THE DEVELOPMENT OF A MANAGEMENT GAME FOR OKLAHOMA RURAL BANKS

By

GLEN DAVIS FISHER

Bachelor of Science

Texas Tech University

Lubbock, Texas

1971

Submitted to the Faculty of the Graduate College
of the Oklahoma State University
in partial fulfillment of the requirements
for the Degree of
MASTER OF SCIENCE
December, 1973

THE DEVELOPMENT OF A MANAGEMENT GAME FOR OKLAHOMA RURAL BANKS

Thesis Approved:

Robert A. Ledbetter
Thesis Adviser

Ted K. Nelson

Robert A. Kathjen

Wynn P. Betty

N N Durham
Dean of the Graduate College

PREFACE

This study is concerned with the development of a management game for Oklahoma rural banks, and that is the primary objective. A computer program is used for the model, and the development of total market deposit supply and loan demand and market share equations are important components of the model.

The author wishes to thank his major advisers, Dr. Michael D. Boehlje and Dr. Robert L. Oehrtman for their assistance. Thanks is due Dr. Oehrtman who graciously accepted the role of major adviser when Dr. Boehlje departed to accept a position at Iowa State University. Dr. Boehlje's guidance, encouragement, and support throughout the graduate program is gratefully acknowledged. Appreciation is also expressed to the other committee members, Dr. Robert A. Rathjen, Dr. Ted R. Nelson, and Dr. Winfield P. Betty, for their valuable assistance in the preparation of the final draft.

Special appreciation is extended to Dr. James S. Plaxico for his interest and encouragement, and to the Department of Agricultural Economics for financial assistance.

The computer programming assistance of Stan Rogers and the cooperation and advice of Larry Briggs and numerous other individuals is sincerely appreciated.

Appreciation is also expressed to Mrs. Barbara Allen and Mrs. Kay Kreider for typing the early drafts of the study and to Mrs. Kay Kreider for typing the final copy.

Finally, special appreciation is extended to my wife, Linda, for her assistance and patience throughout the completion of the study.

TABLE OF CONTENTS

Chapter Page

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

The essential element of commercial banking is converting the inputs of deposits into outputs of loans and investments.[1] Stated in this manner the "production process" appears relatively simple, when in fact it is extremely complex. Banks operate in a highly dynamic environment clouded on one side by uncertainty and surrounded on the other by the legal restrictions with which they must comply. In addition, this environment includes competitors, not only in the form of other banks but also in the form of other financial institutions. These complex and competitive aspects of commercial banking suggest that modern decision aids and management techniques must be utilized by banks in order to maintain their profit margins and enhance their competitive position.

There are approximately 13,500 insured commercial banks in the United States. Many of these are in small and medium sized communities where agriculture is the primary industry. Nearly 60 percent of banks responding to a 1972 American Bankers Association survey of banks under $50 million in resources listed agriculture as the most important source of community income.[2]

The structure of agriculture has been rapidly changing as evidenced in the trend toward larger farms, rising land values, greater mechanization, and increased operating costs. All of these

things require more capital. Table I presents the volume of agricultural credit outstanding in selected years during the last decade. This data shows an increase in agricultural credit from $25 billion on January 1, 1961, to $65 billion on the same date in 1972. Dr. Emanuel Melichar of the Federal Reserve Board has predicted an annual rate of increase of 7 percent in farm debt during the 1970's. However, he is optimistic that banks can adequately meet the 7 percent annual growth in farm loan demand because of the balanced deposit growth in rural areas.[3]

In Oklahoma, the growth in loan demand has outstripped deposit growth by a substantial margin since 1950. While deposits increased by 32.4 percent, loans increased by 65.6 percent during these two decades.[4] Oklahoma banks were able to accomodate this unbalanced growth by increasing their loan to deposit ratio from 30 percent in 1950 to 59.6 percent in 1970.[5] The higher loan to deposit ratio results in decreased liquidity and consequently requires more dynamic management programs to comply with the legal restrictions of various government agencies and meet the financial requirements of the community.

Problem Statement

Because of the complexity involved, the management of a commercial bank is frequently unaware of all the implications of its decisions, and on occasions this has caused a less than optimum portfolio to be developed. After World War II and up until about 15 years ago, bank profits were mostly satisfactory because of rapid expansion of deposits. Most bankers were not enthusiastic adopters of new

TABLE I

FARM LOANS HELD BY LENDERS, UNITED STATES
JANUARY 1, SELECTED YEARS[a]

	Volume Outstanding (In Millions of Dollars)			
	1961	1970	1971	1972
Non-Real Estate				
Banks	$ 4,991	$10,330	$11,102	$12,487
Production Credit Associations	1,480	4,533	5,295	6,078
Federal Intermediate Credit Banks	88	224	220	237
Farmers Home Administration	420	785	795	769
Others	4,900	11,320	12,340	13,700
TOTAL	$11,879	$27,102	$29,752	$33,271
Real Estate				
Banks	$ 1,691	$ 4,113	$ 4,445	$ 4,214
Life Insurance Companies	2,975	5,746	5,626	5,562
Federal Land Banks	2,539	6,714	7.145	7,862
Farmers Home Administration	484	455	347	310
Individuals & Others	5,131	11,441	12,024	13,386
TOTAL	$12,820	$28,469	$29,588	$31,334

[a]American Bankers Association and Economic Research Service, USDA.

management approaches. Only after money tightened in the late 1950's and early 1960's did bankers realize that it would be profitable to investigate and utilize management procedures used in other industries.[6] In 1966, Cohen and Hammer emphasized the need for new management techniques in banking by stating, "Conventional, seat-of-the-pants analysis will prove increasingly inadequate when applied to the more complex types of problems with which bank managers must grapple in the future.[7]

Since then, several models for making management decisions have been developed both on the general level and on an individual bank basis. However, these models have primarily been oriented toward large city banks. Numerous attempts have been oriented toward linear programming methods to optimize bank portfolios for large city banks. However, small rural banks cannot bear the expense of developing detailed models and the ones developed for large city banks are not applicable to the smaller rural banks. Although the operations seem identical except for size of transactions, the difference between small and large banks is noted by Robinson,

> Unit banks in rural areas, though prosperous and progressive in managerial policies, are so different from the large money market banks that it would be difficult to exchange managerial personnel without a considerable intervening period of indoctrination.[8]

Large city banks are very departmentalized and each employee's duties are specifically outlined, whereas an employee in a small rural bank works in a variety of banking areas. The options for investments and the financial statements of large banks are much more detailed than those for small banks.

The existing management games for banks are designed for large banks and the "scaling" down of these models would be as difficult as the development of a new model for small banks. Another glaring concept omitted from existing bank management models is the competitiveness. That is, competitive bank management models are not available. A competitive model is more interesting to participants and enhances the attainment of knowledge pertinent to banking competition.

The benefit of gaining management experience and information at a minimal cost is a potent argument for pretesting bank management decisions.[9] A decision model for rural banks would allow pretesting for superior management strategies and would also be highly useful in research directed toward rural bank management and strategy options.

Another problem facing commercial banks is the training of new employees for management positions. In banks that are departmentalized, employees of one department do not know all the effects of their department's decisions on the overall financial position of the firm, nor do they understand the interactions among departments of the bank. Robinson called commercial banking an art and said that since it is an art, the only way to learn it is by experience and practice.[10] He stated further that,

> The early jobs in commercial banking,---, are bound to be narrow and to be best learned on the job. If the person engaged in learning these jobs understands how they are related to the total problem of commercial bank management, he will be that much better prepared to learn these special jobs with dispatch and understanding.[11]

All of the on-the-job training cannot be eliminated because certain situations arise that are new or totally unexpected. However,

much of the time spent training an employee could be saved through the use of a management game, where no monetary loss would result from a wrong decision. John A. Mayer, president of Mellon National Bank and Trust of Pittsburgh, in commenting on the IBM-McKinsey Bank Management Game, stated,

> It broadens the scope of management decisions, beyond those many officers face in their daily work and gives them a greater appreciation of the myriad and interrelated problems of bank management.[12]

What today are known as management games had their origin over three hundred years ago as war games used to simulate battles. For educational purposes, management games have been used little more than a decade and have been enthusiastically received because they simulate the recurring problems of management. Numerous catalogs of available management games have been published in an attempt to compile listings for educators to choose from.[13]

A management game is a representation of a business situation, either real or hypothetical, and its activity.[14] It is called a "game" because of the act of "playing the game" by the participants. The players make preselected decisions for the industry represented, some form of computation occurs, and results are returned to the players for analysis before making the next set of decisions. The process is very similar to simulation except that the emphasis is placed upon the human element, the player, in gaming. Management games can be (a) static or dynamic, (b) deterministic or probabilistic, and (c) competitive or noncompetitive.[15]

Games used in conjunction with other educational activities have been praised for their educational benefits.[16] Some of the benefits

accrued to management games are:

1. Games result in a high degree of personal involvement.
2. Uncertainty is illustrated in gaming.
3. Many decisions can be made in a short time period.
4. Players can familiarize themselves with business forms and financial statements applicable to the industry.
5. Computerized games allow the use of more complete and complicated models.
6. The cost of training, using games, is lower relative to on-the-job training where a wrong decision could result in a financial loss to the firm.

The potential user of a management game must first be familiar with the basic principles underlying the industry. Attention in gaming is focused upon augmenting the student's past knowledge and experience with a simulated practical application.

The development of a competitive bank management decision model and game for rural banks that could be employed on a time-sharing basis would be a valuable tool in investigating superior management strategies and in training, instructing, and educating present and potential bank employees. A model developed at a central agency such as a university for use by all rural banks who so desired could also be used by the university for research in many aspects of bank management and procedures.

Objectives

The major purpose of this study is the development of a computerized bank management simulation model depicting a majority of the

Oklahoma rural banks. More specific objectives are:

1. To determine relevant loan and investment portfolio options and cost and return coefficients for Oklahoma rural banks,
2. To develop equations estimating county supply of deposits and demand for loans, and to explain changes in market share of commercial banks,
3. To conceptualize the above into a realistic computer simulation model of a rural bank in a competitive environment, and
4. To test and verify the model and develop the appropriate forms and discussion material to make the model available in game form for instructional and educational use in on-campus classroom discussions and conferences with commercial bankers.

Review of Literature

Commercial banking was among the last industries to utilize analytical methods in solving management problems. Once the need was recognized, a wealth of literature involving various management approaches and techniques appeared. In 1966, Cohen and Hammer outlined 23 different studies.[17] Of particular interest are two linear programming studies.

The two linear programming models are the works of Waterman and Gee, and Chambers and Charnes. Cohen and Hammer describe the model by Waterman and Gee as having too many limitations for practical application in most banking situations.[18] The main contribution of

the study was to demonstrate the potential benefits which could be obtained from applying linear programming to banking. The other model by Chambers and Charnes is more complex but highly realistic, in that it can be modified to fit most banks. The model is capable of determining the optimum trade-off between yield and liquidity. Increasing attention to research relating to small rural banks has been evident in the last few years. Part of this increase has been because of the economic and political attention concerning branch banking and bank mergers, but much of the research has been initiated because of the recognition of the importance of the small rural banks and particularly their role as a source of credit for agriculture. In addition, researchers and rural bankers have become aware of the need for management aids and models in order to insure the viability of the rural banking industry. The following discussion of current studies in this area demonstrates the changing attitude toward research for small banks.

Frey developed a model capable of determining the optimal bank loan and portfolio composition over a three year planning horizon.[19] His study involved a rural bank with approximately $7 million of deposits and no access to external sources of funds. Benjamin conducted an analysis of the external sources of funds available to rural banks.[20] The extent of his study was to evaluate advantages and disadvantages of various sources and to identify the extent of use of external funds by operating rural commercial banks. Hutson continued along these lines, but went further in empirically determining the profitability of alternative external funds sources available to rural banks.[21] Using linear programming, he looked at four external funds

sources: the Agricultural Credit Corporations, PCA Participation Agreements, FICB Direct Line Discounting, and Correspondent Arrangements.

With respect to bank management games, the limited work that has been done has been designed with large city banks in mind. In 1960, Warren B. Davis of McKinsey and Company, Inc., with the cooperation and assistance of International Business Machines, developed the "Bank Management Simulation" model for a Bankers Trust Company Training Program.[22] Since then it has been modified and updated several times and is still in use. The game was designed for use as a training device at the management/administrative level. Decisions are made with the objective of obtaining maximum profit from the use of the bank's assets, thus, it is limited to asset management. This game is not structured to handle competition between banks.

Another bank management game entitled "Banking" was developed in 1968 by Science Research Associates, Inc.[23] This game does not require computer manipulation and is designed for players from high school through administrative levels. It is competitive to a degree but is relatively simple with player objectives being to make a profit, promote community development, and influence civic development. The "scorekeeping" or evaluation of decisions is done through a system which awards points weighted by certain preselected criteria.

By far the most complete and challenging bank management game was developed by Alexander Robichek and Charles Haley at Stanford University.[24] The game was initiated in 1965 as a spin-off of the IBM-McKinsey game, and has been revised in 1966, 1970, 1971, and 1972. It was developed to expose participants to the overall problems of

managing a $500 million commercial bank. Like the IBM-McKinsey game, the "Stanford Bank Management Simulator" is not internally competitive. An artificial economic environment typifying conditions of the early 1960's is built into the computer program. Each team and/or player makes decisions on a quarterly basis in the following areas: total salaries, interest rate on loans, compensating balances, service charges, business development and promotion, maximum Federal Reserve borrowing, maximum deposits, investment purchases and sales, minimum liquidity. Each decision set is followed by an output report given to the players before the next decisions are made. The output contains the following information: statement of condition, income statement, investment portfolio, economic and statistical information, comparative statistics of other teams, end of game report for entire period of play.

Other bank management simulators have been developed by a number of commercial banks for internal management use, but their characteristics are not publicized in the literature because of the confidential nature of the data and models.

Organization of Study

The following chapters will present the conceptual and empirical development of the bank management game for Oklahoma rural banks. Chapter II will contain relevant theory, additional literature review, and the conceptual organization of the model. Data sources and the empirical model including a discussion of the computer program will be presented in Chapter III. Results of limited testing of the model along with players instructions will be the subjects of Chapter IV.

Chapter V will contain a summary and conclusion with implications and recommendations for future research.

FOOTNOTES

[1]Paul M. Horvitz, "Economies of Scale in Banking" (Research Study One, Boston University [Boston, 1961]), p. 103.

[2]American Bankers Association, Report of the Agricultural Task Force (June, 1973), p. 3.

[3]Ibid., p. 6.

[4]FDIC, FDIC Operating Statistics (Washington, D. C., 1950-1970), p. 24.

[5]Ibid., p. 31.

[6]Kalman J. Cohen and Frederick S. Hammer, Analytical Methods in Banking (New York, 1966), pp. 61-70.

[7]Ibid., p. 21.

[8]Roland I. Robinson, The Management of Bank Funds, 2nd Ed. (New York, 1962), p. 8.

[9]William H. Dennick and Francis X. Olanie, Jr., "The Bank Management Game," Bankers Monthly, Vol. 77, No. 9 (Sept. 15, 1960), pp. 56-60.

[10]Robinson, p. 4.

[11]Ibid., p. 6.

[12]Banking, "Your Wits Vs. the Computer's," Vol. 53, No. 2 (August, 1960), p. 55.

[13]For example, see David W. Zuckerman and Robert E. Horn, The Guide to Simulation Games for Education and Training (Los Angeles, 1970), and Robert G. Graham and Clifford F. Gray, Business Games Handbook (New York, 1969).

[14]Kenneth C. Schneeberger, "Gaming as an Instrument of Farm Management Education--A Development and Evaluation" (Unpublished Ph.D. Thesis, Oklahoma State University, July, 1968), p. 23.

[15]Ibid., p. 25.

[16]J. R. Green and D. L. Sission, Dynamic Decision Games (New York, 1959), pp. 5-7.

[17]Cohen and Hammer, p. 112.

[18]Ibid., pp. 64-65.

[19]Thomas L. Frey, "Optimal Asset Liability Decisions for a Rural Bank: An Application of Multiperiod Linear Programming" (Unpublished Ph.D. Thesis, University of Illinois, May, 1970).

[20]Gary L. Benjamin, "Rural Bank Needs for External Funds," Business Conditions, Federal Reserve Bank of Chicago (May, 1972).

[21]Arthur L. Hutson, "Economic Analysis of Commercial Bank--Farm Credit System Coordination" (Unpublished Masters Thesis, Oklahoma State University, May, 1973).

[22]International Business Machines Corporation, "General Information Manual--Bank Management Simulation Player's Instructions" (New York, 1963).

[23]Erwin Rausch, "Banking," Science Research Associates, Inc. (New York, 1968).

[24]Alexander Robichek, Charles Haley, and David Niebuhr, "Stanford Bank Management Simulator," Graduate School of Business, Stanford University (1972).

CHAPTER II

THEORY AND MODEL CONCEPTUALIZATION

This chapter will present a brief summary of the economic and financial theory applicable to commercial banking. Following the discussion of theoretical concepts, an overview of the model will be presented with particular emphasis on the hypothesized determinants of time and demand deposits supplied by the public and loans demanded by the public. Competition as reflected in the concept of market share will also be discussed and hypothesized relationships presented. Finally, relevant banking regulations will be briefly reviewed.

Theoretical Concepts

The economic theory of the firm is quite observable in commercial banking. The bank uses its labor and fixed capital resources to acquire deposit funds and allocates these funds to alternative uses in the form of loans or investments. The degree of success achieved in acquiring and using funds is measured by bank profitability.

The commercial banking industry seems to fit best into the class of competition known as monopolistic. Monopolistic competition, as exhibited by banking, varies from the pure competition model in that (1) the product can be slightly differentiated, (2) there are a limited number of banks, (3) resource mobility and entry and exit are

restricted by government regulations and price fixing, and (4) all banks and bank customers do not have perfect market knowledge.[1] Within this monopolistic competition framework, an individual bank is faced with a less than perfectly elastic demand curve for its loans. Thus, as the interest rate rises, the loan volume demanded declines. Just the opposite is true for deposits supplied to the bank. The public is willing to supply more funds as the price they receive from the bank increases. Theoretically, a bank would be willing to acquire funds up to the point where the marginal value product of the funds used in loans and investments equals the marginal cost or price of obtaining the funds. However, since each loan has unique characteristics, it is difficult for the bank to equate the marginal value product of funds to the marginal cost.

Because banks operate in an imperfect market, incorporating the theoretical concepts into a realistic simulation model requires the estimation of loan demand and deposit supply relationships. In addition, each bank's share of the loan and deposit market must be estimated when the model is used in the management game context. The following discussion will provide an overview of the model and illustrate the use of these theoretical relationships.

