Graduate School of Agri-Finance and Banking Top Student Article

Like the rest of the banking industry, agricultural and rural community banks are confronted with fluctuating markets, new regulations, and an uncertain economy in the United States and abroad.

In order for managers in agricultural lending to gain a competitive edge, executives need sophisticated techniques to understand and manage the complexities of new regulations; the cash flow cycles of rural business and agribusiness, and production agriculture; asset and risk management; high performance lending and secondary market loans. The ability to analyze the effect of economic trends and plan strategically are crucial skills.

In response to these needs, ABA developed a rigorous curriculum for the ABA Graduate School of Agri-Finance and Banking. The content was developed with the goal of providing professionals with the techniques, strategies, and analytical ability to achieve outstanding performance. Participating in residential sessions over two consecutive summers, students have instruction in the latest techniques for credit analysis and risk control; strategies for new marketing; loan pricing and customer profitability analysis; and human resource bank management strategies to improve the bottom line. During the year between the two sessions, participants have an opportunity to put their educational experience into practice by studying a problem that is relevant to their financial institution. The interim problems provide an opportunity for participants to have an immediate effect on their banks' profitability. The following article describes the outstanding project selected from the work of the recent graduates.

A Scoring and Loan Pricing System for Agricultural Banks

Historically, Davis County Savings Bank has used separate ratios and separate scoring systems for commercial and agricultural loans. Although this has worked well, there is value in developing a joint ag and commercial scoring system. It will streamline the process and facilitate analysis of the ag and commercial portfolios as one unit. Additionally, there is a trend in agricultural finance to incorporate more business practices and analysis. The objective of this project was to identify universal ratios that can be used on both types of loans.

Review of Components of Credit Scoring Systems

A credit scoring system allows an individual credit score to be assigned to each

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loan in a portfolio. This credit score enables the lender to accomplish three main things:

1. To determine the general quality classification for that particular loan
2. To compare that loan with others in the portfolio and determine the overall quality and risk of the loan portfolio
3. To use the credit score as one factor in a loan pricing system

The main components of any credit scoring system are various balance sheet and income statement ratios. The literature revealed many similarities in the recommended ratios and some differences in the calculations of basic ratios. Those ratios were selected for testing that provide the most insight into and best differentiate the data. An effort was made to use definitions that are consistent with the preliminary findings of the Farm Financial Standards Task Force. The various ratios can be broken down into four basic categories: liquidity, leverage, repayment capacity, and operating efficiency or profitability.

Liquidity

The main liquidity ratio used is the current ratio:

$$\text{Current ratio} = \frac{\text{Total current assets}}{\text{Total current liabilities}}$$

Current ratio was selected to test on the data because it was cited universally in the literature and because personal experience supported its soundness. The sales to receivables and cost of sales to payables ratios were selected for testing on the commercial loans being analyzed because these ratios could provide some interesting insight into the commercial loan accounts.

Leverage

The literature shows that all leverage ratios are essentially variations of each other. The debt to asset ratio is one way to analyze leverage:

$$\text{Debt to asset ratio} = \frac{\text{Total debt}}{\text{Total assets}}$$

Another approach is the debt to worth ratio, which rises geometrically as total debt rises, whereas the debt to asset ratio is a linear progression. The linear progression of the debt to asset ratio does not exaggerate in-cremental differences in highly leveraged operations.

$$\text{Debt to worth ratio} = \frac{\text{Total debt}}{\text{Total equity}}$$

The debt to asset ratio was selected to test on the data because of its universal appeal to lenders and its linear progression.

Repayment Capacity/ Cash Flow Coverage

Cash flow coverage ratios were also found to be variations of each other. ABA defines cash flow coverage ratio as:

$$\text{Cash flow coverage ratio} = \frac{\begin{array}{l}\text{Net farm income +}\\\text{Interest expense+}\\\text{Nonfarm income -}\\\text{Living expenses}\end{array}}{\begin{array}{l}\text{Debt service}\\\text{requirements}\end{array}}$$

Robert Morris Associates (RMA) uses this cash flow coverage formula:[1]

$$\text{Cash flow coverage} = \frac{\text{Net profit} + \text{Depreciation}}{\text{Current portion of long term debt}}$$

The ABA ratio looks at the amount available for making the payments in relation to the payments to be made. The RMA ratio differs from the ABA in that it results in the amount available to pay only principal —rather than principal and interest, which the ABA examines. Since there is value in looking at the ratio as a percentage of what is available to meet the total debt servicing requirements including interest, cash flow coverage was defined as:

$$\text{Cash flow coverage} = \frac{\begin{array}{l}\text{Net farm income} + \\ \text{Interest expense} + \\ \text{Depreciation} + \\ \text{Nonfarm income} - \\ \text{Living expenses}\end{array}}{\begin{array}{l}\text{Total scheduled principal and interest payments}\end{array}}$$

This definition is consistent with that used by the Task Force.

