCA Participation</strong></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Three Year Loan</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volume</td>
<td>200,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The volume data indicates the total amount of loans made during each period.

This is the total contribution to net profit above direct variable costs of using each non-deposit source of funds to make the various maturity types of agricultural loans.
profit for the bank, an economic benefit results from this source of funds through the increase in loanable deposits from the "feedback effect." Consequently, $200,000 of three year loans are made by the bank using the PCA participation arrangement.

With respect to loan portfolio, the bank uses deposit funds to make a larger volume of short-term loans compared to long-term loans. The short-term loans are more profitable as well as more liquid, and thus allow the bank more flexibility. Non-deposit sources of funds, particularly the ACC, the correspondent arrangement and the FICB direct line discount, are also utilized to make primarily short-term loans. The ACC is always utilized to make six month agricultural loans. However, a limited volume of longer-term agricultural loans are made from non-deposit sources, particularly through the PCA participation agreement and the FICB direct line. Non-deposit funds are completely utilized in all periods, and the shadow prices indicate that additional non-deposit funds could have been utilized in a profitable manner by the bank.

Annual Profit and Loss Summary

Table 2 shows the profit and loss summary for the bank for the three year planning horizon. In year one, the net income from taxable sources is $72,177 and the taxable income from the ACC is $4,270. Taxes for the first year total $28,645 which is determined by taxing the first $25,000 of taxable profit at a 22 percent rate and the balance at a 48 percent rate. The income of the ACC is taxed at the same rates. After deducting the taxes paid, the bank has a $69,574 after tax profit.

In year two, the net income from taxable sources decreases to $51,025 because of a decline in the volume of loans and government securities that earn taxable income. In contrast, non-taxable income increases to $37,428 in the second year. The tax liability decreases to $17,994 for a net after tax profit
### TABLE 2

**PROFIT AND LOSS SUMMARY**

<table>
<thead>
<tr>
<th></th>
<th>YEAR 1</th>
<th>YEAR 2</th>
<th>YEAR 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Net Profit from Taxable Sources</strong>&lt;sup&gt;b&lt;/sup&gt;</td>
<td>$72,177</td>
<td>$51,025</td>
<td>$94,241</td>
</tr>
<tr>
<td><strong>Net Profit from the ACC</strong></td>
<td>4,270</td>
<td>4,270</td>
<td>4,270</td>
</tr>
<tr>
<td><strong>Net Profit from Non-taxable Sources</strong></td>
<td>21,752</td>
<td>37,428</td>
<td>41,376</td>
</tr>
<tr>
<td><strong>Total Net Profit</strong></td>
<td>$98,219</td>
<td>$92,723</td>
<td>$139,887</td>
</tr>
<tr>
<td><strong>Less Taxes Paid</strong>&lt;sup&gt;c&lt;/sup&gt;</td>
<td>28,645</td>
<td>17,994</td>
<td>38,089</td>
</tr>
<tr>
<td><strong>Total after Tax Profit</strong></td>
<td>$69,574</td>
<td>$74,729</td>
<td>$101,798</td>
</tr>
</tbody>
</table>

<sup>a</sup>This profit and loss summary presents only aggregate income figures. The model was not designed to keep detailed accounting records.

<sup>b</sup>The net profit from taxable sources figure represents the net profit after all variable and fixed expenses have been deducted.

<sup>c</sup>Includes taxes paid by the Agricultural Credit Corporation.
of \$74,729 in year two. In year three, the bank experiences an increase in both loan volume and municipal bond investments, thus resulting in an increase in taxable income to \$94,241 and an increase in non-taxable income to \$41,376. The taxes paid in the third year total \$38,089 for a net after tax profit of \$101,798.

Under various loan demand modifications, the bank's profitability was not significantly affected because of the substitutability between the various classes of loans. Even under the assumption of a 50 percent decrease in loan demand for six month and one year agricultural loans, the bank was able to substitute longer-term agricultural loans in its portfolio without greatly affecting profit. This suggests that wide variations in loan portfolio composition may result in only small differences in net return. Thus, the major determinant of bank profitability may be the sources of funds and liability management rather than the uses of funds or asset management.

**Summary and Conclusion**

The results indicate that the case bank could utilize non-deposit sources of funds to increase profit and satisfy local loan demand. A total of \$10,058,505 of loans were made with funds from non-deposit sources, resulting in a \$49,546 contribution to bank profits during the three year planning horizon. Before tax profit was increased by approximately 17.6 percent through the use of the non-deposit funds sources. The bank's assets increased from an initial level of \$7,210,406 to a balance of \$8,909,924 at the end of the planning horizon. A discounted net return of \$213,435 was generated for the three year period. Capital and surplus increased from \$500,000 at the beginning of the planning horizon to \$598,838 at the end.