The Management Game Model: An Overview

The model is designed to typify the overall management decisions of a commercial bank in a rural Oklahoma county containing three competing banks. The county is assumed as the market area for the banks involved. Agriculture is the principal industry in the county and the chief enterprises are wheat farming with stocker grazing

and range cow-calf operations. Playing the "game" requires at least three individuals, but no maximum exists as to the number of participants. The three competing banks begin with identical financial statements and each has exactly one-third of the total market. Each bank starts with total assets of approximately $5 million. The principal goal of the teams is to make the maximum possible profit, thus increasing the bank's capital structure. Consideration must also be given to a secondary goal of maintaining or increasing market share.

After studying background data and the beginning financial statements, the three teams make decisions in six month intervals for a three to five year period of operation. Decisions are made on the interest rates charged on loans and paid on time deposits, the service charge on demand deposits, and the bank's outlay for loan officer's salaries and advertising expense as well as the loan and investment portfolio volumes desired during the next period.

Selected economic and statistical information is utilized in combination with the players' decisions to estimate the market volume of time and demand deposits supplied to the banks. Equations for four classes of loans demanded by the public are also estimated utilizing the exogenous data and player decisions. After the market volume of time deposits, demand deposits, and loans has been determined through the equations within the model, market share equations are used to allocate this volume to the three individual banks.

The model contains a history file to keep a record of past loan volume and investment purchases along with their corresponding interest rates. After dropping the maturing portfolio items and adding the current decisions and market share to the history file, the model

budgets the costs and returns for the current six month period and provide the output to the "players." These results in the form of new financial statements and other relevant data are used by the decision groups to make new sets of decisions. Since banks operate under both state and federal regulations, the model is also designed to "check" each bank for compliance with these regulations and restrictions, and penalties are assessed when a regulation has been violated.

A more detailed explanation of the empirical model will be developed in Chapter III.

Market Relationships

Deposits Equations

Numerous econometric studies of the United States economy have included equations estimating the supply of time and demand deposits on an aggregative basis. These equations have frequently been used to obtain empirical estimates of the stock of money and the price (interest) and income elasticity of the money supply. The specification of the determinants of the county supply of deposits will draw heavily on these studies.

Time Deposits

Equations to explain the supply of time deposits have been estimated by DeLeeuw, Goldfeld, Hamburger, Silber,[2] and Penson.[3] Hamburger developed a model to explain the semi-annual household stock of time deposits supplied by the public using the yield on time deposits, yield on substitute assets, and income or wealth constraint, and a

lagged dependent variable as independent variables.[4] All of the signs were consistent with economic theory and the equation had an R^2 of .99. Goldfeld estimated the public's desired holding of time deposits using the yield on time deposits, income, the product of income times the long term bond rate, and the lagged dependent variable as independent variables.[5] Fitted in logarithmic form, theoretically consistent signs were obtained and the equation had an R^2 of .998.

Based on these results, the function explaining the semi-annual stock of time deposits supplied by the public to commercial banks on a county basis is hypothesized to be:

$$TD = f(CPI, r_{TD}, t, r_B, TD\text{-}1, T),$$

where, TD = County Stock of Time Deposits on June 30 and December 31

CPI = County Personal Income

r_{TD} = Yield on Time Deposits

t = Dummy (= 1, June 30 and = 0, December 31

r_B = Yield on Corporate Bonds

TD-1 = TD Lagged One Period

T = Time (June 30, 1962 = 0).

County personal income is included in the equation because increases (decreases) in income would be expected to result in higher (lower) savings, assuming a constant marginal propensity to save. The yield on time deposits represents the price paid to holders of time deposits. Time deposits in Oklahoma banks have been rapidly increasing since the 1950's and the lagged dependent as well as the trend variable should reflect this deposit growth. The dummy variable is added to separate any significant seasonal change in the stock of time deposits.

Demand Deposits

Teigen developed an equation for quarterly changes in demand deposits at commercial banks using aggregate data for the United States for the period from post World War II to the early 1960's.[6] The variables used to explain the changes in demand deposits were income and its products with the treasure bill rate and the yield on time deposits, demand deposits lagged one period, and three dummy variables for the first three quarters of the year which took the value of unity in quarters corresponding with their subscript and zero otherwise. The estimated equation had an R^2 of .948, the hypothesis that the stock of demand deposits responds to movements in the bill rate and the yield on time deposits as well as to income was supported by the results.[7] A model developed by Bramley and Chase explained the supply of deposits through the use of rate of interest on private securities, interest rate on time deposits, implicit rate on demand deposits, national income, and nominal wealth as independent variables.[8] Penson also did work in estimating the deisred holding of demand deposits.[9] Goldfeld's equation for demand deposits was very similar to that for time deposits with the exception that the interest rate on time deposits had a negative sign in the demand deposit equation.[10]

With these past equations as a reference, the equation for estimating the semi-annual county stock of demand deposits supplied to the banks is hypothesized to be:

$$DD = f(t, CPI, r_{TD}, DD\text{-}1, DD\text{-}2, T) \qquad (2)$$

where, DD = County Stock of Demand Deposits on June 30 and December 31

t = Dummy (= 1, June 30 and = 0, December 31)

CPI = County Personal Income

r_{TD} = Yield on Time Deposits

DD-1 = DD Lagged One Period

DD-2 = DD Lagged Two Periods

T = Time (June 30, 1962 = 0).

The signs of the parameters for this equation are expected to be the same as those in the time deposit equation with the exception of the yield on time deposits. This variable should have a negative sign in this equation because time deposits are considered a substitute for demand deposits.

Loan Equations

Only a limited amount of work has been done in estimating the public's demand for loans in rural areas. Most of the estimates have been made for real estate loans on a national basis where data is more readily available. However, the factors which have been isolated as determinants of loan demand in these national studies will be useful in developing estimates for a rural Oklahoma county.

Real Estate Loans

Hesser and Schuh have developed an equation explaining the volume of farm mortgage loans closed during the year.[11] Independent variables considered in the estimation were interest rate, a concept of internal funds approximating realized net farm income, expected

farm prices, technology, farm wage rate, stock of mortgage debt at the beginning of the year, rate of voluntary farm transfers, and the dependent variable lagged one period. They concluded that better estimates were obtained with the expected prices, stock of debt, and farm transfers variables deleted from the equation.[12] Hesser and Schuh estimated the gross change in farm real estate mortgage debt, and as such ignored the refinancing which often occurs in agriculture. Lins recognized this refinancing concept and developed a model for estimating the net changes in farm real estate debt.[13] He estimated equations by class of lender and then aggregated these estimates into total farm mortgage debt. Since this study deals entirely with commercial banks, only the equation estimated by Lins for commercial banks will be discussed. The demand for farm mortgage loans, annual change of capital appreciation of farm real estate assets, annual net farm plus non-farm income, and the ratio of money balances to gross production expenses.[14] The equation had an R^2 of .64, but none of the variables were statistically significant at acceptable levels.

After a careful analysis of these past studies and review of the available data for rural Oklahoma counties, the following hypothesized relationship was chosen to explain the demand for farm mortgage credit at commercial banks on a semi-annual basis:

$$AGREL = f(t, CPI, r, IFP, AGREL-2, T, RI) \qquad (3)$$

where, AGREL = County Stock of Farm Real Estate Debt at Commercial Banks on June 30 and December 1

t = Dummy (= 1, June 30 and = 0, December 31)

CPI = County Personal Income

r = Proxy for Interest Rate on Farm Real Estate Loans

IFP = Weighted Index of Farm Prices (1910-14 = 100)

AGREL-2 = AGREL Lagged Two Periods

T = Time (June 30, 1962 = 0)

FI = Index of Range Conditions Used as Proxy for Weather.

County personal income is used in the equation because county net farm income is published only every five years in the census. This does not appear to be a serious problem considering the high intensity of agriculture in the selected counties. Since income represents internal funds available to finance purchases, the expected sign for this variable will be negative. The expected sign on the interest rate variable is negative. The demand for farm real estate debt is expected to be positively correlated with farm prices. Higher farm prices over time tend to drive up the value of land, thus increasing the amount of debt the land will carry and increasing use of farm mortgage debt for new land purchases. Because of the nature of the data over the time period involved, a positive sign would be anticipated for the lagged dependent and time variables. The proxy for weather would most likely be inversely correlated with the demand for long term debt on farm real estate.

Production Loans

The only previous study to deal with the estimation of the demand for short term agricultural credit was done by Penson.[15] His model simultaneously determined the desired stock of financial and production assets of the farm sector. Variables used in the analysis were the

interest rate and stock of physical assets. The results obtained for the estimation were inconclusive.

Determinants of short term farm credit demand would be expected to be similar to the variables considered in the real estate debt equation. Estimation of this equation will require substantial exploratory work and a number of possible relationships will be considered, but the basic hypothesis of this analysis will be that:

$$AGPROD = f(t, CPI, IFP, AGPROD\text{-}1, AGPROD\text{-}2, r, RI, RI\text{-}1, T) \quad (4)$$

where, AGPROD = County Stock of Short Term Agricultural Loans Held by Commercial Banks on June 30 and December 31

t = Dummy (= 1, June 30 and = 0, December 31)

CPI = County Personal Income

AGPROD-1 = AGPROD Lagged One Period

AGPROD-2 = AGPROD Lagged Two Periods

IFP = Weighted Index of Farm Prices (1910-14 = 100)

r = Proxy for Interest Rate on Short Term Agricultural Loans

RI = Range Index Used as Proxy for Weather

RI-1 = RI Lagged One Period

T = Time (June 30, 1962 = 0).

Most of the economic logic used for the long term farm credit equation also applies here. However, the proxy for weather could carry a positive sign in this short term equation because it would act much like the farm price variable in creating demand for short term agricultural credit. Good (bad) weather would increase (decrease) the demand for other inputs since production and income would be expected

to be higher and farmers would demand more funds in anticipation of higher returns.

Commercial Loans

The estimation of the demand for commercial and industrial loans at commercial banks was undertaken by Goldfeld for inclusion into his econometric model of the economy.[16] At his admission, the results were less than satisfactory, but it was discovered that the demand is positively correlated with inventory investments of business.[17] Other variables considered in Goldfeld's work were industry sales, relative cost of loans, lagged dependent, and dummy variables for the quarters of the year. Nothing resembling inventory investments by businesses is published on a county basis. Consequently, county retail sales is used as a crude measurement of inventory investment.

Based on Goldfeld's work and theoretical concepts, the following commercial loan demand relationship is hypothesized:

$$COMML = f(t, COMML\text{-}1, CPI, CRS, CRS+1, T, r) \qquad (5)$$

where, COMML = County Stock of Commercial and Industrial Loans Held by Commercial Banks on June 30 and December 31

t = Dummy (= 1, June 30 and = 0, December 31)

COMML-1 = COMML Lagged One Period

CPI = County Personal Income

CRS = County Retail Sales

CRS+1 = CRS in the Upcoming Period

T = Time (June 30, 1962 = 0)

r = Proxy for Interest Rate on Commercial Loans.

The impact and signs of the county personal income, interest rate and independent time variables and the lagged dependent variable are expected to be similar in this equation as in the two agricultural loan equations discussed previously. County retail sales is used in two forms (current sales and sales from the next period). Both of these sales variables should have a positive sign. The county retail sales in the upcoming period is included to obtain a more accurate proxy for inventory investment and assumes that sales in the upcoming period are in inventory in the current period.

Installment Loans

As was the case for short term agricultural loans, no previous work was located concerning the public's demand for installment loans at commercial banks. To further complicate the estimation, there have been no published data series listing rates charged for installment loans. Therefore, the demand equation for bank installment credit will be estimated with the available data excluding a measure of interest rate. The hypothesized function is:

$$INSTA = f(CPI, INSTA\text{-}1, t, T) \qquad (6)$$

where, INSTA = County Stock of Installment Loans Held by Commercial Banks on June 30 and December 31

CPI = County Personal Income

INSTA-1 = INSTA Lagged One Period

t = Dummy (= 1, June 30 and = 0, December 31)

T = Time (June 30, 1962 = 0).

The basis for selection of these variables is similar to that used in the equations previously discussed with the exception of the limited availability of data on interest rates. All variables are expected to be positively correlated with demand for installment credit as was the case for the other equations containing these variables.

Market Share

Market share equations for both types of deposits and for the four classes of loans will be estimated and incorporated into the model as a basis for allocating the market loan demand and deposit supply to the respective banks. Previous studies estimating determinants of market share are very limited and no empirical studies were found in the field of commercial banking. Weiss has analyzed the determinants of market share for a branded consumer market.[18] He basically concluded that although price and advertising were important variables, other "absent marketing" variables were also very important in determining market share.[19] For a bank such "absent marketing" or qualitative variables as "friendliness" and "accessibility" are difficult to include. The basic hypothesis for all six market share equations is:

$$\Delta SMKT\ (k,j) = f[(r_i - \bar{r}_i),\ (Adv - \overline{Adv}),\ \Delta r_i,\ \Delta Adv,\ (\Delta Adv - \overline{\Delta Adv}),\ (\Delta r_i - \overline{\Delta r_i}),\ NBANKS,\ NMILES]$$

where, Δ = Change

SMKT = Market Share of i^{th} Bank for the j^{th} Class of Loans or Deposits

r_i = Interest Rate for the i^{th} Class of Loans and Time Deposit; for demand deposits, this is service charge expressed as

a percent

$\bar{r}_i$ = Average Interest Rate of All Banks in the County for the i^{th} Class of Loans and Deposits

Adv = Advertising Outlay

$\overline{Adv}$ = Average Advertising Outlay of All Banks in the County

NBANKS = Number of Banks in the County

NMILES = Approximate Size of the Market Expressed as the Distance to the Farthest Competing Bank.

For demand deposits and loans, a negative relationship would be expected between market share and the difference between the individual bank's rate and the average rate. This relationship should be positive for time deposits, as a rate higher than the average would attract a greater share of the market. An advertising outlay greater than average would be expected to increase market share in all classes of deposits and loans. The number of banks within the market should have a negative relationship with the change in the market share since each bank would have less of the same market if the number of banks in the market increased. The larger (smaller) the market area, the larger (smaller) the potential change in market share derived from other variables.

Bank Regulations

It is assumed that the bank is a national bank and a member of both the Federal Reserve System and the Federal Deposit Insurance Corporation. The most current Federal Reserve Bank reserve requirements for time and demand deposits are included in the model.[20]

Currently, the reserve requirement is calculated using 14 day averages as taken from form number AC 73 revised 8-72. Within the model these percentages are applied, based on a "moment in time" balance sheet. The reserve requirement is 8 percent on the first $12 million of demand deposits, 10 percent on the next $8 million, and 12 percent of the next $90 million. Three percent of time deposits is also required.

The Federal Reserve also periodically checks a member bank's capital structure and liquidity requirements. The current form for analyzing bank capital is FR 363 (Form ABC) revised 3-72.[21] Capital requirements are imposed against the bank's assets in differing percentages depending upon the type and maturity of the asset. The sum of the direct capital requirements plus any additional capital required based on the liquidity of the assets equals the total capital required. After the total capital requirement is determined, it is checked against the bank's capital structure. Although there is no exact requirement, each bank's total capital structure must be approximately 80 percent of the calculated capital requirement. This figure is based on conversations with Federal Reserve employees and thus is used in the model. An equation was developed to calculate the capital requirement within the model.

The bank must also comply with all Oklahoma Banking Code requirements. For Federal Reserve members, the reserve and capital requirements are identical with the Federal Reserve requirements. Certain maximum restrictions on interest rates and loans are also included. Current restrictions on the maximum allowable interest rate on time deposits are shown in Table II.

TABLE II

MAXIMUM INTEREST RATES PAYABLE ON TIME AND SAVINGS DEPOSITS IN PERCENT PER ANNUM EFFECTIVE JULY, 1973[a]

Type of Deposit	Ceiling Rate
Passbook Accounts	5.00
Other Time Deposits:	
90 Days to 1 Year	5.50
1 Year to 2 1/2 Years	6.00
2 1/2 Years and Over	6.50
4 Years and Over	No Ceiling with Minimum of $1,000

[a] Federal Reserve Bulletin, July, 1973.

An average maximum rate of 6.5 percent is incorporated in the model since no distinction is made as to the type of time and savings deposits. A maximum legal interest rate of 18 percent is also placed on all loans. In addition, any bank cannot have a long term loan volume to time deposits ratio in excess of 70 percent.

FOOTNOTES

[1]Any current text in economics will provide a discussion of monopolistic competition and elasticity of demand, for example see Richard H. Leftwich, The Price System and Resource Allocation, 4th Ed. (Hinsdale, 1970).

[2]George K. Karbouche, The Competition for Savings; Determinants of Deposits at Commercial Banks, Mutual Savings Banks, and Savings and Loan Associations, SBE 107, National Industrial Conference Board, Inc. (1969).

[3]John B. Penson, Jr., "Demand for Financial Assets in the Farm Section: A Portfolio Balance Approach," American Journal of Agricultural Economics, Vol. 54, No. 2 (May, 1972), pp. 163-174.

[4]Karbouche, p. 40.

[5]Stephen M. Goldfeld, Commercial Bank Behavior and Economic Activity, A Structural Study of Monetary Policy in the Postwar United States (Amsterdam, 1966).

[6]Ronald L. Teigen, "An Aggregated Quarterly Model of the U.S. Monetary Sector, 1953-1964," Targets and Indicators for Monetary Policy (Chicago, 1969), pp. 76-78.

[7]Ibid., p. 180.

[8]Ibid., p. 253

[9]Penson, p. 164.

[10]Goldfeld, p. 108.

[11]Leon F. Hesser and G. Edward Schuh, "The Demand for Agricultural Mortgage Credit," Journal of Farm Economics, Vol. 54, No. 5 (December, 1962), pp. 1583-1588.

[12]Ibid., p. 1586.

[13]David A. Lins, "Determinants of Net Changes in Farm Real Estate Debt," Agricultural Economics Research, Vol. 24, No. 1 (January, 1972), pp. 1-8.

[14]Ibid., p. 3

[15]Penson, p. 170.

[16]Goldfeld, p. 110.

[17]Ibid., p. 69.

[18]Doyle L. Weiss, "An Analysis of Market Share Behavior for a Branded Consumer Market" (Unpublished Ph.D. Thesis, Carnegie Institute of Technology, Graduate School of Industrial Administration, March, 1968), pp. 37-38.

[19]Ibid., p. 43.

[20]Board of Governors, The Federal Reserve System, Federal Reserve Bulletin (Washington, D. C., July, 1973).

[21]This form was obtained from the Federal Reserve Bank of Kansas City.

CHAPTER III

THE EMPIRICAL MODEL

This chapter will present a detailed discussion of the bank management game. Data sources and explanations will be included where relevant. The results of the statistical estimation of the loan demand and deposit supply equations will also be presented.

The Computer Model

The program is written in Fortran IV language for use on an IBM 360, Model 65 computer. The discussion of the model will be presented in the same sequence as the operations are performed within the computer program. A flow chart of the program which indicates the major components and operations in the game is presented in Figure 1. The numbers in the blocks indicate the order in which the operations are completed and will be referred to in the following discussion.