Operating Efficiency and Profitability

The greatest disagreement in the literature was found in the calculation of the various measures of operating efficiency and profitability. One area of disagreement is in how to fix the value of operator and family labor. For this project, net operator's draws have been chosen as the method of assigning a value to the operator's labor because it is what the operator is actually paying

himself for the time and effort he spends in the business.

Another major difference in the calculation of various profitability ratios is whether the value of farm production or gross revenues is used. The value of farm production indicates the amount of actual production. However, in comparing two livestock operations, one that purchases all grain fed to livestock and another that raises all grain, the method using the value of farm production method can distort the various profitability measures.

The two farms can have the same net profit after all expenses. The farm that raises its grain will have higher operating expenses and lower feed costs because the cost of the grain produced for feed will be included in operating expense. The other farm, which purchases feed, will show disproportionately high feed costs because purchasing the grain separates these costs from other operating expenses. If net profit is evaluated as a percentage of the value of farm production, the operation that purchased the grain will show a much higher net profit margin than the other farm, when in reality there are no differences in profitability. Therefore, gross revenues are used in the profitability ratios.

The two main profitability measures used in both agricultural enterprises and commercial businesses are return on assets (ROA) and return on equity (ROE). An additional ratio, asset utilization, was consistently used in the literature. The following ratios were selected for testing:

$$\text{Return on assets} = \frac{\begin{array}{l}\text{Net income} + \\ \text{Interest expense} - \\ \text{Operator's draw}\end{array}}{\text{Total assets}}$$

$$\text{Return on equity} = \frac{\text{Net income - Operator's draw}}{\text{Total equity}}$$

$$\text{Asset utilization} = \frac{\text{Operating revenues}}{\text{Total assets}}$$

$$\text{Profit margin} = \frac{\text{Net farm income - Operator's draw + Interest expense}}{\text{Operating revenues}}$$

In these three ratios, operator's draw is defined as the net of nonfarm income minus living expenses. The minimum operator's draw used is zero. In the case that nonfarm income exceeds living expenses, the excess may be used to make loan payments and therefore is included in the calculation of cash flow coverage. But the excess should not be considered as part of the ROA. These definitions are consistent with those of the Task Force. In studying them, it was found that ROA is the product of profit margin and asset utilization.

$$\text{Revenues ROA} = \underbrace{\frac{\text{Net farm income- Operator's draw + Interest expense}}{\text{Operating revenues}}}_{\textbf{Profit margin}} \times \underbrace{\frac{\text{Operating revenues}}{\text{Total assets}}}_{\textbf{Asset utilization}}$$

Additionally, the operating profit margin can be broken down into three separate ratios: net income to revenues, operator's draw to revenues, and interest expense to revenues. When ROA is divided by the debt to asset ratio, it yields a percentage that can be termed the capital solvency rate. In its simplified form the following ratio results:

$$\text{Capital solvency rate} = \frac{\text{Net income + Interest - Operator's draw}}{\text{Total debt}}$$

The capital solvency rate must exceed the mean interest rate of all loans or the income is insufficient to meet the debt servicing requirements. The following measures of profitability were selected for testing:

Return on assets
Return on equity
Asset turnover
Operating profit margin
Net income to revenues
Operator's draw to revenues
Interest expense to revenues
Capital solvency rate

Review of Components to Be Used in Loan Pricing

The foundation of any loan pricing system must be the asset/liability management policies of the financial institution. These policies guide bank management in determining the premium or discount for each individual borrower, based on credit worthiness and other factors. This portion of the project develops a loan pricing system that incorporates a credit score as well as other pertinent factors. There are two basic components of loan pricing: cost of funds and interest rate spread.