Time and demand deposits appear to be significantly more profitable than non-deposit sources of funds. The shadow prices indicated that increased demand
deposits were approximately ten times more profitable and increased time deposits were approximately five times more profitable than the non-deposit funds sources. If the bank has unlimited access to deposit funds, non-deposit sources of funds would be relatively unimportant.

However, even though the non-deposit sources of funds were not as profitable as deposit funds, they did allow the bank to increase its loan volume and better serve the local community. In fact, a rural bank can economically benefit by using non-deposit funds sources, even if these sources do not contribute directly to bank profits. By making economically sound loans, irrespective of the source of funds, increased economic activity will occur in the community resulting in increased bank deposits and loanable funds in the future. If the deposit funds are as highly profitable as the results of this study indicate, the increase in deposits which is propagated through the availability of additional loanable funds may be the primary benefit of the non-deposit funds sources. Recognition of the "feedback" concept by commercial banks will not only increase bank profits in the future, but will also provide evidence of the broader responsibility of rural banks to invest in the future of their community.

Changes in short term loan demand resulted in the substitution of long for short term loans in the loan portfolio, but no significant changes in income over the planning horizon. Wide variations in the maturity of the loan portfolio resulted in only small differences in net return. Thus, bank profitability may be more dependent on sources of funds and liability management than on uses of funds or asset management.

Finally, the analytical model used in this study enables simultaneous evaluation of the optimal composition of the liability and asset portfolio of a commercial bank. Valuable quantitative evidence can be obtained on the acquisition and use of deposit and non-deposit funds sources. The model can also provide useful insights into the interrelationships between federal regulations, invest-
ment policy, and income and capital accumulation. In addition, the shadow prices on resource availability and alternative investments indicate the sensitivity of liability and investment decisions to changes in parameter values. This information can be used to delineate the types of decisions in commercial banking that merit detailed data collection and analysis as well as to guide further research on the problems encountered by rural commercial banks.
FOOTNOTES

1/ It should be noted, however, that Melichar's projections indicate that the growth in aggregate deposits experienced by rural banks in recent years is approximately equal to the 7 percent projected rate of growth in total farm debt. See [9].

2/ Additional alternatives for mobilizing funds within the commercial banking sector and utilizing non-deposit funds have been proposed or developed since the late sixties. Bankers acceptances and warehouse receipts are being used by a limited number of banks to finance the cattle feeding industry. Development credit corporations which provide a secondary money market to provide funds mobility from surplus to deficit areas have also been utilized to a limited extent for rural agri-business. The federal funds market also provides a source of short term funds, although data indicates that many small banks in rural areas view the federal funds market as a more liquid investment than Treasury bills and other money market instruments rather than as a source of loanable funds. See [10].

3/ In fact, a recent study [12] indicates that because of the compensating balances frequently required by the correspondent bank, the net flow of funds through the correspondent system is actually from rural communities to urban centers.

4/ Many commercial loans are not made for a two year maturity. However, this specification implicitly recognizes the procedure frequently used in commercial banking of specifying a line of credit and then extending it (rolling over) beyond the original maturity date.

5/ To keep the model of manageable size, it was assumed that all loans, government securities and municipal bonds are held until maturity.

6/ This formulation of the model precludes rate competition in the deposit market. If all banks in the market are paying ceiling rates on deposits as is frequently the case, this assumption is justified. Furthermore, access to additional funds and the resulting issues of liability management are incorporated in the analysis by including non-deposit funds sources in the model.

7/ Each period in the model is six months in length. Consequently Fed Funds are not included in the analysis since this source of funds is typically used to cover reserve requirements and other short term needs.

8/ As in the deposit market, this specification of the model precludes rate competition in the loan market.
Even though government securities were not purchased during any period of the planning horizon, the bank held some government securities in all three years since the initial asset portfolio included securities that did not mature until the end of the third year. If the analysis would have been extended beyond three years, it is anticipated that government securities would have been purchased once the securities in the initial portfolio matured.

It was assumed that if an agricultural credit corporation was formed, it would be a joint venture of four banks. This assumption allows each bank to contribute a portion of the $200,000 minimum capital requirement without impairing the capital and surplus position of the bank.