As indicated in Figure 1, all items are set at zero before any computations are made or any data is entered (Block 1). Then the time period for the current period of play, the exogenous variables supplied by the "game administrator," and the decisions supplied by the decision groups or "players" are read (Blocks 2, 3, and 4). The time period, which represents a six month period, ranges from 1 to 20 since the longest maturity asset item is 10 years or 20 periods. The exogenous variables include such items as county personal income,

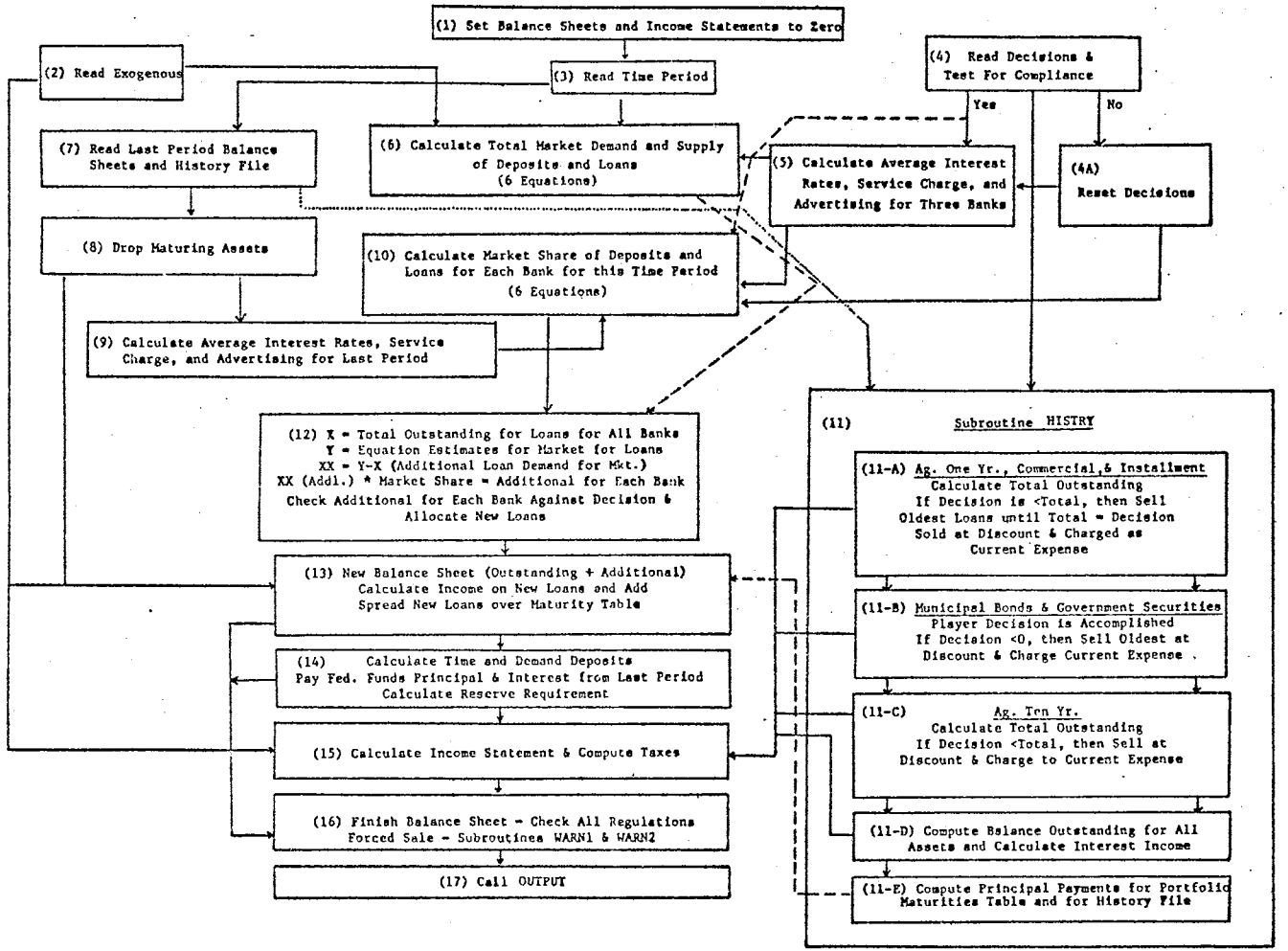

Figure 1. Flow Chart for Management Game Program

county retail sales, index of farm prices, range index, interest rates for all investments, federal funds rate, prime rate, reserve requirements, lagged dependent variables for the market equations, and last period's market share estimates. Also included are forecast ranges for the next period for income, sales, farm prices, and prime rate.

The player's decisions are also read into the program at this time. A sample decision input form is shown in Figure 5 in Chapter IV, and the decisions will be discussed in detail in that chapter. This form is coded so that the decisions can be keypunched directly. As indicated earlier, decisions are made in the areas of interest rates charged and paid, service charge, salaries, advertising, and loan and investment volumes.

After the decisions are read, the program is designed to check certain decisions against the legal regulations discussed in Chapter II and other policy limits. In most cases, if a player's decision is not in compliance, it is simply reset at the maximum allowable (Block 4A). The decision for loan officers' salaries cannot be less than $20,000, and the advertising and promotion decision cannot exceed $10,000. However, if a bank wishes to pay more than $10,000 for advertising, the program will charge as current expense the desired decision amount, but only the $10,000 maximum will be used in the market share calculations. The next operation is to compute the average rates on loans, average service charge, average rate on time deposits, and average advertising expense for the current period for the three banks (Block 5). These averages are also used in the market share computations to be discussed later.

The program at this point contains all the necessary information required to estimate market loan demand and deposit supply. These estimates are obtained by using equations to compute the total market quantities of demand deposits, time deposits, agricultural real estate loans, agricultural production loans, commercial loans, and consumer installment loans (Block 6). The empirical equations used in these computations will be presented and discussed in detail later in this chapter.

Having obtained estimates for the market volume of deposits and loans, the program must compile additional data in order to calculate each bank's market share for each class of deposits and loans. To accomplish this, the balance sheets and history files from the preceding period are obtained from storage (Block 7). The history file is a rotating array containing loan and investment volumes and their corresponding interest rates from the past operations of the banks. It also contains the past period service charge, advertising and time deposit rate decisions which are used in the market share calculations and the interest rate on federal funds.

After the history file is entered, the maturing assets are removed from the file and the new decisions on rates, etc. are added to the history file for the current time period (Block 8). In Block 9, average interest rates, service charges, and advertising are computed for the previous period. These averages for last period are necessary because the market share equations use the changes in these rates and expenses to estimate the change in market share from one period to the next (Block 10). The actual equations used in these market share calculations will also be discussed in detail later.

The decisions for laons and investments allow the banks to sell assets at a discount if so desired, as well as to purchase assets. A subroutine named "HISTRY" is used to check the decisions against the outstanding balances and update the history file as needed (Blocks 11-A and 11-C). First the total volume outstanding for each loan class is summed and compared with the players' decisions. If the decision is less than the amount outstanding, the difference is sold at a discount and the amount of the discount is charged to current expense. If the decision is zero, all the loans in that class are sold. The oldest loans are sold first and the history file cell containing these loan volumes is reduced by the amount sold. The discount for selling loans is currently set at 2 percent of the face value. The same procedure is used for investments except that the decision must be negative if any of the investments are to be sold (Block 11-B). At this point, the history file for each bank contains the outstanding loans and investments before principal payments are made or before any new additional amounts for the current time period are added (Block 11-D).

Before the principal payments are deducted, the amounts outstanding are transferred to the appropriate balance sheet items and the interest income for these volumes is computed. The volume of new loans made and interest income from them will be added to these items later when the new loans are allocated to the banks.

The remainder of the "HISTRY" subroutine is concerned with performing the operations necessary to complete the maturity table and determine the timing or principal payments (Block 11-E). The agricultural real estate loan is a ten year loan with ten equal principal payments. The agricultural production loan is a one year loan with one

lump sum principal payment. The commercial loan matures in two years and one-half of the principal is paid at the end of the first year and the other half at the end of the second year. The consumer installment loan is made for a two year maturity with one-fourth of the principal coming due each six months during the life of the loan. At the end of each period when principal payments are made, each sell for each class of loans in the history file is reduced by the appropriate amount corresponding to the principal payment for that type of loan. The resulting reduced volume for each class of loans is stored in the history file for use in the subsequent periods of play. This completes the "HISTRY" subroutine and the loan and investment portfolio values are returned to the main program for further computations.

The next step in the program is to compute the volume of new loans made by each bank (Block 12). First, the total outstanding loan volumes for each loan class are summed for all three banks, and these values are compared with the estimates of total market demand obtained from the market equations mentioned previously. The difference between the market demand and the current amount outstanding is the additional amount available to the three banks in the form of new loans. Each bank's market share percentage obtained from the market share equations for each loan class is applied to the additional amount available to determine the additional loan volume which the bank can obtain. These additional loan volumes for each bank are then compared with the decisions. If the decision as to the maximum desired volume outstanding minus the actual amount outstanding for each bank is greater than the additional amount available to that bank from the market share calculation, the volume of new loans made for the bank is

equal to the amount available. If the decision minus the actual amount outstanding is less than the additional amount available, the volume of new loans is equal to the maximum volume desired minus the actual amount outstanding. If the decision is less than or equal to the amount outstanding, the operations performed in the "HISTRY" subroutine have already sold the necessary volume of loans at a discount and no new loans are made.

All new loans made are added into the history file for the current time period and then spread over the maturities table (Block 13). The new loans and the interest income from these loans are also added to the balance sheet and income statement items calculated in the "HISTRY" subroutine for the amounts already outstanding.

The volume of time and demand deposits for each bank is obtained by multiplying the market equation estimates for time and demand deposits times each bank's market share of these items (Block 14). Both the total market equations and the market share equations have been discussed previously. Each bank's volume of time and demand deposits is computed anew in each period. However, the volumes are somewhat dependent upon past periods because the market share equation estimates the change in market share calculation for loans since each bank can be assured of maintaining its outstanding volume of loans if the proper decision is made. A bank could undergo drastic fluctuations in deposits volume if irrational or erratic decisions were made.

Forced borrowing of federal funds occurs if the bank's deposits and cash are not sufficient to make all loans and investments and meet the Federal Reserve Bank reserve requirements. The computation of current period cash will be discussed later. At this point, any

forced borrowing of federal funds during the last period plus interest is paid, and the new volume of time and demand deposits is used to compute the current period reserve requirement (Block 14). The remainder of the program is concerned with completing the income statement and balance sheet itmes for the current period.

The interest income from loans has already been calculated (Blocks 11-D and 13). The service charge income and interest income on investments is now calculated, completing the income section (Block 15). The "Other Expenses" are calculated using cost data obtained from a previous study by Hutson[1] and from a survey of banks conducted by the Federal Reserve Board.[2] The data from Hutson's study provides estimates of the transactions cost of making new loans and purchasing investments and is presented in Table III. Also included in "other expenses" is depreciation and other miscellaneous items. Interest expense is calculated as the sum of time deposit interest paid and interest on federal funds, if applicable. Advertising expense and salaries expense are basically determined by the player's decisions. This completes the expense calculations and net income before taxes is calculated. After net income before taxes is determined for each bank, a computation of federal income taxes occurs assuming the bank is organized as a corporation. All income derived from municipal bonds is exempt from income taxes, and this income is deducted from net income before the tax computation. The first $25,000 of net income is taxed at a rate of 22 percent, and the net income over $25,000 is taxed at a rate of 48 percent.

There still remain a few balance sheet items to be computed to complete the balance sheet (Block 16). The undivided profits section

TABLE III

TRANSACTION COST PER DOLLAR
PER YEAR FOR ASSET ITEMS

Item	Cost/Dollar
1 Year Agricultural Loan	.002156
10 Year Agricultural Loan	.001078
2 Year Installment Loan	.00336
6 Month Government Security	.00137
1 Year Government Security	.00137
3 Year Government Security	.00137
2 Year Municipal Bond	.00137
5 Year Municipal Bond	.00137
Demand Deposits	.0019

[a]Taken from A. L. Hutson, "Economic Analysis of Commercial Bank--Farm Credit System Coordination."

of the balance sheet is calculated adding the current net income after taxes to the previous balance. Total liabilities and capital are then calculated as is total assets excluding "cash." Cash is calculated as the residual difference between total liabilities and capital and total assets. This assures that the assets and liabilities will balance. Once cash has been computed, the program checks the cash against the reserve requirement for deposits which was calculated earlier. If cash is not sufficient, the bank is forced to purchase federal funds at the current rate to make up the deficit. The amount purchased is put into "Cash" on the assets side of the balance sheet and into the "Federal Funds Purchased" account on the liabilities side and new total totals for assets and liabilities are computed. As was mentioned earlier, the amount of forced borrowing of federal funds plus the interest will not be repaid until the beginning of the next six month period.

Next, each bank's capital and liquidity requirement is calculated using the current balance sheet items and is compared with the bank's capital structure, which is the sum of capital stock, surplus, and undivided profits (Block 16). If the bank's capital structure is not at least 80 percent of the calculated capital requirement, then a printed warning will appear on the bank's balance sheet. The second time the warning appears an appropriate volume of the bank's loans will automatically be sold to reduce the capital requirement. The forced sale is accomplished in subroutine "WARN1." The other legal requirement to be checked is the long term loan to time deposit ratio. A warning similar to that just discussed for capital requirement is issued to those noncomplying banks. A second warning on the long

term loan to time deposit ratio results in the forced sale of long term loans. The forced sale is accomplished in subroutine "WARN2."

This completes the main program and the output is printed by a subroutine identified appropriately as "OUTPUT" (Block 17). The first part of the "OUTPUT" subroutine is concerned with initializing certain items for use in printing the "Table of Portfolio Maturities". The rest of the subroutine includes the write and format statements for the printing of the output. The output is printed for each of the three banks. The first page of each bank's four page output is the balance sheet, with the second, third, and fourth pages being the income statement, decisions input and table of portfolio maturities, and economic and statistical information for the current period and next period respectively. A copy of the output will be included and discussed in Chapter IV.

Empirical Market Relationships

The equations to estimate market supply of deposits and demand for loans and the market share equations are important components of the model. The following discussion will present the statistical results obtained in estimating these relationships.

Loan Demand and Deposit Supply

Data Sources

Data used in the estimation of the county market deposit supply and loan demand equations was obtained from several different sources. County data was used when it was available. When county data was not

available, the least aggregated data available was used. Eighteen Oklahoma counties (see Figure 2) which had total bank deposits of $12 to $30 million as of June 30, 1972, were designated as the sample. These 18 counties exclude all metropolitan areas in Oklahoma and the primary land use industry in all of these counties is agricultural production. The majority of the counties contain three commercial banks (the number selected for use in the model) and the maximum number in any county is six. As can be seen in Figure 2, the selected counties represent all areas of the state and are fairly well dispersed throughout the state. The total value of agricultural products sold ranged from $4 million to $25 million in 1969 for these 18 counties. The Bureau for Business and Economic Research of the University of Oklahoma provided county data for personal income and retail sales.[3] The Federal Reserve Bank of Kansas City provided unpublished data for the county stock of deposits and loans in commercial banks on June 30 and December 31 from 1961 through 1972. The Range and Pasture Conditions Index used as a proxy for weather conditions is published by the U.S.D.A.[4] Interest rates for the agricultural loan equations were also taken from U.S.D.A. publications.[5] The Department of Agricultural Economics at Oklahoma State University was the source for the index of farm prices received by Oklahoma farmers.[6] To obtain a weighted index for each individual county, the indices for livestock and livestock products and for all crops for Oklahoma were multiplied by the proportion of the total value of agricultural products weighted by the actual type of agriculture sales for that county. The interest rate for commercial loans and average yield on corporate bonds was obtained from the Survey of

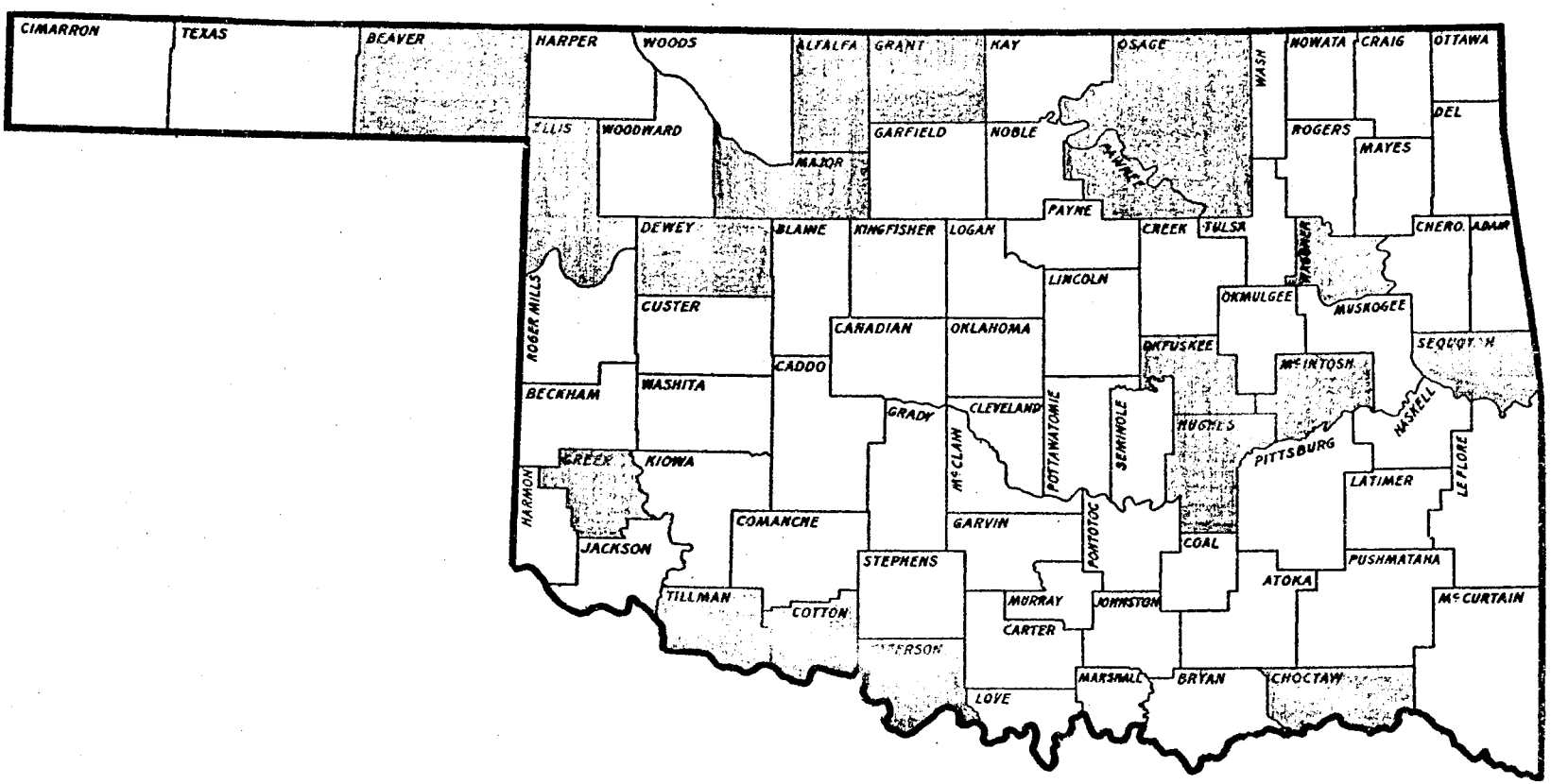

Figure 2. Counties with Time + Demand Deposits in Commercial Banks from $12-30 Million As of June 30, 1972

Business Conditions,[7] and the Federal Reserve Bulletin[8] was the source of interest rates on time deposits in commercial banks. The average of the maximum legal rates for several classes of time and savings deposits was used as the measure of the interest rate on time deposits.