Cost of Funds

For this project there were two main reasons for calculating cost of funds: for the purposes of asset management and for analyzing the overall cost of funds in determining the benefits of compensating balance when pricing a loan for an individual customer.

Value of Compensating Balances

If a customer maintains a compensating deposit balance, it can significantly increase the loan yield. When a customer maintains a profitable DDA account of a significant balance, this in effect funds part of the credit line. One equation[2] for calculating the estimated loan yield when considering compensating balances is:

$$y = \frac{u\,r + f\,(1-u)}{u - (b1 + b2\,u)\,(1-R)}$$

Where y = estimated loan yield
    u = estimated first-
        year commitment usage
    r = adjusted nominal rate
    f = commitment fee
   b1 = compensating balance require-
        ment on total commitment
   b2 = compensating balance require-
        ment on borrowings
    R = reserve requirement on
        compensating balances

If customers have not been required to have specific minimum compensating balances, their compensating balances for the previous twelve months have been considered in determining the loan price for the coming twelve-month period. If a loan commitment fee has not been charged, the equation can be rewritten:

$$y = \frac{u\,r}{u - (b\,(1-R))}$$

When the desired yield is known, the equation can be solved for the adjusted nominal interest rate required.

$$r = \frac{y\,(u - (b\,(1-R)))}{u}$$

Where b = historic compensating balance
OR
compensating balance requirement

In calculating the value of a compensating balance when loan pricing, we need to use only that amount that exceeds the minimum balance required to pay for the cost of servicing the DDA account. Otherwise, double credit will be given for the compensating balance.

A computerized account analysis on individual checking accounts calculates a credit for the checking account balance that has been maintained for the statement cycle. This credit is then applied to the transaction service cost of the account and charges are assessed accordingly.

As mentioned previously, the compensating balances for the preceding twelve months are considered in pricing a line of credit. Actually, the prior year's compensating balance is irrelevant to pricing a customer loan for the coming year. It merely indicates what kind of balance will be maintained and prevents new customers from participating in this aspect of the loan pricing schedule.

There are two ways to get around this problem. One option is to require a minimum compensating balance, which is factored into the loan price. The customer is then service charged if the balance falls

below the minimum. The second alternative is to give a rebate at the end of the year based on the correlation between the customer's deposit balances and average outstanding loan balance.

Conclusions

Review of Data

Data were collected on all ag and commercial loan customers with established credit lines of over $25,000. Those customers who had insufficient information in their credit files were excluded from the sample. To offer a broader based sample, data were also collected on several customers with loans of less than $25,000. The sample comprises 41 commercial and 87 agricultural credit lines.

A maximum of four years' of data on each customer were collected where it was available. A maximum of one year's worth of projected profit and loss data were collected unless additional years had historic value. Only the most recent data on each customer were used.

Development of Credit Score

Selection of Ratios

In developing a credit score, it is necessary to select ratios that test the different aspects of the customer's financial condition. In order to keep the scoring system simple yet accurate, one ratio from each of the four basic categories was used to determine the credit score, which needed to be universal for both ag and commercial lines of credit. Therefore the ratios selected show the most consistency between the loan classes.

In general, the current ratio, debt to asset ratio, cash flow coverage, return on assets, and capital solvency ratios were all fairly consistent between loan classes. However, the operating efficiency ratios such as asset turnover and operating profit margin, varied greatly between ag and commercial lines of credit. Therefore, this project concentrated on ratios showing the most consistency across loan classes:

Current ratio (liquidity)
Debt to asset ratio (leverage)
Cash flow coverage (cash flow coverage)
Return on assets (profitability)
Capital solvency rate

The capital solvency rate was included because it adds greater insight into an operation than the debt to asset ratio and ROA-considered separately.

Current Ratio

The mean current ratio was 3.43. The distributions showed that 11 credit lines had current ratios in excess of 10 to 1. When these 11 are excluded, the mean drops to 2.33. For scoring purposes, a minimum acceptable ratio of 1.5 to 1 and a maximum of 3.5 to 1 were used.

Debt to Asset Ratio

The mean debt to asset ratio expressed as a percentage for all credit lines was 43.66%. For scoring purposes, it was decided to set a minimum accepted value of 30% and a maximum of 55%.