The Oklahoma State University version of Iowa State University's OMNITAB statistical computer program was utilized to fit regression equations of the various hypothesized forms discussed in Chapter II to the data. For all the equations presented in the following discussion, the standard error or each parameter will be given in parentheses immediately below the parameter. All of the variables used in the following equations are identified in Table IV.

Deposit Equations

Time Deposits. After testing variations of the hypothesis, the following equation was selected for use in estimating the county stock of time deposits:

$$TD = \underset{(346088.8)}{-\ 771{,}932.0} + \underset{(94495.9)}{184{,}257.4\ (r_{TD})} + \underset{(.012)}{1.05\ (TD_{-1})} - \underset{(.31)}{.042\ (r_B)\ (CPI)} + \underset{(6647.0)}{16{,}710.5\ (T)}$$

The R^2 for this equation is .9895 and the standard error of the estimate is $278,591. The F-ratio for the regression equation is equal to 7,521.03. The signs are all theoretically consistent and all parameters are significant at the 5 percent level or greater, except the product of county income and the yield on corporate bonds. This variable was included to represent the substitute relationship between time deposits and bonds, even though it was not significant. The coefficient

TABLE IV

DEFINITION OF VARIABLES FOR MARKET EQUATIONS

Code	Definition
TD	County stock of time deposits
DD	County stock of demand deposits
AGREL	County stock of agricultural real estate loans
AGPROD	County stock of agricultural production loans
COMML	County stock of commercial loans
INSTA	County stock of consumer installment loans
r_{TD}	Yield on time deposits
r_B	Yield on corporate bonds
CPI	County personal income in thousands of dollars
T	Time (June 30, 1962 = 0
t	Dummy seasonal variable (= 1, June 30 and = 0, December 31
r_i	Interest rate on i^{th} class of loans
IFP	Index of farm prices
RI	Index of range conditions
CRS	County retail sales in thousands of dollars

of - .042 for this variable indicates that a one unit increase (decrease) in the yield on corporate bonds will result in a .042 times (CPI) decrease (increase) in the supply of time deposits when all other variables are held constant at their mean values. The time deposit rate coefficient indicates that a one unit increase (decrease) in the interest rate on time deposits will result in a $184,257 increase (decrease) in the county supply of time deposits.

Demand Deposits. The following equation was selected for estimating county demand deposits:

$$\begin{array}{l} DD = \underset{(574896.9)}{2{,}360{,}364.5} - \underset{(57172.3)}{222{,}615.8}\,(t) + \underset{(4.54)}{18.535}\,(CPI) \\ \quad - \underset{(155315.0)}{464{,}534.8}\,(r_{TD}) + \underset{(.0442)}{.3187}\,(DD\text{-}1) + \underset{(.0427)}{.5559}\,(DD\text{-}2) + \underset{(10352.7)}{53{,}343}\,(T) \end{array}$$

The R^2 is .9417 with a standard error of $465,641 and an F-ratio of 853.60. All signs are as expected and every coefficient is statistically significant at the 1 percent level. The parameter for the dummy variable indicates that the supply of demand deposits is $222,616 lower on June 30 than on December 31 with other variables fixed at their mean. A $1,000 increase (decrease) in county personal income results in a $18.54 increase (decrease) in the supply of demand deposits with other factors held constant. The substitution between time and demand deposits is brought out by the coefficient for the interest rate on time deposits representing a $464,533 decrease (increase) in supply of demand deposits for each 1 percent increase (decrease) in the time deposit rate.

Loan Equations

Agricultural Real Estate Loans. To estimate the demand for long term agricultural loans, the following equation was chosen:

$$\begin{array}{l} \text{AGREL} = \underset{(344{,}398.3)}{1{,}237{,}394.1} - \underset{(.796)}{1.482}\ (\text{CPI}) - \underset{(6279.1)}{211{,}185.8}\ (r_i) \\ \quad + \underset{(254.15)}{156.32}\ (\text{IFP}) + \underset{(.024)}{.990}\ (\text{AGREL-2}) + \underset{(2884.3)}{7{,}560.8}\ (\text{T}) \end{array}$$

This equation has an R^2 of .8813, a standard error of $125,084, and an F-ratio of 472.35. The hypothesized signs are present and the lagged dependent, interest rate, and time variable coefficients are significant at the 1 percent level. County personal income is significant at the 10 percent level and the coefficient indicates that a $1,000 increase (decrease) in income will result in a $1.48 decrease (increase) in the demand for agricultural real estate loans. The coefficient of 156.32 for the index of farm prices indicates that with other variables held constant, a one unit change in this variable results in a $156.32 change in the demand for agricultural real estate loans in the same direction. This equation is highly interest elastic, since a one unit increase (decrease) in the interest rate will result in a $211,186 decrease (increase) in the demand for long term agricultural loans, other factors held constant.

Agricultural Production Loans. The equation selected for estimating the demand for short term agricultural loans is:

$$\begin{array}{l} \text{AGPROD} = - \underset{(340{,}553.6)}{372{,}823.0} - \underset{(45{,}005.3)}{99{,}106.4}\ (\text{t}) - \underset{(2.06)}{2.18}\ (\text{CPI}) \end{array}$$

$$+ \underset{(565.11)}{1{,}572.44}\ (IFP) + \underset{(.016)}{1.097}\ (AGPROD\text{-}2) - \underset{(29734.2)}{93{,}829.7}\ (r_i)$$

$$+ \underset{(3476.5)}{8{,}381.6}\ (RI)$$

The R^2 is .9461 with a standard error of $323,584 and an F-ratio of 927.82. With the exception of the income variable, all parameters are significant at the 5 percent level or higher and all the signs are consistent with the hypothesis. The volume of agricultural production loans demanded on June 30 is $99,106 less than on December 31 with other factors held constant. The coefficient for range condition (RI) indicates that a one unit increase (decrease) in the index of range conditions results in a $8,382 increase (decrease) in the demand for short term agricultural loans. The volume of agricultural production loans demanded decreases (increases) $93,830 for each 1 percent increase (decrease) in the interest rate for this class of loan.

Commercial Loans. The commercial loan equation selected is:

$$COMML = - \underset{(27571.7)}{37{,}415.7} + \underset{(.027)}{.8947}\ (COMML\text{-}1) + \underset{(1803.1)}{3450.2}\ (T)$$

$$+ \underset{(2.27)}{8.95}\ (CRS)$$

The R^2 is .8824 with a standard error of $166,558 and an F-ratio of 846.04. The parameters are all significant at the 10 percent level or better and all have the expected signs. All models tested that included the interest rate variable yielded a positive sign for that variable. Because it was not significant and was theoretically inconsistent, interest rate was excluded from the equation. The income variable would not significantly enter the equation and likewise, it

was excluded. The county retail sales coefficient indicates that the demand for commercial loans will increase (decrease) by $8.95 when county retail sales increases (decreases) $1,000 with other variables held constant.

Consumer Installment Loans. The estimation of this equation without data for interest rates provided reasonable results. The actual equation selected is:

$$\underset{\quad}{\text{INSTA}} = \underset{(26,661.5)}{48,821.1} + \underset{(1.62)}{8.45}\ (\text{CPI}) + \underset{(.025)}{.898}\ (\text{INSTA-1}) - \underset{(1,954.6)}{2,168.0}\ (\text{T})$$

The R^2 is .9235, standard error is $191,821 and the F-ratio is 1433.13. All parameters except time are significant at the 1 percent level, and most of the signs are as expected. The time variable was expected to have a positive sign indicating an upward trend over the time period, but a negative sign resulted and the parameter was not significant. The coefficient for county personal income indicates that the demand for installment loans will increase (decrease) $8.45 for each $1,000 increase (decrease) in income.

Market Share

Data Sources

Most of the data used for the estimation of the market share equations was primary data obtained through a mailed questionnaire. The survey included 76 banks in the 18 counties identified earlier in Figure 2. A copy of the questionnaire appears in Figure 3. Exactly 50 percent of the sample banks returned completed questionnaires, but

Banking Competition Questionnaire

Confidential

For Statistical Purposes Only

Location of Your Bank _____ Town.

Date of Charter _____.

Number of Competing Banks in Trade Area _____.

Approximate Distance to Furthest Competitor _____.

Do you have an Agricultural Loan Officer so designated? ___Yes ___No

	1970	1971	1972
Demand Deposits:			
Amount December 31			
Service Charge Income ($/Yr.)			
Time Deposits:			
Amount as of December 31			
Interest Expense ($/Yr.)			
Loans:			
Volume as of December 31			
Real Estate			
Agriculture			
Commercial			
Installment			
Average Interest Rates (%)			
Real Estate			
Agriculture			
Commercial			
Installment			
Total Advertising Expense ($/Yr.)			

Figure 3. Questionnaire Form for Bank Survey

11 of those could not be included because of incomplete data. The summarized data obtained from the survey is presented in Appendix A. All of the banks in many of the sample counties did not return the questionnaires, and because averages for all banks in the county were desired, the data was somewhat inadequate. Secondary data from the Federal Reserve Bank of Kansas City was also used in combination with the primary data to estimate market share equations. The OMNITAB statistical program fit the hypothesized relationships to the data. In the following discussion, the standard errors are presented in the same manner as for the market equations and all variables are defined in Table V.

Deposit Equations

Time Deposits. The equation selected for estimating the change in market share of time deposits is:

$$\Delta \text{ \% Mkt. Sh. TD} = \underset{(.619)}{-.3846} \underset{(.125)}{-.1804}\ (\text{NBANKS}) + \underset{(.0298)}{.0631}\ (\text{NMILES})$$

$$+ \underset{(.00023)}{.000345}\ (\Delta\text{Adv}) + \underset{(.334)}{.8951}\ (r_{TD}-\bar{r}_{TD}) + \underset{(.325)}{.2256}\ (\Delta r_{TD}-\Delta\bar{r}_{TD})$$

$$+ \underset{(.00039)}{.000947}\ (\Delta\text{Adv}-\overline{\Delta\text{Adv}})$$

The R^2 is .2780 with a standard error of 1.60 and an F-ratio of 3.40. All of the coefficients are significant at the 20 percent level or greater except the $(\Delta r_{TD}-\Delta\bar{r}_{TD})$ variable, and all the signs are as expected. The coefficients indicate that a one dollar increase (decrease) in the change in a bank's advertising outlay will result in a .000345 percent increase (decrease) in the change in that bank's

TABLE V

DEFINITIONS OF VARIABLES FOR MARKET SHARE EQUATIONS

Code	Definition
$\Delta\%$	Change in the percent share of the market for each class
NBANKS	Number of competing banks
NMILES	Distance to farthest competitor
Adv	Advertising expense for each bank
r_{TD}	Interest rate on time deposits
SC	Service charge on demand deposits in percent
r_i	Interest rate on the i^{th} class of loan
$\overline{\quad}$	A bar over any variable indicates average for the market

market share of time deposits with other factors held constant. If a bank pays a 1 percent higher rate on time deposits than the average rate, the change in that bank's market share of time deposits will be .8951 percent assuming other variables constant. The number of banks coefficient indicates that a one bank increase (decrease) in the number of banks in the market will decrease (increase) the change in market share by .1804 percent. The change in market share will increase (decrease) by .0631 percent for each mile increase in the total size of the market.

Demand Deposits. To allocate the market supply of demand deposits to the three banks, the following equation was selected:

$$\begin{aligned}\Delta \text{ \% Mkt. Sh. DD} = {} & \underset{(.568)}{1.5044} - \underset{(4.22)}{12.564}\ (\Delta SC) + \underset{(.00023)}{.000273}\ (\Delta Adv) \\ & - \underset{(5.35)}{6.678}\ (\Delta SC - \overline{\Delta SC}) + \underset{(.00039)}{.000731}\ (\Delta Adv - \overline{\Delta Adv}) - \underset{(.0886)}{.2722}\ (NBANKS)\end{aligned}$$

The R^2 is .5562 with the standard error and F-ratio being 1.65 and 14.54 respectively. The coefficients for (ΔSC) and (NBANKS) are significant at the 1 percent level and the coefficient for $(\Delta Adv - \overline{\Delta Adv})$ is significant at the 10 percent level. The other two coefficients are very close to being significant at the 20 percent level, and all signs are as expected. The coefficients indicate that when a bank changes its service charge on demand deposits by 1 percent, that bank's share of the market for demand deposits will change in the opposite direction by 12.564 percent, other factors held constant. The coefficient for the change in advertising variable indicates that a one dollar increase (decrease) in this variable will increase (decrease) the bank's

change in the market share of demand deposits by .000273 percent, other factors held constant. Both the change in service charge and change in advertising variables are also included as parts of other variables in this equation.

Loan Equations

Agricultural Real Estate Loans. The equation to estimate the change in market share for agricultural real estate loans is:

$$\Delta \text{ \% Mkt. Sh. AGREL} = \underset{}{4.823} + \underset{(8.42)}{.6474} \text{ (NBANKS)} - \underset{(1.75)}{.3618} \text{ (NMILES)} + \underset{(.470)}{.00366} \text{ (}\Delta\text{Adv)} - \underset{(.0025)}{5.271} \text{ (}r_i - \bar{r}_i\text{)} + \underset{(10.41)}{.00246} \text{ (Adv} - \overline{\text{Adv}}\text{)} \quad (.0016)$$

The R^2 is .0671 and the standard error is 21.45 with an F-ratio for regression of .69. The only coefficients significant at the 20 percent level are the ones for (ΔAdv) and (Adv-$\overline{\text{Adv}}$). The signs are as expected except that the signs on the (NBANKS) and (NMILES) variables are reversed. The results indicate that an interest rate 1 percent higher (lower) than the average rate will result in a 5.271 percent decrease (increase) in the change in that bank's market share of agricultural real estate loans. The coefficient for change in advertising indicates that a one dollar change in this variable will change the market share by .00366 percent in the same direction.

Agricultural Production Loans. The equation selected to determine the market share of agricultural production loans is:

$$\Delta \text{ \% Mkt. Sh. AGPROD} = - \underset{}{2.375} + \underset{(1.62)}{.1654} \text{ (NBANKS)} + \underset{(.383)}{.037} \text{ (NMILES)} \quad (.096)$$

$$- .6691\ (\Delta r_i - \overline{\Delta r_i}) + .00099\ (\Delta Adv - \overline{\Delta Adv})$$
$$(2.80) \qquad\qquad (.00093)$$

The R^2 is .0694 with the standard error of estimate being 4.48 and an F-ratio of .91. None of the parameters are significant, and the sign is not as expected for the (NBANKS) coefficient. The difference between the change in an individual bank's interest rate for agricultural production loans and the change in the average rate is not nearly as important as the difference in current rates was for long term agricultural loans. The coefficient for the (ΔAdv- $\overline{\text{Adv}}$) variable indicates that a one dollar increase (decrease) in this variable will increase (decrease) the change in the market share of agricultural production loans by .00099 percent, other variables held constant.

Commercial Loans. The equation selected for commercial loan market share is:

$$\Delta \text{ \% Mkt. Sh. COMML} = - 1.373 + .1374\ (\text{NBANKS}) - 3.716\ (\Delta r_i)$$
$$(2.88) \quad (.458) \qquad\qquad (6.20)$$

$$+ 18.757\ (\Delta r_i - \overline{\Delta r_i}) + .00327\ (\Delta Adv - \overline{\Delta Adv})$$
$$(8.16) \qquad\qquad (.00167)$$

The R^2 is .2157 and the standard error is 4.48 with an F-ratio for regression of .91. Again, the sign for the (NBANKS) coefficient is not as expected and the sign for the coefficient on $(\Delta r_i - \overline{\Delta r_i})$ is not as hypothesized, but is significant at the 5 percent level. When the average rate differential variable $\Delta r_i - \overline{\Delta r_i}$ was deleted, the proper signs for other variables did not appear, and since some form of an equation was needed, this one was selected. The coefficient

for ($\Delta Adv - \overline{\Delta Adv}$) is significant at the 10 percent level and indicates that the change in market share for commercial loans will increase (decrease by .00327 percent when a bank's change in advertising is one dollar greater than the average change in advertising).

Consumer Installment Loans. For estimating the change in installment loan market share, the following equation was chosen:

$$\Delta \text{ \% Mkt. Sh. INSTA} = -2.633 + .8358\ (\text{NBANKS}) - .0537\ (\text{NMILES}) \quad (1.99)\ (.407)\ (.113)$$

$$+ .000581\ (Adv - \overline{Adv}) - .000373\ (\Delta r_i - \overline{\Delta r_i})$$

The R^2 is 18.81, the standard error is 5.27, and the F-ratio is 2.84. As for most loan market share equations, the signs are reversed on the (NBANKS) and (NMILES) coefficients. The (NBANKS) coefficient is significant at the 5 percent level and the ($Adv - \overline{Adv}$) coefficient is significant at the 20 percent level, and indicates that an advertising outlay one dollar greater (smaller) than the average outlay will increase (decrease) a bank's change in the share of the market of installment loans by .00581 percent. As the results indicate, a 1 percent change in the ($\Delta r_i - \Delta r_i$) variable results in a .00373 change in the market share of installment loans in the opposite direction.

Low R^2's, statistical insignificance of variables, and low F-ratios for the market share equations were less than expected, and the need for further research is noted. However, with the exception of the commercial loan market share equation discussed below, these equations are acceptable for their intended use within the model. Pretesting the model resulted in reasonable allocation of the market demand and supply volumes of deposits and loans (other than commercial loans) to the

three banks through the use of these equations. However, the positive sign and relatively large value for the coefficient on the $(\Delta r_i - \overline{\Delta r}_i)$ variable in the commercial loan market share equation resulted in unrealistic market share estimates when the game was pretested. A bank that charged a higher rate on commercial loans received the largest volume of these loans. Because of the inadequacy of the commercial loan market share equation, the $(\Delta r_i - \overline{\Delta r}_i)$ variable was deleted from the equation for use in the model. Eliminating the variable remedied the situation. The need for further research in this area will be discussed in Chapter V.

FOOTNOTES

[1]Arthur L. Hutson, Economic Analysis of Commercial Bank--Farm Credit System Coordination" (Unpublished Masters Thesis, Oklahoma State University, May, 1973).

[2]Federal Reserve Board, Functional Cost Analysis, 1971 Average Banks, Survey (Washington, D. C., 1971).

[3]The data from this source is from both published and unpublished listings. The published data appears biannually in the Statistical Abstract of Oklahoma, Bureau for Business and Economic Research, University of Oklahoma (1960-1972).

[4]Oklahoma Crop and Livestock Reporting Service, Range and Pasture (Oklahoma City, 1961-1972).

[5]Interest rates were taken from both the Agricultural Finance Review, Vol. 32 Supplement, U.S.D.A., E.R.S. (January, 1972), and Agricultural Statistics, U.S.D.A. (1972).

[6]This data is published periodically in Oklahoma Current Farm Economics, Oklahoma State University, Agricultural Experiment Station.

[7]United States Department of Commerce, Survey of Business Conditions, Bureau of Economic Analysis (Washington, D. C., January, 1973).

[8]Board of Governors, Federal Reserve System, Federal Reserve Bulletin (Washington, D. C., January 1969-July, 1973).

CHAPTER IV

INSTRUCTIONS, TESTING, AND EVALUATION

Introduction

This chapter will present an explanation of the operations necessary to utilize the game; including a discussion of the data input, the output from that data, and player's instructions. The results of a series of decisions made by three teams will be summarized and the highlights will be compared and discussed. Finally, an evaluation of the "game" will be presented supplemented by comments from the members of the test teams.

Playing the Game

Administrator's Instructions and Data Input Procedures

Although the computer program for the model is designed for the IBM 360 Model 65 computer and is structured for the three competing banks, the flexibility of the program is illustrated by the fact that minor modifications will adapt the model to other computer systems and/or different numbers of competing banks. As presently structured, all three banks begin with identical financial statements. This is accomplished by the "game administrator" entering identical history files, balance sheets, and decisions for the three banks to obtain

the initial output that is given to each decision team before they begin play.

The arrangement of the input data cards is presented in Figure 4. For the beginning output, the administrator must provide all of the cards shown in Figure 4. After that, most of the card input is generated by the program as card output and there are only a few cards to be punched for each decision set.

The first input card shown in Figure 4 contains the time period for the period of play, and the data required for the warnings given to those banks that do not comply with the regulations. This card is part of the card output from the previous set of decisions. The next 9 cards contain the 72 exogenous variables used in the market equations and various other areas of the program. The first 6 cards for the exogenous variables can be handled in either of two ways. Several sets of these variables can be preselected by the administrator and punched on cards before the game is played, or the administrator may choose to prepare each set of exogenous cards just prior to each period of play. The last 3 of the 9 exogenous variable cards contain each bank's share of the market for each class of loan and deposits for the previous period. Since these market share values are calculated within the program each period, the cards containing these values are also part of the card output from the previous set of decisions.

The players' decisions for each period of play are punched on the next 12 cards as shown in Figure 4. Each bank's decisions are punched on 4 cards and the cards are read in the order of the preassigned bank number designation. The decisions will be discussed in detail later. Next, the previous period's balance sheet and the history file

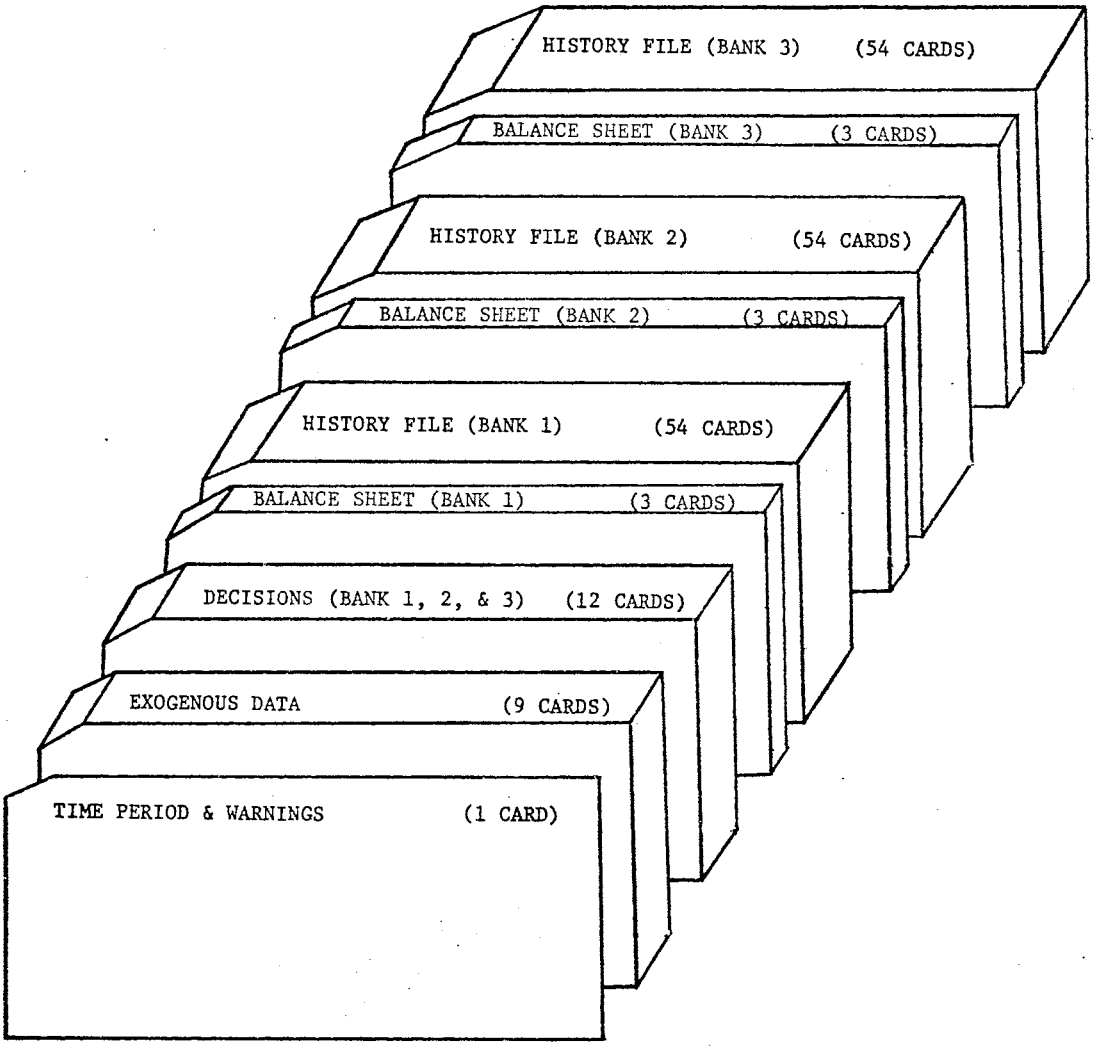

Figure 4. Arrangement of Data Input Cards

for each bank is read in the order of the designated bank number. Each bank's balance sheet items are contained on 3 cards and each bank's history file items are contained on 54 cards. After this balance sheet and history file data used to initialize playing of the game is entered, all of these cards for this period's play are part of the card output from the previous run.

If the exogenous variables have been prepunched, only the 12 cards for the player's decisions have to be punched for subsequent periods of play. The card output obtained from the previous set of decisions has to be rearranged to coincide with the order in which it is read into the program for the following decision. The first card of the output contains the name of the program and can be discarded. The next card is the time period card, and it is the first card for the input data for the subsequent period of play. The next 3 output cards contain the exogenous variables for market share and these must be placed after the other 6 prepunched cards for exogenous variables in the input deck. The remaining output cards that summarize the balance sheets and history files are in the correct order and can be entered directly. Finally, the 12 decision input cards must be added in their proper position as shown in Figure 4. The printed output tables obtained will be presented and discussed later. The administrator is responsible for distributing these output tables of the game to each of the decision groups for their analysis before making the next set of decisions.

Players' Instructions--Decisions and Output

All of the participants are provided with the beginning output tables and the decision forms. These items are supplemented with a set of written players' instructions and examples by the administrator. A copy of the players' instructions appears in Appendix B.

Decision Form

A copy of the decision form is presented in Figure 5. Each decision group should fill in their preassigned bank number, the six month time period, and the year for the current play. The decision for time deposit rate represents an average rate for all classes of time and saving deposits and presently cannot be in excess of 6.50 percent. The decision for loan officers' salaries includes the president's salary and must be at least $20,000 for the six month period. Service charge is expressed as a percentage of demand deposits, and there is no restriction on the magnitude of this decision. A typical range for the service charge decision is from 0.0 percent to 1.00 percent. Advertising and promotion may be set at any value desired, but the players should be cautioned that a saturation point exists above which advertising expenses have no effect on loan or deposit volumes. Each bank team also must make decisions with respect to the interest rates for the four classes of loans as indicated in Figure 5.

The decisions for loan volumes are policy decisions that indicate the maximum volume of outstanding loans that the players are willing to accept for the next six month period. These maximum volumes may

DECISIONS

Bank _____ Period _____ Year _____

Time Deposit Rate	_____%	(101-110)	Loans:*		
Loan Officers Salaries	$_____	(111-120)	Agricultural Ten Year	$_____	(311-320)
			Agricultural One Year	$_____	(321-330)
Service Charge	_____%	(131-140)	Commercial	$_____	(351-360)
			Installment	$_____	(361-370
Advertising and Promotion	$_____	(141-150)			
			Investments:**		
Interest Rates:					
			Six Month Security	$_____	(371-380)
Agricultural Ten Year	_____%	(231-240)	One Year Security	$_____	(401-410)
Agricultural One Year	_____%	(251-260)	Three Year Security	$_____	(411-420)
Commercial Loans	_____%	(271-280)	Two Year Municipal	$_____	(421-430)
Installment Loans	_____%	(301-310)	Five Year Municipal Bond	$_____	(431-440)

*Maximum Volume Desired Outstanding--May not be met.

**Actual Dollar Amount Purchased.

Figure 5. Players Decision Form

not be obtained if they are greater than the bank's market share determined by the competitive relationships within the model. If a bank decision team desires to let its market share, determined by interest rates, advertising, and service charges dictate the volume of loans, then the decision for maximum volume outstanding should be set at a large unobtainable level. To sell loans, the appropriate loan decision should be set at the volume which the bank wishes to have outstanding after the sale. A loan decision of zero (0.0) for investments means that the bank does not desire to add any investments in that particular class, but does desire to maintain in its portfolio those investments previously purchased less those maturing. To sell investments before maturity, the investment decision must be negative and equal to the volume which the bank desires to sell.

Output Tables

Each bank decision team received a four page output at the beginning of the game and after each six month period of play. As discussed previously, the initial or beginning output is identical for all three banks. A sample copy of this output appears in Table VI. A later section of this chapter will present a discussion of the decisions and results generated in testing and verifying the game, and the output presented in Table VI was given to all three decision teams to initialize that test.

The balance sheet or "Statement of Conditions" is the first table of the output. Most of the entries are clearly understood. Within the "government securities to one year" account is included the volume of both the six month and one year government securities. The

TABLE VI

COMPUTER OUTPUT STATEMENTS FOR BANK MANAGEMENT GAME

STATEMENTS OF CONDITIONS

BANK NO. 1 PERIOD 2 YEAR 0

ASSETS			LIABILITIES	
CASH AND DUE FROMS		966117.00	DEMAND DEPOSITS	2823129.00
GOVERNMENT SECURITIES:				
TO ONE YEAR	850000.00		TIME DEPOSITS	1719709.00
ONE TO THREE YEARS	450000.00			
TOTAL SECURITIES		1300000.00	FED FUNDS PURCHASED	0.00
MUNICIPAL BONDS:				
TWO YEAR	550000.00		TOTAL LIABILITIES	4542838.00
FIVE YEAR	350000.00			
TOTAL BONDS		900000.00		
LOANS:			CAPITAL FUNDS	
AG TEN YEAR	250000.00			
AG ONE YEAR	934610.70		CAPITAL STOCK	140000.00
COMMERCIAL	329832.10		SURPLUS	210000.00
INSTALLMENT	395691.90		UNDIVIDED PROFITS	293412.80
TOTAL LOANS		1910133.00		
BANKING PREMISES AND EQUIP.		100000.00	TOTAL CAPITAL	643412.80
OTHER ASSETS		10000.00		
TOTAL ASSETS		5186250.00	TOTAL LIABILITIES AND CAPITAL	5186250.00

TABLE VI (Continued)

SEMI-ANNUAL INCOME STATEMENT

BANK NO. 1 PERIOD 2 YEAR 0

SUMMARY			DETAIL ON SELECTED ACCOUNTS		
INCOME:					
INTEREST ON LOANS	70261.75		INTEREST ON LOANS		70261.75
INTEREST ON INVESTMENTS	42762.49		AG TEN YEAR	7501.25	
SERVICE CHARGE	3528.91		AG ONE YEAR	29781.58	
OTHER	7700.00		COMMERCIAL	12633.28	
TOTAL INCOME		124253.00	INSTALLMENT	20345.70	
EXPENSES:					
INTEREST PAID	36543.81				
ADVERTISING	3000.00		INTEREST PAID		36543.81
SALARIES	53000.00		TIME DEPOSITS	36543.81	
OTHER	18126.83		FEDERAL FUNDS	0.00	
TOTAL EXPENSES		110670.60			
NET INCOME BEFORE TAXES		13582.38			
LESS TAXES		169.48			
NET INCOME		13412.89			

TABLE VI (Continued)

DECISIONS INPUT

BANK NO. 1 PERIOD 2 YEAR 0

TIME DEPOSIT RATE	4.25%	LOANS: 1/	
LOAN OFFICERS SALARIES	25000.00	AG TEN YEAR	250000.00
SERVICE CHARGE	0.25%	AG ONE YEAR	1000000.00
ADVERTISING AND PROMOTION	3000.00	COMMERCIAL	500000.00
INTEREST RATES:		INSTALLMENTS	500000.00
AG TEN YEAR	6.25%	INVESTMENTS: 2/	
AG ONE YEAR	8.50%	SIX MONTH SECURITY	300000.00
COMMERCIAL LOANS	8.75%	ONE YEAR SECURITY	250000.00
INSTALLMENT LOANS	10.50%	THREE YEAR SECURITY	50000.00
		TWO YEAR MUNICIPAL BOND	150000.00
		FIVE YEAR MUNICIPAL BOND	50000.00

1/MAXIMUM VOLUME DESIRED OUTSTANDING--MAY NOT BE MET.
2/ACTUAL DOLLAR AMOUNT PURCHASED.

TABLE OF PORTFOLIO MATURITIES

MATURES AT END OF PERIOD

		PERIOD										
ITEM	TOTAL	0	1	2	3	4	5	6	7	8	9	10
1 YR GOVT	550000.	300000.	250000.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3 YEAR GOVT	450000.	50000.	100000.	100000.	50000.	100000.	50000.	0.	0.	0.	0.	0.
2 YEAR MUNI	550000.	200000.	100000.	100000.	150000.	0.	0.	0.	0.	0.	0.	0.
5 YEAR MUNI	350000.	50000.	50000.	50000.	50000.	50000.	0.	50000.	0.	0.	50000.	0.
10 YEAR AG	250000.	6500.	23150.	6000.	22650.	5500.	22650.	4500.	22150.	3000.	22150.	3000.
1 YEAR AG	934611.	230000.	704611.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2 YEAR COMM	329832.	75000.	121166.	37500.	96166.	0.	0.	0.	0.	0.	0.	0.
2 YEAR INST	395692.	127673.	108923.	88923.	70173.	0.	0.	0.	0.	0.	0.	0.
6 MO. SECUR	300000.	300000.										
TOTALS		1339172.	1457848.	382423.	438989.	155500.	72650.	54500.	22150.	3000.	72150.	3000.

TABLE VI (Continued)

ECONOMIC AND STATISTICAL INFORMATION

ALL BANKS, PERIOD 2 YEAR 0

PREVIOUS PERIOD

COUNTY PERSONAL INCOME	$10000000.00
COUNTY RETAIL SALES	$ 6500000.00
INDEX OF RELEVENT FARM PRICES	325.00
INDEX OF RANGE CONDITIONS 1/	78.00
PRIME RATE	6.25%
AVERAGE FOR GAME BANKS:	
AVERAGE RATE ON TIME DEPOSITS	4.25%
AVERAGE SERVICE CHARGE	0.25%
AVERAGE ADVERTISING EXPENSE	$ 3000.00
AVERAGE RATES ON LOANS:	
AG TEN YEAR	6.25%
AG ONE YEAR	8.50%
COMMERCIAL	8.75%
INSTALLMENT	10.50%
FRB RESERVE REQUIREMENT:	
TIME DEPOSITS	3.00%
DEMAND DEPOSITS 2/	8.00,10.00,12.00%
AVERAGE YIELD ON CORPORATE BONDS	7.36%

	BANK NUMBER		
	1	2	3
LOANS:			
VOLUME	$ 1910133.00	$ 1910093.00	$ 1910158.00
% OF MARKET	33.33%	33.33%	33.33%
TIME DEPOSITS:			
VOLUME	$ 1719709.00	$ 1719709.00	$ 1719709.00
% OF MARKET	33.33%	33.33%	33.33%
DEMAND DEPOSITS			
VOLUME	$ 2823129.00	$ 2823129.00	$ 2823129.00
% OF MARKET	33.33%	33.33%	33.33%

1/INDICES ARE AS FOLLOWS: BELOW 49,VERY BAD; 50-59,BAD; 60-69,POOR; 70-79,FAIR; 80-89,GOOD; 90-99,VERY GOOD; ABOVE 100,EXCELLENT.

2/FRB RATES ON DEMAND DEPOSITS ARE AS FOLLOWS; 8.00% ON THE FIRST $2,000,000.00; 10.00% ON THE NEXT $8,000,000.00; AND 12.00% ON THE NEXT $90,000,000.00.

NEXT PERIOD

ACTUAL	
FEDERAL FUNDS RATE	6.40%
SIX MONTH SECURITY RATE	6.30%
ONE YEAR SECURITY RATE	6.25%
THREE YEAR SECURITY RATE	6.25%
TWO YEAR MUNICIPAL BOND RATE	3.10%
FIVE YEAR MUNICIPAL BOND RATE	3.35%
FRB RESERVE REQUIREMENTS:	
DEMAND DEPOSITS	8.00,10.00,12.00%
TIME DEPOSITS	3.00%

EXPECTED	FROM	TO
COUNTY PERSONAL INCOME	$ 9750000.00	$11000000.00
COUNTY RETAIL SALES	$ 6250000.00	$ 7000000.00
INDEX OF FARM PRICES	325.00	360.00
PRIME RATE	7.00	7.75

"federal funds purchased" account shows the amount of forced borrowing of federal funds if deposits were not sufficient to support the asset structure. The "capital stock" and "surplus" accounts are assumed to be constant from period to period, and all the net income after taxes is accumulated in the "undivided profits" account.