Cash Flow Coverage

The mean cash flow coverage ratio expressed as a percentage for all credit lines was 269.5%. Of all ratios selected for use in the credit score, this one had the greatest difference between the ag and commercial lines of credit. The mean of all ag lines was 250.1%, for commercial lines it was 330.2%. The data showed that nine records

had coverage ratios in excess of 500%. Three of these records had no long-term debt payments, which yielded coverage ratios of 1000%. When these nine are excluded from the sample, the adjusted mean is 203.6%, with an adjusted mean for ag lines of 220% and the adjusted commercial mean of 161%. The adjusted mean was used as the midpoint for the credit score, with a minimum of 150% and a maximum of 250%.

Return on Assets

The mean ROA (expressed as a percentage) on all credit lines is 9.6%, which was fairly consistent between the ag and commercial lines. The components of this ratio however, vary greatly among loan classes. While some basic differences between the cost and expense structures of farm and commercial businesses are evident, the overall profitability as evidenced by ROA remains consistent. Therefore ROA can be used for both ag and commercial credit lines. Among the distributions, six lines had returns on assets of over 20%. If these six are excluded, the mean ROA drops to 7.85%. Therefore, a minimum accepted value of 6% and a maximum value of 10% with a midpoint of 8% were used for ROA.

Capital Solvency Rate

The mean capital solvency rate is 26.5%. The commercial lines of credit averaged 22.7%. In the distributions, 11 credit lines had capital solvency rates greater than 50%. When these 11 were excluded from the sample, the mean dropped to 17%, which was too low to be used as a midpoint for the credit score. Therefore, a minimum of 15% and a maximum of 35% were selected for the capital solvency rate.

Relative Weighting of Ratios

The relative weighting of each selected ratio must be determined based on the perceived value of that ratio. It was difficult to weight any ratio as significantly more important than the others, so each was given equal weight.

The foundation of any loan pricing system is asset/liability policies of the bank.

A point scale of 100 was developed, with 20 points assigned to each ratio. Zero points were assigned for having the minimum ratio. Twenty points were assigned for having the maximum ratio in the range. Ratios falling within the range were interpolated. This 100 point scale was inverted and then divided by 20. The resulting value was rounded to a whole number with all values less than 1 yielding a score of 1. This produced a 1 to 5 rating with 1 being good and 5 being poor. The credit score was then applied to the loan portfolio.

In analyzing the data, an effort was made to use the most recent year for which data were available. It should be noted that 48 records contained neither historic nor projected profit and loss data for the year analyzed. Because three of the ratios in the credit score use data from the income statement, three is the best score possible without profit and loss data. Personal knowledge of the portfolio suggests that many of these customers would score significantly better if profit and loss data were available. Table 1 displays the total established credit lines and current loan balances by credit score. These numbers are skewed by the lack of information available for the credit lines mentioned above.

Table 1.
Total Credit Lines Ranked by Score
Davis County Savings Bank

Score	Credit Line		Balance	
1	$2,065,750	17.4%	$1,011,607	13.4%
2	906,750	7.6%	624,235	8.6%
3	2,530,000	21.2%	1,168,295	16.0%
4	4,273,685	35.7%	2,833,085	38.8%
5	2,176,540	18.2%	1,667,693	22.8%
	$11,963,725		$7,304,915	

Loan Price

The goal of revising the current loan pricing system was to develop an objective method of pricing that incorporates the new credit score and offers an attractive interest rate to qualified new customers. Different customers are charged different interest rates for many reasons:

1. Marginal lines of credit require much greater supervision by a loan officer, therefore warranting a higher interest rate to help compensate for this increase in cost.

2. There is increased risk with a marginal line of credit. However, this risk can not be realistically offset by a marginal increase in the interest rate.

3. The best loan customers are the ones who can most easily find another lender. Therefore, most banks find it advantageous to be competitive in loan pricing for their best customers.

Many lending institutions do not wish to reveal to their customers their credit scoring system or individual credit scores; these systems should remain tools for bank management. On the other hand, showing the customer how the loan rate is calculated helps justify a differential pricing system. Therefore, it is recommended that the customer's loan price be based on the 100 point scale rather than on the credit score of one to five. This will have the same effect as basing the loan price on the actual credit score, while not revealing the customer's credit score. Table 2 shows the proposed relationship between the 100 point scale and the interest rate discount.