The next table of the output is the "Income Statement." This table summarized the income and expense items with a detailed breakdown of the interest income from each class of loan. The third table of the output summarized the decisions made for the previous period of play. These decisions are presented in exactly the same format as the decision input form discussed previously.

Also provided on the third page of the output is the "Table of Portfolio Maturities." The first column of this table is the "totals" column showing the total amount outstanding for each class of portfolio item as these items appear on the current "Statement of Conditions." The remaining 11 columns present by class of loan or investment the amount of cash which will come due or flow into the bank in the form of principle payments on loans or maturing investments at the end of the six month period designated in the column headings. The "totals" column includes the values for the "0" period column which represents the amount of cash which has just been repaid or matured and is available for reinvestment in the upcoming period of play. The "Table of Portfolio Maturities" is included as a decision making aid for the players. The amount of cash available from maturing assets plus "Cash" from the balance sheet plus any anticipated increase in deposits gives the decision groups a starting point in deciding how much cash they will have available for reinvestment and required reserve and what

amount they can purchase in the next period without borrowing federal funds of having excess cash. The table also provides a tool for long range planning since it shows the amount of maturing assets for ten future periods or five years.

The fourth and final page of the output is identical in all periods for all banks. This page presents selected economic and statistical information for the previous and upcoming period of play. For the previous period, the averages for the three banks for several decisions such as interest rates, service charge and advertising are presented so that each bank can compare its decisions with its competitors. The relative position of each bank in the volume and percent of the market of loans and time and demand deposits is also presented. The information provided for the next period indicates to the decision teams exactly what the rate of interest will be for government securities and municipal bonds and what the interest rate on federal funds will be if the bank is forced to purchase these funds. Also included are forecast ranges for certain variables relevant to the county's economic condition as well as a forecast range for the prime rate.

Model Testing

To test the model in a gaming situation, three different groups were asked to participate in making bank management decisions. In order to evaluate the potential of the game in different environments, a team of graduate students of the Department of Agricultural Economics at Oklahoma State University, a team of faculty members of the Department of Agricultural Economics, and a team of bank officers from a

local commercial bank were chosen for model testing and verification. All three teams started with beginning statements identical to those presented earlier in Table VI. The results in Table VI are for the period ending December 31, and the first set of decisions will be made for the six months from January through June. The following discussion will present each bank's decisions and the resulting output for four periods of play.

Period Number One

The economic and statistical data for the first period indicates rising interest rates and farm prices. The banks begin with an excess of cash and deposits should increase within the community.

The decisions made by each team for the first six month period are presented in Table VII along with selected output items. Bank number one increased the advertising outlay from $3,000 to $12,000, while banks two and three increased this item to $7,000 and $5,000, respectively. The large increase in advertising for bank one resulted in an increase in that bank's share of the market of deposits and loans at the expense of bank three, which had a higher rate for time deposits and lower rates on loans. The lower interest rates for loans for bank two compared to bank one enabled bank two to maintain its share of loans in spite of the lower advertising. Bank three restricted the volume desired for both classes of agricultural loans and might have had a larger share of the market had not these restrictions been effective. Each bank chose to place all anticipated cash into six month government securities, reflecting the expected rise in interest rates by all teams.

TABLE VII

DECISIONS AND RESULTS FOR PERIOD ONE

Decision Items	Bank 1	Bank 2	Bank 3
Time Deposit Rate	5.50	5.50	6.50
Loan Officers' Salaries	20,000.00	20,000.00	20,000.00
Service Charge	0.00	0.00	0.10
Advertising and Promotion	12,000.00	7,000.00	5,000.00
Interest Rates:			
Ag. Ten Year	7.00	6.40	8.00
Ag. One Year	8.25	8.00	8.00
Commercial Loans	9.00	8.25	8.00
Installment Loans	11.50	10.00	10.00
Loans:			
Ag. Ten Year	300,000.00	9,999,999.00	250,000.00
Ag. One Year	5,000,000.00	9,999,999.00	1,000,000.00
Commercial	5,000,000.00	9,999,999.00	500,000.00
Installment	5,000,000.00	9,999,999.00	1,000,000.00
Investments:			
Six Month Security	1,800,000.00	1,500,000.00	1,500,000.00
One Year Security	0.00	0.00	0.00
Three Year Security	0.00	0.00	0.00
Two Year Municipal	0.00	0.00	0.00
Five Year Municipal	0.00	0.00	0.00
Output Items:			
Total Assets	5,675,580.00	5,246,936.00	5,150,379.00
Cash	350,376.00	283,636.00	250,219.50
Total Loans:	2,115,204.00	2,053,300.00	1,990,160.00
Ag. Ten Year	263,696.00	259,028.50	250,000.00
Ag. One Year	1,061,354.00	1,032,465.00	1,000,000.00
Commercial	372,841.00	352,213.90	335,713.80
Installment	417,313.50	409,594.80	404,447.40
Total Investments:	3,100,000.00	2,800,000.00	2,800,000.00
Gov't Securities	2,450,000.00	2,150,000.00	2,150,000.00
Municipal Bonds	650,000.00	650,000.00	650,000.00
Demand Deposits	2,812,768.00	2,607,137.00	2,338,722.00
Time Deposits	2,183,405.00	1,961,882.00	1,878,250.00
Fed. Funds Borrowed *	0.00	0.00	257,322.50
Net Income After Taxes	35,994.25	34,505.13	32,761.78

*Interest Repaid Next Period

Because of bank three's loss of deposits, forced federal funds borrowing occurred to increase cash and satisfy the reserve requirements on deposits. The interest expense on the federal funds was approximately $8,000 which will be reflected as an expense on bank three's income statement for the next period of play. Banks one and two had net income after taxes of $35,994 and $34,505 respectively. Bank three's after tax income was $32,672, but deducting the federal funds interest liability that was incurred this period would reduce bank three's net income to approximately $26,372.

Period Number Two

Indications given to the teams are a continued rise in interest rates and farm prices in addition to significant increases in the county personal income and retail sales. The municipal bond interest rates on an after tax basis were attractive.

The second set of decisions and the output from those decisions as summarized in Table VIII represents quite a contrast to the first period decisions and results. Bank three eliminated its service charge on demand deposits and drastically increased its advertising and promotion outlay while maintaining the maximum allowable rate on time deposits. The combination of these decisions resulted in a large increase in deposits for bank three and an expansion of almost $1 million in total assets. Market share for all loans did not change significantly from the previous period, but none of the banks was able to make any new loans for agricultural real estate because the average interest rate was high enough to reduce the total market demand below what was already outstanding. Banks two and three were forced to purchase

TABLE VIII

DECISIONS AND RESULTS FOR PERIOD TWO

Decision Items	Bank 1	Bank 2	Bank 3
Time Deposit Rate	5.80	6.50	6.50
Loan Officers' Salaries	20,000.00	20,000.00	20,000.00
Service Charge	0.00	0.00	0.00
Advertising and Promotion	14,000.00	10,500.00	15,000.00
Interest Rates:			
Ag. Ten Year	8.90	8.80	9.00
Ag. One Year	9.60	8.25	8.50
Commercial Loans	9.80	9.00	8.50
Installment Loans	11.50	11.00	9.75
Loans:			
Ag. Ten Year	400,000.00	9,999,999.00	250,000.00
Ag. One Year	5,000,000.00	9,999,999.00	1,500,000.00
Commercial	5,000,000.00	9,999,999.00	400,000.00
Installment	5,000,000.00	9,999,999.00	1,000,000.00
Investments:			
Six Month Security	525,000.00	1,000,000.00	1,750,000.00
One Year Security	950,000.00	0.00	0.00
Three Year Security	125,000.00	0.00	0.00
Two Year Municipal	300,000.00	500,000.00	1,000,000.00
Five Year Municipal	100,000.00	1,000,000.00	0.00
Output Items:			
Total Assets	5,613,640.00	5,855,400.00	6,047,958.00
Cash	519,512.00	297,684.00	302,906.50
Total Loans	2,184,128.00	2,147,716.00	2,085,052.00
Ag. Ten Year	240,546.00	235,879.00	226,850.00
Ag. One Year	1,099,835.00	1,087,517.00	1,050,608.00
Commercial	395,886.30	391,693.30	385,122.10
Installment	447,861.70	432,627.10	422,472.90
Total Investments:	2,800,000.00	3,300,000.00	3,550,000.00
Gov't Securities	1,900,000.00	1,300,000.00	2,050,000.00
Municipal Bonds	900,000.00	2,000,000.00	1,500,000.00
Demand Deposits	2,661,481.00	2,685,401.00	2,718,487.00
Time Deposits	2,234,210.00	2,304,804.00	2,368,602.00
Fed. Funds Borrowed *	0.00	149,278.00	250,446.50
Net Income After Taxes	38,542.98	38,000.13	34,337.52

*Interest Repaid Next Period

federal funds to cover their investment and loan portfolios and the interest on these federal funds will reduce their net income in the next period. After two periods of play, bank one had accumulated the largest net income after taxes. All the bank teams seemed more aware of their competitors' decisions and most of the decision items were approaching the average for the three banks. The market share of both loans and deposits was also stabilizing, and the three banks were nearly identical in market share. Banks one and two appeared to be satisfied with allowing the market share relationships determine their loan volume, while bank three had placed maximum restrictions on the different classes of loans even though these restrictions were not effective in most instances. All of the banks still invested relatively large amounts in the six month government security again this period, but bank one shifted cash into all classes of investments. The municipal bonds seemed attractive during this period for all three banks.

Period Number Three

Interest rate expectations are for a reversal of the past upward trend in combination with large increases in income and sales and a continuing upward movement in farm prices for the third period.

The third period decision set shows interestingly uniform decisions for all three teams. The decisions for time deposit rate, loan officers' salaries, service charge, and advertising and promotion were almost identical and the interest rate decisions were very similar in most cases. Bank one charged slightly higher rates than its competitors for all loans except installment loans, and its market share

TABLE IX

DECISIONS AND RESULTS FOR PERIOD THREE

Decision Items	Bank 1	Bank 2	Bank 3
Time Deposit Rate	6.50	6.50	6.50
Loan Officers' Salaries	20,000.00	20,000.00	20,000.00
Service Charge	0.00	0.00	0.00
Advertising and Promotion	15,000.00	12,000.00	10,000.00
Interest Rates:			
Ag. Ten Year	9.10	8.80	9.00
Ag. One Year	9.20	8.25	8.00
Commercial Loans	9.20	9.00	8.50
Installment Loans	9.75	10.70	10.00
Loans:			
Ag. Ten Year	5,000,000.00	9,999,999.00	250,000.00
Ag. One Year	5,000,000.00	9,999,999.00	2,000,000.00
Commercial	5,000,000.00	9,999,999.00	500,000.00
Installment	5,000,000.00	9,999,999.00	600,000.00
Investments:			
Six Month Security	0.00	0.00	1,000,000.00
One Year Security	0.00	920,000.00	0.00
Three Year Security	0.00	1,000,000.00	0.00
Two Year Municipal	0.00	0.00	0.00
Five Year Municipal	600,000.00	0.00	500,000.00
Output Items:			
Total Assets	5,733,969.00	6,617,761.00	5,903,150.00
Cash	761,660.00	296,501.20	521,170.00
Total Loans:	2,237,309.00	2,241,260.00	2,221,980.00
Ag. Ten Year	232,526.00	228,326.00	220,200.00
Ag. One Year	1,122,114.00	1,143,768.00	1,140,992.00
Commercial	403,203.40	412,005.30	418,096.10
Installment	479,466.60	457,161.00	442,692.10
Total Investments:	2,625,000.00	3,970,000.00	3,050,000.00
Gov't Securities	1,275,000.00	2,120,000.00	1,200,000.00
Municipal Bonds	1,350,000.00	1,850,000.00	1,850,000.00
Demand Deposits	2,608,082.00	2,631,309.00	2,662,276.00
Time Deposits	2,377,283.00	2,445,685.00	2,511,031.00
Fed. Funds Borrowed*	0.00	770,464.20	0.00
Net Income After Taxes	30,654.45	54,386.71	19,419.44

*Interest Repaid Next Period

of installment loans reflected the lower rate. Team three was still restricting certain classes of loans, but none of the restrictions were effective. The five year municipal bond showed an attractive after tax yield and banks one and three invested in this item. Total market deposits increased considerably this period and banks one and three invested in this item. Total market deposits increased considerably this period and banks one and three did not acquire sufficient assets and ended up with surplus cash. In contrast, bank two had a considerable volume of forced borrowing of federal funds due to large purchases of investments. The market share of loans and demand deposits was almost identical for each bank during period three, but bank three had a slightly larger share of time deposits compared to its competitors. Adjusting net income for the interest on federal funds, bank one again appeared to have a larger net income after taxes.

Period Number Four

All interest rate information supplied by the administrator began to show a slight downward trend in the last period, and the data given to the teams for this period indicate that this downward movement would continue in the national money markets. Other general economic data given to the players reflected the expansion of deposit supply and loan demand for this period.

The fourth period of play represents the last decision set for the three teams. The results and decisions for period four are shown in Table X. Bank one decided to lower the time deposit rate--most likely because other rates were declining, but banks two and three did

TABLE X

DECISIONS AND RESULTS FOR PERIOD FOUR

Decision Items	Bank 1	Bank 2	Bank 3
Time Deposit Rate	6.00	6.50	6.50
Loan Officers' Salaries	20,000.00	20,000.00	20,000.00
Service Charge	0.00	0.00	0.00
Advertising and Promotion	15,000.00	10,000.00	10,000.00
Interest Rates:			
Ag. Ten Year	8.25	8.50	9.00
Ag. One Year	8.10	8.10	8.00
Commercial Loans	8.20	8.85	8.50
Installment Loans	8.30	9.00	10.00
Loans:			
Ag. Ten Year	5,000,000.00	9,999,999.00	250,000.00
Ag. One Year	5,000,000.00	9,999,999.00	1,500,000.00
Commercial	5,000,000.00	9,999,999.00	500,000.00
Installment	5,000,000.00	9,999,999.00	600,000.00
Investments:			
Six Month Security	0.00	0.00	600,000.00
One Year Security	0.00	0.00	0.00
Three Year Security	0.00	0.00	200,000.00
Two Year Municipal	0.00	0.00	150,000.00
Five Year Municipal	2,000,000.00	0.00	150,000.00
Output Items:			
Total Assets	6,139,602.00	6,395,127.00	6,343,822.00
Cash	317,784.60	323,730.10	1,104,363.00
Total Loans:	2,286,818.00	2,241,397.00	2,229,459.00
Ag. Ten Year	209,876.00	205,676.00	197,550.00
Ag. One Year	1,137,705.00	1,137,322.00	1,141,263.00
Commercial	423,433.10	411,843.30	423,058.40
Installment	515,804.20	486,556.60	467,588.90
Total Investments:	3,425,000.00	3,720,000.00	2,900,000.00
Gov't Securities	275,000.00	2,070,000.00	950,000.00
Municipal Bonds	3,150,000.00	1,650,000.00	1,950,000.00
Demand Deposits	2,815,965.00	2,841,043.00	2,874,479.00
Time Deposits	2,539,608.00	2,654,206.00	2,724,831.00
Fed. Funds Borrowed*	7,639.63	105,015.10	0.00
Net Income After Taxes	27,786.31	24,559.19	14,669.31

*Interest Repaid Next Period

not follow suit, and the result was a decrease in time deposits for bank one. A most interesting decision was the advertising and promotion outlay for these banks. Banks two and three reduced their advertising outlay to $10,000, which was the saturation point preselected by the administrator, but not revealed to the players. All advertising outlays in excess of $10,000 do not have any effect on the bank's market share. However, the decision team for bank one did not recognize that advertising expenditures in excess of $10,000 did not increase the bank's market share of loans and deposits, and their decision for advertising was specified at $15,000 for the second straight period. The interest rate decisions were relatively uniform for all the banks, with bank one having the lowest rates on ten year agricultural, commercial and installment loans, and bank three having the lowest rate on the one year agricultural loans. The decisions for loan volumes were relatively unchanged from previous periods. However, the investment decisions were considerably different for this fourth period of play. Bank one invested all available funds in the five year municipal bond item, while bank three spread its funds over several different investments. Bank two did not purchase any new investments because of the large debt that had been incurred from forced borrowing of federal funds in the previous period. This decision enabled bank two to substantially resolve its liquidity problems, and it was forced to purchase only $105,000 of federal funds this period.

Bank size as reflected by total assets was approximately the same for all banks at the end of period four. Each bank had grown by about $1,000,000 over the four periods of play. Bank three had excess

cash of approximately $800,000 this fourth period, which reduced their earnings substantially. Investing this excess cash at the lowest available interest rate on municipal bonds, this $800,000 would have earned an additional tax free income of $16,000 for bank three. The market share of loans and deposits again showed little change from the previous period for all three banks.

For the entire period of play, the accumulated net income after taxes for bank one, bank two, and bank three was $132,703, $147,671, and $101,098 respectively. These figures are consistent with the actual net incomes for banks in five to seven million dollar size category. Bank three's net income would have been very similar to its competitors had team three managed their cash more efficiently in the last two periods of play.

This sample play used as a test suggests that after the first few periods of play, the decision teams seemed to concentrate on maximizing their profit in addition to competing with the other teams for loans and deposits. The market share aspect was apparently less important after the initial thrusts at obtaining the share since all teams seemed to reach the maximum (minimum) values allowable for most decision items very quickly. All of the teams seemed to rather quickly determine the importance of advertising in the market share aspect. They also quickly eliminated any service charge on demand deposits in competing for the deposits. The time deposit rate was pushed to the maximum by competitive forces of the three banks. None of the banks seemed to follow any definite pattern in acquiring investments and in most cases, the investment with the highest rate was the most attractive.

Evaluation and Potential

The evaluation of the model used in the management game context can best be accomplished by comparing the benefits received by the teams that participated in the test as expressed in their informal evaluation to the potential benefits from playing the game. The teams comprised of graduate students unfamiliar with the banking industry, faculty members familiar with teaching concepts, and actual banking officers were preselected with the above evaluation in mind.

Potential Benefits

The game was designed to be used in both university and commercial banking environments. Thus, different benefits would be expected to accrue from using the game with these different groups. Basically, the benefits accrued to both groups should: (1) provide participants a learning experience in making bank policy decisions that affect the acquisition and use of funds in a rural bank situation that operates within an environment of changing economic and market conditions, and competition from other banks; (2) increase the participants' appreciation of the need for financial planning and analytical decision making in bank asset and liability management; and (3) generate discussion during the decision making process among bank management team members concerning why specific decisions are made.

As a teaching tool used in conjunction with other teaching materials in the univeristy classroom, the game would be expected to provide a general introduction to bank money management problems and alternative bank money management strategies as well as to the

competitive relationships in the banking industry. Some specific benefits for students would be to become familiar with the significance and impact of regulations applied to commercial banks by the various government agencies, to recognize the importance of maintaining the minimum required amount of cash in a dynamic competitive environment, to become better acquainted with interest rate structure of both bank loans and national money market investment items, and to recognize the importance of economic variables that influence changes in the volume of rural bank deposits and loans.

Since the commercial bank personnel should be more familiar with general bank operations, slightly different benefits should be accrued through the use of the game in the institutional environment. With respect to potential usefulness for commercial banks, the game could make a significant contribution in training programs for new bank employees and could also be helpful in acquainting departmental bank employees with the overall bank money management issues. A loan officer would be able to learn more about maintaining a balanced portfolio of government securities and municipal bonds and the acquisition of bank deposits by playing the game. The need for long range planning should become evident by making the policy decisions of the game. Bank officers would be expected to specifically recognize the relationships between relevant economic variables and deposit and loan volumes and to anticipate the effects of the relationships. The employees would also be expected to ascertain in detail the effects of their decisions on their bank's market share and recognize some better strategies in this area.

Feedback from Test Teams

Each of the participants were asked to comment on their experience in playing the game with respect to benefits derived from, criticism of, and potential for the bank management game.

The graduate student team specifically mentioned the acquisition of general knowledge of commercial banking as one of the prime benefits they received. One player commented, "The game provides a player with insight into the complex interrelationships of bank operation." Another said that it was beneficial in that he became more familiar with the different options available to banks as well as the decision making process. The competitive aspects of the game were also considered valuable by the graduate student participants. "They (competitive aspects) make the player aware of the dynamic aspects of business competition," stated one participant. Another benefit gained by the participants was the awareness of the need for long range planning in the investment of bank funds. The economic and statistical information contained in the output was recognized by the graduate student players as having a significant effect upon deposits and loans. They learned to analyze this data and make decisions based on the expectations derived from the analysis.

Most of the benefits identified by the graduate student were also noted by the faculty members who participated in the test. A faculty comment of particular interest was that the game approached reality in that competition forced rates, etc. to a high (low) level, and after that point was reached, significant service promotion and highly capable personnel were all that would change a bank's share of the market.

As was expected, the team composed of bank personnel derived somewhat different benefits from the game. Both of the bank officers who participated judged that playing the game was very interesting and could be valuable to any bank officer, including a bank president, but particularly junior bank officers. In particular, the bankers indicated that the game forced them to become more aware of the effect of economic variables on bank operations and management and significantly increased their awareness of the broad policy decisions that must be made and how various economic indicators and actions of competitors influenced these decisions. One banker stated that bankers get so involved with day to day decisions and individual customers that they become isolated from an overall view of the bank and the policy decisions which need to be made on that level, and that playing the game made him aware of some of these policy decisions and issues.

The major criticisms made by the participants concerned the inadequate background provided before play was begun and the advertising relationship built into the model. The students were particularly critical of the lack of adequate background data and the inadequate explanation of the decision making process employed by bankers. They felt that they were "second guessing" on numerous decisions. Also criticized was the lack of goals and objectives for the players. These "administrative" problems were the fault of the administrator and the criticisms should lead to proper adjustments to correct the problems. Some of the players suggested that advertising had too much influence on the market share of loans and deposits, but one player highly praised the advertising relationship as realistic.

Basically, the feedback from the test participants was favorable and the potential usefulness of the game in the classroom or in bank educational programs appears excellent. The students and faculty indicated that the game should be very valuable in reinforcing concepts discussed in the classroom and that in general, more could be learned about banking from the game than from textbooks in the same period of time. Even though the model was structured to be highly oriented toward a rural agricultural bank, the bank officers could perceive benefits to players who had no relation to agriculture whatsoever. The banking personnel indicated that the model would be valuable in banking workshops, seminars, and short courses.

CHAPTER V

SUMMARY AND CONCLUSIONS

Summary

Only limited research has been undertaken concerning the problems confronting the small rural banks that service the majority of the agricultural producers in Oklahoma. Agricultural loan demand has increased rapidly during the past few years while sources of funds in the form of rural deposits have not expanded as rapidly. Thus, new and more dynamic management techniques are necessary for commercial banks in rural areas to adequately service local loan demand and maintain bank profits. However, many small rural banks lack sufficient resources to develop or investigate new management techniques. In addition, rural banks frequently encounter problems in training their new employees as to the broad policy decisions that must be made by bank management personnel. The purpose of this study was to develop a simulation model of a typical rural Oklahoma bank that could be used in a management game context by rural bankers. The specific objectives were: (1) to determine relevant loan and investment portfolio options and cost and return coefficients for Oklahoma rural banks, (2) to develop equations for estimating the county supply of deposits and demand for loans, and to explain changes in market share of commercial bank deposits and loans, (3) to conceptualize the above into a

realistic computer simulation model of a rural bank in a competitive environment, and (4) to test and verify the model and develop the appropriate forms and discussion material to make the model available in game form for instructional and educational use in on-campus classroom discussions and conferences with commercial bankers.

Model Description

The model is designed to be used in a gaming context with three banks competing with each other for the county or community deposits and loans. The primary industry of the community is assumed to be agriculture. Consequently, agricultural loans constitute a significant portion of the loan demand faced by the three banks. Policy decisions are made by the game participants for a six month period of operation. The decision items included are time deposit rate, service charge rate, loan officers' salaries, advertising and promotion outlay, interest rates on loans, and desired volume of loans and investments. The decisions for each bank are used in conjunction with selected exogenous economic variables to determine the volume of loans and investments and the resulting income and net worth statements.

Market equations were estimated to use in determining the community supply of time and demand deposits and the demand for agricultural real estate loans, agricultural production loans, commercial loans, and consumer installment loans. The values from these equations represent the total market volume available to all three of the "game" banks. This market volume of loans and deposits is then allocated to the three individual banks by market share equations. These equations use each of the bank's decisions compared to both the average decisions for all

banks and the previous period's decisions for that bank as a basis for estimating the individual bank's market share of a particular class of loan or deposit. Thus, the banks compete with each other on an interest rate and advertising basis to attract the community loans and deposits. In addition to making loans, each bank can also purchase an unlimited quantity of investments at the stated interest rate. The classes of investments offered to the banks are: six month government securities, one year government securities, three year government securities, two year municipal bonds, and five year municipal bonds. However, if a bank becomes over extended in portfolio items to the extent that cash is not sufficient to meet investment needs plus reserve requirements on deposits, that bank is forced to purchase federal funds in the amount of the cash deficit and interest on these funds is deducted as an expense.

The model is designed with a history file to record loan and investment volumes and their corresponding interest rates for past periods of play. Data from the history file is utilized to determine outstanding loan volumes for comparison with estimates from the market equations to determine the volume of new loans that can be made within the community. The history file data is also used in calculating the income from outstanding loans and investments. Cost and return data used in calculating the income statement were obtained from a previous study in Oklahoma and from publications of the Federal Reserve System. Actual historical data from the Federal Reserve Bulletin is used for the interest rates on investments and federal funds. In addition to the cost and return data, Oklahoma rural county data was

also employed in the estimation of the market volume of loans and deposits.

The computer output generated by the program for each game participant is comprised of four pages containing the balance sheet, income statement, previous period decision input, table of portfolio maturities, and economic and statistical information for the previous as well as the next period. The balance sheets are designed to present the bank's position as of the end of each six month period (June 30 and December 31). The income statement presents a detailed listing of the income and expense items for the six month period corresponding to the date of the balance sheet. The previous period decision input is included in the output so that the players have a record of their past decisions. The table of portfolio maturities is provided as a decision making aid for both short range and long range policy planning. This table shows the amount of cash coming into the bank at the end of each period for the current period and for ten periods into the future. The economic and statistical information is identical for all banks and presents the players with data concerning financial characteristics of the market or community and market share and average rate information for the three banks for the previous period as well as certain economic indicators for the upcoming six month period. The output is designed to be distributed to the players after each period of play so that it can be analyzed before the next set of decisions are made.

Empirical Results

Estimating Equations

The total market loan demand and deposit supply equations used in the model were estimated by multiple regression analysis using county data for 18 Oklahoma counties that exhibited total bank deposits from $12 to $30 million as of June 30, 1972. The market share equations were estimated using primary data obtained from a survey of the banks in the 18 counties.

The equation to estimate total market time deposits has an R^2 of .9895 and most of the coefficients are significant at the 5 percent level or greater. The R^2 for the demand deposits total market equation is .9417 and all coefficients are significant at the 1 percent level. Total market equations for the four classes of loans have R^2's of .8813, .9461, .8824, and .9235 for the agricultural real estate, agricultural production, commercial, and consumer installment loans respectively. With the exception of one parameter in the agricultural real estate loan equation, all parameters for the market loan equations are significant at the 10 percent level or greater. The variables used in the market equations are interest rates, income, retail sales, farm prices, range conditions, lagged dependent time trend, and dummy seasonal. All coefficients except one in each of the time deposits and agricultural real-estate loans equations are significant at the 5 percent level or greater. In the time deposits equation, the coefficient of the time deposit rate of interest indicates that a one unit increase in the interest on time deposits will result in a $184,257 increase in the county supply of time deposits. Similarly, in the agricultural real

estate loans equation, the coefficient of the agricultural real estate loan rate of interest indicates that a one unit increase in the interest rate will result in a $211,186 decrease in the demand for long term agricultural loans. Income is positively correlated with demand deposits but negatively correlated with the agricultural loans equations.

The statistical results for the market share equations are less satisfactory than those for the market equations. The R^2's range from .5562 for the market share of demand deposits equation to .0671 for the agricultural real estate market share equation. Many coefficients in all equations are significant at least at the 20 percent level, but some of the coefficients are highly insignificant.

Some of the more significant variables for the market share equations are the time deposit rate minus the average in explaining the change in time deposit market share, the change in an individual bank's advertising in most equations, the change in an individual bank's service charge in the demand deposit equation, and the interest rate difference from the average for the loan equations. Even though the statistical results of the market share equations are inconclusive in some areas, a test play proved that the equations adequately serve their intended purpose of allocating loans and deposits to the individual banks in a competitive manner.

Model Testing

To insure that the completed computer model would yield reasonable results when applied in a gaming context, three teams were selected to test the game. The teams included university graduate students, faculty,

and banking personnel. All of the participants indicated that they were able to understand the decision making process after the initial explanation, but the graduate students suggested that additional background data would have facilitated the learning process derived from the game.

When the game banks were adequately managed, annual net income before taxes for the banks was approximately $90,000. This figure, of course, varied when a team failed to properly analyze the conditions and made improper decisions. Average annual net income before taxes should be approximately 1.8 percent of available funds according to a survey of banks with up to $50 million deposits conducted by the Federal Reserve Board. Applying this 1.8 percent to the game banks shows that the model depicts the income and expense items for an actual bank of comparable size.

During the first few periods of testing, all teams recognized the importance of advertising and the amount of this expense item increased rapidly until a saturation point was isolated. All teams also increased their time deposit interest rate to the maximum allowable and eliminated their service charge on demand deposits. Once these decisions were made by all teams, the only basis for competition was the interest rates on loans in attempting to gain a larger share of the loan market. The teams were very conscious of the investment portfolio items in attempting to invest all available funds in the most profitable after taxes asset.

Conclusions

This initial attempt to develop a management game for Oklahoma rural banks yielded a satisfactory model not only to be applied in its present form, but also to be used as a reference point for further refinement. The inclusion of total market deposit supply, total loan demand, and market share equations represents an important part of the overall model. The R^2's, F-ratios, and statistical significance of the coefficients for the total market equations indicate that the equations alone should be potentially useful outside the model as a tool for financial management. The interest rate variables' coefficients for time deposits and the two agricultural loans have the expected signs and approximate relative magnitudes. The dummy seasonal variable included in the demand deposits and short-term agricultural loan equations shows that for this data the volume of both demand deposits and short-term agricultural loans should be lower on December 31 than June 30, other factors held constant.

Even though the survey data used in the market share equations estimation was somewhat inadequate, the results obtained indicate that the competition in commercial banking is affected by advertising, service charges, and interest rates of the respective banks. These market share equations substantiate to a degree the idea that customers "shop" for the better interest rates both on loans when they need credit and also on time deposits when they have funds to invest.

The use of the overall model in gaming should be effective as a teaching tool for banking personnel when it is used in a concentrated session of six to ten decision sets in a two day period supplemented

with discussion periods for the participants. Not only does this maintain the players' interest, but also facilitates the intended learning process. When used in a university class, two alternatives exist in applying the game effectively. One alternative is to concentrate on the game to the extent possible over a two week period of classes and ignore other subject matter while the game is being played. This method would be better when most of the students had previously been exposed to sufficient background material concerning finance and banking. The other alternative would be to use the game throughout most of the semester with the instructor gradually introducing different parts of the game for the students' concentration. Used in this way, background theory would be supplemented by the assumed practicality and reality involved in the game to help maintain the students' interest.

In general, playing the game should: (1) provide participants a learning experience in making bank policy decisions that affect the acquisition and use of funds in a rural bank situation that operates within an environment of changing economic and market conditions, and competition from other banks, (2) increase the participants' appreciation of the need for financial planning and analytical decision making in bank asset and liability management, and (3) generate discussion among the bank management team members during the decision making process concerning why specific decisions are made. Students should specifically learn that: (1) there is a maximum allowable interest rate on time deposits, (2) cash reserves must be maintained on time and demand deposits, (3) different loan classes have different interest rate structures as do investments, (4) service charges on demand

deposits affect the volume of this item, (5) municipal bond income is tax exempt, (6) there is uncertainty in banking because of competitors and changing economic conditions, and (7) commercial bankers do much more than accept or reject loan applications.

The three teams participating in the model testing were selected because they represented potential users of the game. The feedback and evaluation from the teams was encouraging. As expected, all players said the game was interesting, but more important, they indicated it was beneficial. While the banking personnel involved could identify with the game's output and thus concentrate on specific areas, the students learned through the output statements some of the options available to a bank and the types of broad policy decisions which bankers make. The bank loan officers were reminded of the importance of the broad policy decisions made by bank management personnel and were able to become more familiar with other bank operations and management functions within the bank. All players seemed to quickly realize the importance of their competitors actions and the effect of those actions. They appeared to recognize the county, state, and national economic factors which affect bank deposit and loan volumes and to utilize these factors in their formation of decisions. Based on the observations of the test teams, the game appears to possess excellent potential for university classroom and banking workshop use.

The current computer cost of using the game is approximately $3.25 per period of play for three teams and this cost can be reduced considerably by having the program mounted on a disk. One person can adequately administer the game with a keypunch operator available to punch the 12 required decision input cards for each play. Playing the

game requires at least three individuals, but no maximum number of participants exists. As presently structured, the model is quite flexible. The exogenous data containing national, state, and county economic and statistical information can be compiled for any past period of time or can be selected by the administrator to illustrate any desired type of economic conditions or geographic region. The size of the "game banks" can be easily altered with minor changes in beginning input cards and subsequent changes in the exogenous variables for each period of play. The total market equations as used in the model should be adequate for use in the situation where county deposit supply and loan demand are significantly higher than those currently being used. Additional flexibility of the model is demonstrated by the fact that the number of banks in the model can be changed and the program is adaptable to other computer systems.

Implications for Further Research

The principal problem encountered in this study was the lack of adequate data for the commercial banking industry particularly on a rural county basis. Because of limited data, the equation used to estimate community demand for installment loans excluded an interest rate variable and the agricultural production loans equation was estimated with a proxy for interest rate. However, within the past few years, a new published series has been initiated to include interest rates charged by banks on installment and agricultural loans. When sufficient data has been published for these variables, the two equations mentioned above should be reestimated including these interest rate variables.

The reestimation of the equations for market share of loans and deposits is also required. The data used to estimate these equations presented the major obstacle to better results. A personal interview survey should be undertaken making certain that all banks within selected counties are surveyed. Having data for all banks in several counties over at least a five year period should provide more satisfactory results than those presented here. In addition to the items of data gathered for this study, an attempt should be made to establish a relationship between the market share of loans and deposits and the salaries paid by the bank. Also, the relationship between advertising outlay and market share was estimated as a linear relationship in this study and an attempt should be made to obtain a non-linear relationship to reflect the diminishing returns from increased advertising expenditures.

Only limited testing of the model has occurred and further use should be predicated upon greater testing of the model in game form with both students and banking personnel to insure its adequacy under varying economic conditions depicted by the exogenous variables. The additional testing would also allow expanded evaluation of the learning experience intended.

The model developed in this study could be used in simulation to evaluate the consequences of alternative bank management strategies in terms of market share, bank profitability, and the satisfaction of community loan demand. The results obtained through simulation could be valuable to rural bankers in assessing their competitive situation and evaluating potential changes in their management policies.

A trade-off naturally exists between complexity of the model and the reality involved. The assumptions and limitations used in the model at present represent an acceptable balance between complexity and reality. However, several portfolio items such as long term bonds could be added as options to the bank to accomodate a more realistic approach. In addition, the participants could be given the opportunity to make more decisions in applicable areas such as profit distribution in the form of dividends, maximum purchase and/or sale of federal funds, compensating balances for commercial loans, and the allocation of advertising and promotion to different bank departments. Further work should also be done to accomodate storage of various input items to make the application of the game more efficient in the use of the administrator's time.

A SELECTED BIBLIOGRAPHY

American Bankers Association, Report of the Agricultural Task Force, (June, 1973).

Banking, "Your Wits vs. the Computer's," Vol. 53, No. 2 (August, 1960), p. 55.

Benjamin, Gary L., "Rural Bank Needs for External Funds," Business Conditions, Federal Reserve Bank of Chicago (May, 1972).

Bureau for Business and Economic Research, Statistical Abstract of Oklahoma, University of Oklahoma (1960-1972).

Cohen, Kalman J. and Frederick S. Hammer, Analytical Methods in Banking. Homewood: Richard D. Irwin, Inc., May, 1966.

Dennick, William H. and Frances X. Olanie, Jr., "The Bank Management Game," Bankers Monthly, Vol. 77, No. 9 (Sept. 15, 1960), pp. 56-60.

FDIC, FDIC Operating Statistics. Washington, D. C., 1950-1970.

Federal Reserve Bank, Form for Analyzing Bank Capital. Kansas City, March, 1972.

Federal Reserve Board, Federal Reserve Bulletin. Washington, D. C., July, 1973.

Federal Reserve Board, Functional Cost Analysis 1971 Average Banks. Washington, D. C., 1971.

Frey, Thomas L., "Optimal Asset Liability Decisions for a Rural Bank: An Application of Multiperiod Linear Programming" (Unpublished Ph.D. Thesis, University of Illinois, May, 1970).

Goldfeld, Stephen M., Commercial Bank Behavior and Economic Activity, A Structural Study of Monetary Policy in the Postwar United States. Amsterdam: North-Holland Publishing Co., 1966.

Graham, Robert G. and Clifford E. Gray, Business Games Handbook. New York: American Management Association, Inc., 1969.