Table 2.
Interest Rate Discount Scale
Davis County Savings Bank

Total Points	Interest Rate Discount
0 - 14	0.00%
15 - 29	0.25%
30 - 44	0.50%
45 - 59	0.75%
60 - 74	1.00%
75 - 89	1.25%
90 - 100	1.50%

Compensating Balances

To determine the actual account servicing costs on deposits owned by loan customers, the following data were gathered on all DDA accounts for the month of April:

Ledger balance
Average daily collected balance
Interest paid
Number of on-us checks deposited
Number of foreign checks deposited
Number of service chargeable credits
Number of service chargeable debits.

The net earnings for the month for each DDA account was then calculated using the following formula:

Net earnings =   Earnings
                   - Cost
                   - Service charge
                   - Transaction charge
                   - Foreign charge
                   - On-us charge

Where:

Earnings = Collected funds X
           (1 - Reserve requirement (12%))
           (zero if collected funds is negative)

Cost = Collected funds X 10% interest
       (zero if collected funds is positive)

Service charge $5.00/month
Transaction charge $0.20/credit
                    plus $0.10/debit
Foreign charge $0.065/check
                    deposited
On-us charge $0.05/check
                    deposited

In analyzing the net earnings on DDA accounts of customers who are borrowers, it was noted that the highest earning was in excess of $270.00, and the lowest was a negative $280.00. All accounts added together netted earnings of $165.00 for the month on 123 customers. The average was $1.34 per customer, compared to an average of negative $6.56 for all DDA accounts. The maximum monthly net earnings for all customers was $346.74, with a minimum of negative $2,210.42.

In addition to the data discussed above, the twelve-month-average ledger and collected balances for DDA and savings accounts, as well as current CD balances, were used in reviewing historic deposit relationships. The account analysis and customer profitability programs were also reviewed. It seemed impractical to use either the customer profitability analysis or the account analysis data in considering compensating balances for our loan pricing. In theory, it may be possible to develop a formula by which a rebate could be given to customers based on their loan balances and corresponding deposit balances for a given period of time. Experience has shown that rebate programs are very difficult to manage.

Therefore, it was recommended that all ag and commercial customers be charged on their deposit accounts based on the account analysis program. Secondly, it was recommended that customer loan interest rates be discounted based on their historic compensating balances. The recommended discount was 12.5 basis points for each 5% collected deposit balance versus the established line of credit. Due to their higher interest rates, it was recommended that CDs are not included in the calculation of collected deposit balances. A maximum discount on a loan of 50 basis points would be allowed. Since this method does not allow a discount for new customers, it was recommended that a discount be considered for a

1990 ABA National Agricultural Co
"Mountains of Change, Mile-Hi

Dick Kirk,
ABA President (left)

Alan Tubbs
ABA President-Elect (center)
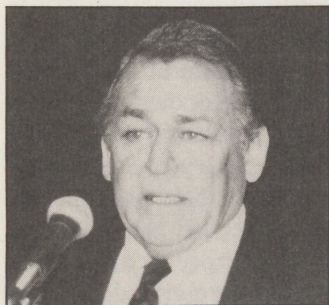
Jack Parnell, Deputy Secretary
of Agriculture (above)

Peter Meyers, President, Farm Credit Council (center) Mike Grove, Chain,
Agriculture Bankers Division (left) Harold Steele, Chairman, Farm Credit Administ

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Dr. Barry L. Flinchbaugh and
Dr. Mark A. Edelman (right)

Dr. Neil Harl (above)

Dr. David Kohl, VIP and David Nolan,
a member of Executive Committee (left)

Chan,
Credit Administration (right)

Hungry
Iowa
Bankers

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new borrower who moves a deposit account when establishing a new line of credit.

Summary of Loan Pricing

The combination of the recommended method of loan pricing and discounts for compensating deposit balances yields a maximum discount of 200 basis points. The current method contains a maximum discount of 300 basis points. Most customers have been automatically given a 50 basis point discount. It is recommended that a new base interest rate be established that is 100 basis points below the current base rate. As new loans are generated they can be indexed to the new rate, while the old base rate is phased out.

An analysis was conducted to determine the effect that the change would have on interest rates for bank customers. Currently the weighted average interest rate is 12.902%. The revised interest rate pricing would marginally increase the weighted average to 13.027%. This yield is sufficient to cover the cost of funds and the required interest rate spread.

A regression analysis was performed on the current interest rate versus the new interest rate to determine the correlation between the two rates. This analysis yielded an R2 value of 0.216, which would indicate a relatively low correlation in that 78% of the variation between the two interest rates can not be accounted for by a linear relationship.

It can be argued that the poor correlation is partly due to the lack of profit and loss data upon which to base the credit score and the subsequent loan price. When the credit lines without profit and loss data were excluded from the sample, the regression analysis yields an R2 value of 0.234, which is only slightly better than that using the entire sample. Therefore, one may con-clude that there is not a significant correlation between the two interest rates as calculated.

A form was designed to calculate the customer's credit score and interest rate. To supplement to this form, it is recommended that a computer program be developed to calculate the customer's credit score and interest rate.

Presentation to Management

This analysis was presented to the bank senior management team. In reviewing the customer list by credit score, the executives noted several customers ranked differently than a subjective approach would have yielded. Most of the differences can be attributed to the quality or lack of information available in the credit file.

Many customers had poorer credit scores than expected. Most often this could be attributed to the lack of profit and loss data. One business with a credit score of three, has virtually no long-term debt and a 35% debt to asset ratio. It is a tightly held corporation and the owner draws most of the profits out in the form of salaries. Consequently, it has a return on assets of 0.39% and a capital solvency rate of 1.1%. It was determined that allowances should be made, in this type of situation, for the resulting growth in personal equity.

Management also noted that a few customers scored much better than expected. This was generally due to an overly optimistic projected profit and loss. The inaccuracy of the information in the credit files was a limiting factor in the calculation of any credit score or loan pricing system. It was recommended that historical profit and loss information be obtained on more borrowers in the form of a tax return that has been reconciled on an accrual basis. Man-

agement concurred with this recommendation.

In reviewing the comparative loan pricing, it was again noted that quality information is required to accurately and fairly price loans. It is management's opinion that officer discretion needs to be allowed in pricing loans. On some high quality loans, profit and loss information will not always be readily available. In these situations, officers need to have the authority to offer interest rates that can be justified. It was decided that these deviations need to be reviewed by the loan committee and supported by comments in the credit file.

The value and calculation of compensating balances was discussed. It was recognized that ideally only the portion of the deposit balance above that which was necessary to cover the cost of maintaining the account would be considered in loan pricing. After discussion however, management realized the practical problems of tracking the necessary data on an ongoing basis. In addition, it was felt that the method of determining the compensating balance and subsequent loan discount must be simplistic enough to be easily understood by the bank's customers. Therefore, it was agreed that the deposit account maintenance cost would not be considered in loan pricing.

It was agreed that the average collected balance should be used rather than the average ledger balance. The rationale is that the bank does not have the funds to invest until the deposits are collected. Discussion occurred about whether CDs should be included in the calculation of the compensating balances. It was pointed out that current market conditions do not allow for interest rates spread over the CD cost sufficient to yield anything more than break even. Therefore, the bank realizes no profit from the investment of CDs in loans. If customers have CDs, they will be offered the opportunity to pledge the CDs as collateral on their loans, thereby allowing the bank to price that portion of their loans at 3% over the CD rate as per the current policy. Otherwise it would be explained to the customer that CDs are not considered part of the compensating balance. It was the recommendation of management that a statement be included on the loan pricing form stating that CDs are not included in the calculation of compensating balances.

After a thorough review of the analysis in this project, management recommended to the board of directors that the proposed credit scoring system and loan pricing schedule be adopted by Davis County Savings Bank. The new credit score and loan pricing schedule would be implemented gradually as new data are collected on the bank's customers. Credit lines that have already been priced for this year based on information currently in the files, will continue under the old loan pricing system. As new information is gathered, the loans will be repriced using the new system. This should result in most customers being repriced within a 9- to 10-month time frame with a gradual phase in of the new pricing system.

by Dean W. Ekstrand, Assistant Vice President, Davis County Savings Bank, Bloomfield, Iowa.

[1]Robert Morris Associates, RMA Annual Statement Studies, Robert Morris Associates, Philadelphia, Pennsylvania, 1987.
[2]Brick, John R., "Pricing Commercial Loans," A Special Collection from The Journal of Commercial Bank Lending: LOAN PRICING, Robert Morris Associates, Philadelphia, Pennsylvania, 1989.