Green, J. R. and R. L. Sission, Dynamic Management Decision Games. New York: John Wiley and Sons, 1959.

Hesser, Leon F. and G. Edward Schuh, "The Demand for Agricultural Mortgage Credit," Journal of Farm Economics, Vol. 54, No. 5 (December, 1962), pp. 1583-1588.

Horvitz, Paul M., "Economics of Scale in Banking" (Research Study One, Boston University [Boston, 1961]).

Hutson, Arthur L., "Economic Analysis of Commercial Bank--Farm Credit System Coordination" (Unpublished Masters Thesis, Oklahoma State University, May, 1973).

International Business Machines Corporation, "General Information Manual--Bank Management Simulation Player's Instructions" (New York, 1963).

Karbouche, George K., The Competition for Savings; Determinants of Deposits at Commercial Banks, Mutual Savings Banks, and Savings and Loan Associations, SBE 107. New York: National Industrial Conference Board Inc., 1969.

Leftwich, Richard H., The Price System and Resource Allocation, 4th Ed. Hinsdale, Ill.: Dryden Press, Inc., 1970.

Lins, David A., "Determinants of Net Changes in Farm Real Estate Debt," Agricultural Economics Research, Vol. 24, No. 1 (January, 1972), pp. 1-8.

Penson, John B., Jr., "Demand for Financial Assets in the Farm Section: A Portfolio Balance Approach," American Journal of Agricultural Economics, Vol. 54, No. 2 (May, 1972), pp. 163-174.

Oklahoma Crop and Livestock Reporting Service, Range and Pasture. Oklahoma City, 1961-1972.

Oklahoma State University, Oklahoma Current Farm Economics. Agricultural Experiment Station Bulletin, 1961-1972.

Rausch, Erwin, "Banking," New York: Science Research Associates, Inc., 1968.

Robichek, Alexander, Charles Haley, and David Niebuhr, "Stanford Bank Management Simulator," Graduate School of Business, Stanford University (1972).

Robinson, Roland I., The Management of Bank Funds, 2nd Ed. New York: McGraw-Hill Co., Inc., 1962.

Schneeberger, Kenneth C., "Gaming as an Instrument of Farm Management Education--A Development and Evaluation" (Unpublished Ph.D. Thesis, Oklahoma State University, July, 1968).

Teigen, Ronald L., "An Aggregated Quarterly Model of the U. S. Monetary Sector, 1953-64," Targets and Indicators for Monetary Policy. San Francisco: Chandler Publishing Co., 1969.

United States Department of Commerce, Survey of Business Conditions. Washington, D. C.: Bureau of Economic Analysis, January, 1973.

United States Department of Agriculture, Agricultural Finance Review. Washington, D. C.: Economic Research Service, Vol. 32, Supplement, January, 1972.

United States Department of Agriculture, Agricultural Statistics, 1972. Washington, D. C.: U. S. Government Printing Office, 1972.

Weiss, Doyle L., "An Analysis of Market Share Behavior for a Branded Consumer Market" (Unpublished Ph.D. Thesis, Carnegie Institute of Technology, Graduate School of Industrial Administration, March, 1968).

Zuckerman, David W. and Robert F. Horn, The Guide to Simulation Games for Education and Training. Cambridge, Mass.: Paul E. Twelker, 1970.

APPENDIX A

SUMMARIZED QUESTIONNAIRE DATA

QUESTIONNAIRE DATA, 1970

ITEMS	COUNTY				
	1	2	3	4	5
Average-Demand Deposits ($)	1,490,905	2,200,562	1,776,188	974,694	1,768,351
Range-Demand Deposits ($)	1,099,560-1,882,251	1,445,605-3,650,000	932,135-2,661,000	1,128,000-2,100,000	918,245-3,180,000
Average-Service Charge-Income ($)	6,101	14,580	5,110	5,960	5,229
Range-Service Charge-Income ($)	5,203-7,000	7,641-23,000	3,165-6,831	5,000-6,846	1,068-11,272
Average-Time Deposits ($)	1,179,155	1,696,700	1,870,129	1,354,164	993,066
Range-Time Deposits ($)	1,014,020-1,344,291	1,365,443-2,250,000	663,952-4,093,000	1,315,994-2,745,000	1,143-2,470,000
Average-Interest Expense ($)	46,670	87,583	89,118	89,570	53,721
Range-Interest Expense ($)	46,000-47,340	77,253-97,998	26,585-206,000	42,736-150,975	20,508-92,051
Average-Real Estate Loans ($)	102,807	342,740	2,222,505	118,223	205,945
Range-Real Estate Loans ($)	53,615-152,000	253,545-500,000	24,079-493,377	80,250-274,320	34,000-377,890
Average-Agriculture Loans ($)	1,161,072	1,004,038	560,762	948,831	411,883
Range-Agriculture Loans ($)	1,011,144-1,311,000	446,754-1,500,000	289,584-877,000	788,273-2,057,400	282,676-502,775
Average-Commerical Loans ($)	140,513	216,625	162,789	313,527	115,398
Range-Commerical Loans ($)	71,000-210,026	81,897-300,000	56,000-305,267	186,002-754,380	9.721-286,474
Average-Installment Loans ($)	48,071	378,316	1,772,217	289,410	165,541
Range-Installment Loans ($)	15,143-81,000	309,868-500,000	83,000-280,620	235,920-342,900	14,826-265,000
Average-Real Estate Rates (%)	7.25	8.33	7.33	7.75	7.66
Range-Real Estate Rates (%)	7.00-7.50	8.00-9.00	6.5-8.00	7.5-8.00	7.00-8.00
Average-Agriculture Rates (%)	7.25	8.66	7.66	7.50	8.00
Range-Agriculture Rates (%)	7.00-7.50	8.00-10.00	7.5-8.00	7.5-7.5	7.50-8.50
Average-Commerical Rates (%)	7.50	8.66	7.66	7.75	8.00
Range-Commercial Rates (%)	7.00-8.00	8.00-9.00	7.5-8.00	7.5-8.00	8.00-8.00
Average-Installment Rates (%)	10.57	13.88	11.73	9.66	11.00
Range-Installment Rates (%)	10.00-11.13	14.00-14.75	9.31-14.75	9.31-10.00	10.00-12.00
Average-Advertising Expense ($)	2,230	5,393	2,534	1,693	1.703
Range-Advertising Expense ($)	2,000-2,461	3,483-6,696	2,200-4,773	1,481-2,100	241-3,165

QUESTIONNAIRE DATA, 1970

ITEMS	COUNTY				
	6	7	8	9	10
Average-Demand Deposits ($)	2,113,768	1,466,936	2,268,601	2,929,867	3,377,007
Range-Demand Deposits ($)	1,879,536-2,415,168	789,593-2,517,325	1,358,907-2,732,999	1,441,848-5,214,219	2,863,015-3,891,000
Average-Service Charge-Income ($)	3,140	3,229	9,964	4,683	14,078
Range-Service Charge-Income ($)	2,281-4,000	291-4,167	3,977-17,398	3,068-6,298	12,160-15,997
Average-Time Deposits ($)	4,127,939	752,156	2,413,031	2,012,381	2,898,838
Range-Time Deposits ($)	0-4,127,939	60,456-2,093,616	600,256-3,358,068	1,387,233-2,682,959	2,398,000-3,399,674
Average-Interest Expense ($)	187,495	32,300	102,855	77,057	120,478
Range-Interest Expense ($)	0-187,495	889-95,608	20,915-154,191	60,110-106,179	93,456-147,500
Average-Real Estate Loans ($)	199,395	188,820	204,803	261,240	383,595
Range-Real Estate Loans ($)	88,000-310,791	18,513-486,106	126,637-286,774	162,418-456,304	370,190-397,000
Average-Agriculture Loans ($)	778,447	583,154	1,762,340	617,935	1,363,184
Range-Agriculture Loans ($)	555,000-1,001,895	75,659-1,356,494	758,614-2,663,000	476,276-740,000	1,207,368-1,519,000
Average-Commercial Loans ($)	533,192	338,166	319,828	530,614	357,208
Range-Commercial Loans ($)	204,000-862,385	149,185-549,041	120,752-838,734	168,791-1,088,053	308,000-406,416
Average-Installment Loans ($)	338,049	263,610	228,254	435,156	880,274
Range-Installment Loans ($)	173,000-503,098	49,897-645,414	87,071-365,693	207,098-591,000	567,000-1,193,549
Average-Real Estate Rates (%)	8.00	7.87	7.66	8.50	8.00
Range-Real Estate Rates (%)	8.00-8.00	7.50-8.00	7.5-8.00	8.00-9.00	7.5-8.5
Average-Agriculture Rates (%)		8.00	7.91	8.00	7.50
Range-Agriculture Rates (%)	8.00-8.00	8.00-8.00	7.75-8.50	8.00-8.00	6.5-8.00
Average-Commercial Rates (%)	8.00	8.12	8.16	8.00	8.25
Range-Commercial Rates (%)	8.00-8.00	8.00-8.50	7.75-8.50	0-8.00	8.00-8.50
Average-Installment Rates (%)	14.75	14.65	11.11	10.50	13.10
Range-Installment Rates (%)	14.75-14.75	10.08-18.00	10.00-11.50	9.00-12.00	11.20-15.00
Average-Advertising Expense ($)	9,387	1,537	5,462	5,976	5,918
Range-Advertising Expense ($)	7.000-11,775	230-3,735	828-8,686	3,980-8,227	4,237-7,599

QUESTIONNAIRE DATA, 1971

ITEMS	COUNTY				
	1	2	3	4	5
Average-Demand Deposits ($)	1,645,626	2,470,127	1,877,531	1,024,516	1,604,654
Range-Demand Deposits	1,265,253-2,026,000	1,637,964-4,000,000	1,074,522-2,916,000	1,078,350-2,200,000	741,783-2,900,000
Average-Service Charge-Income ($)	6,961	14,655	6,259	6,105	5,000
Range-Service Charge-Income ($)	6,922-7,000	7,195-23,000	4,370-9,113	5,400-6,917	766-10,704
Average-Time Deposits ($)	1,332,938	2,110,980	2,196,873	1,631,908	1,152,558
Range-Time Deposits ($)	1,304,877-1,361,000	1,605,900-3,100,000	777,225-4,651,000	1,687,925-3,206,000	636,398-2,820,000
Average-Interest Expense ($)	53,419	90,074	91,847	112,476	78,376
Range-Interest Expense	49,838-57,000	78,488-110,000	32,888-191,000	71,100-176,240	31,077-146,534
Average-Real Estate Loans ($)	99,503	347,110	164,995	131,485	168,601
Range-Real Estate Loans ($)	42,006-157,000	245,640-520,000	32,610-386,303	78,115-316,240	16,500-320,703
Average-Agriculture Loans ($)	1,543,139	1,141,168	576,000	1,148,683	519,033
Range-Agriculture Loans ($)	1,429,279-1,657,000	439,866-1,765,000	354,540-728,000	900,000-2,371,800	331,137-765,164
Average-Commercial Loans ($)	148,425	237,700	122,372	335,787	122,806
Range-Commercial Loans	125,000-171,850	101,767-350,000	31,000-291,721	137,453-869,660	12,612-293,806
Average-Installment Loans ($)	65,160	484,087	191,656	324,295	198,153
Range-Installment Loans	34,320-96,000	324,352-750,000	93,000-296,191	253,291-395,300	15,612-332,000
Average-Real Estate Rates (%)	7.5	8.16	7.66	7.75	7.83
Range-Real Estate Rates (%)	7.5-7.5	8-8.5	7-8	7.5-8	7.5-8
Average-Agriculture Rates (%)	7.5	8.33	7.83	7.5	8
Range-Agriculture Rates (%)	7.5-8	8-9	7.5-8	7.5-7.5	7.5-8.5
Average-Commercial Rates (%)	7.75	8.33	7.83	7.75	8
Range-Commercial Rates (%)	7.5-8	8-8.5	7.5-8	7.5-8	7.5-8.5
Average-Installment Rates (%)	11	13.40	12.35	9.66	10
Range-Installment Rates (%)	10-12	12.45-14.75	9.31-14.75	9.31-10.00	10-10
Average-Advertising Expense ($)	2,343	4,767	2,951	2,374	1.236
Range-Advertising Expense ($)	2,000-2,687	4,236-5,065	989-4,702	1,500-2,918	264-2,208

QUESTIONNAIRE DATA, 1971

ITEMS	COUNTY				
	6	7	8	9	10
Average-Demand Deposits ($)	2,417,745	4,074,016	2,363,127	2,931,421	3,316,920
Range-Demand Deposits ($)	2,154,490-2,681,000	617,764-2,531,127	617,764-2,531,127	1,487,599-5,332,323	2,688,840-3,945,000
Average-Service Charge-Income ($)	3,335	3,902	10,265	6,060	16,464
Range-Service Charge-Income ($)	2,670-4,000	1,962-5,842	4,093-18,185	5,570-6,550	12,150-20,779
Average-Time Deposits ($)	3,277,821	986,632	2,848,085	2,396,617	3,383,317
Range-Time Deposits ($)	0-3,277,821	166,313-2,650,517	812,042-3,915,472	1,624,920-3,122,763	2,922,000-3,844,635
Average-Interest Expense ($)	145,320	47,258	129,338	96,656	139,878
Range-Interest Expense ($)	0-145,320	3,042-141,342	28,501-181,314	65,348-125,438	113,988-165,150
Average-Real Estate Loans ($)	239,399	319,767	175,230	347,882	267,265
Range-Real Estate Loans ($)	80,000-398,798	37,944-934,794	84,904-224,786	165,000-125,438	107,000-427,531
Average-Agriculture Loans ($)	914,378	601,054	3,219,000	770,908	1,395,092
Range-Agriculture Loans ($)	618,000-1,210,756	60,208-1,406,478	943,478-3,341,000	531,241-975,000	1,298,185-1,492,000
Average-Commercial Loans ($)	557,738	175,812	471,681	735,112	352,421
Range-Commercial Loans ($)	184,000-931,476	53,160-254,732	137,850-956,193	190,000-1,527,415	248,000-456,842
Average-Installment Loans ($)	363,252	271,103	272,578	426,735	986,556
Range-Installment Loans ($)	155,000-571,505	58,956-618,697	102,233-450,502	111,068-672,000	627,000-1,346,112
Average-Real Estate Rates (%)	8	8	7.75	8.5	8.25
Range-Real Estate Rates (%)	8-8	8-8	7.5-8	8-9	8-8.5
Average-Agriculture Rates (%)	8	8	8.11	8.25	7.75
Range-Agriculture Rates (%)	8-8	8-8	8-8.5	8-8.5	7.5-8
Average-Commercial Rates (%)	8	8.25	8.11	8	8.25
Range-Commercial Rates (%)	8-8	8-8.5	8-8.5	0-8	8-8.5
Average-Installment Rates (%)	14.75	14.65	11.44	10.98	13.10
Range-Installment Rates (%)	14.75-14.75	11.08-18	10-12.82	10-11.95	11.20-15
Average-Advertising Expense ($)	9,774	3,015	5,828	5,205	6,185
Range-Advertising Expense ($)	7,000-12,457	1,306-7,504	2,035-5,409	3,606-7,667	4,604-7.765

QUESTIONNAIRE DATA, 1972

ITEMS	COUNTY				
	1	2	3	4	5
Average-Demand Deposits ($)	1,877,736	2,881,532	2,270,295	1,863,546	1,747,205
Range-Demand Deposits ($)	1,478,473-2,277,000	1,877,574-4,800,000	1,179,012-3,793,000	1,141,638-2,337,000	1,260,000-3,751,000
Average-Service Charge-Income ($)	7,458	16,027	6,560	6,339	3,208
Range-Service Charge-Income ($)	5,917-9,000	8,236-25,500	3,675-8,806	4,850-7,200	273-8,847
Average-Time Deposits ($)	1,747,856	2,462,784	2,590,020	2,503,807	1,307,520
Range-Time Deposits ($)	1,507,712-1,988,000	1,721,654-3,900,000	1,028,657-5,145,000	1,750,423-3,761,000	1,504-3,000,000
Average-Interest Deposits ($)	68,125	127,237	124,688	131,689	89,764
Range-Interest Deposits ($)	62,250-74,000	104,757-166,000	42,976-269,000	88,212-206,855	42,226-159,933
Average-Real Estate Loans ($)	126,120	447,778	195,743	187,694	126,799
Range-Real Estate Loans ($)	81,240-171,000	252,158-750,000	61,886-331,230	92,123-370,960	18,410-324,189
Average-Agriculture Loans ($)	1,476,498	1,563,703	839,461	1,657,939	696,109
Range-Agriculture Loans ($)	1,210,996-1,742,000	614,752-2,700,000	476,653-1,154,231	1,000,000-2,782,200	406,083-864,251
Average-Commerical Loans ($)	250,912	315,969	160,429	497,714	141,354
Range-Commercial Loans ($)	217,000-284,825	126,474-450,000	38,000-439,650	173,004-1,020,140	26,628-317,831
Average-Installment Loans ($)	124,477	605,217	217,741	374,133	165,202
Range-Installment Loans ($)	106,955-142,000	432,129-950,000	97,000-334,281	284,567-463,700	52,941-137,665
Average-Real Estate Rates (%)	7.75	8.16	7.75	7.75	7.83
Range-Real Estate Rates (%)	7.50-8.00	8.00-8.50	7.00-8.50	7.50-8.00	7.50-8.00
Average-Agriculture Rates (%)	7.75	8.33	7.87	7.75	7.83
Range-Agriculture Rates (%)	7.50-8.00	8.00-9.00	7.50-8.50	7.50-8.00	7.50-8.00
Average-Commercial Rates (%)	7.75	8.33	8.00	7.75	8.00
Range-Commercial Rates (%)	7.50-8.00	8.00-8.50	7.50-8.50	7.50-8.00	8.00-8.00
Average-Installment Rates (%)	11.5	13.35	12.94	9.66	11.00
Range-Installment Rates (%)	10.00-13.00	11.30-14.75	9.31-14.75	9.31-10.00	10.00-12.00
Average-Advertising Expense ($)	4,448	4,406	2,952	2,551	1,520
Range-Advertising Expense ($)	2,896-6,000	3,556-5,000	1,741-4,069	1,500-3,127	894-2,145

QUESTIONNAIRE DATA, 1972

ITEMS	COUNTY				
	6	7	8	9	10
Average-Demand Deposits ($)	2,804,584	1,671,139	2,764,261	352,774	4,043,139
Range-Demand Deposits ($)	2,315,168-3,194,000	769,745-3,232,848	1,480,754-3,465,536	1,612,262-6,413,778	3,223,278-4,863,000
Average-Service Charge-Income ($)	3,360	4,246	11,058	6,680	17,471
Range-Service Charge-Income ($)	2,720-4,000	2,307-6,185	4,586-19,513	-6,821	12,161-22,781
Average-Time Deposits ($)	4,127,939	1,193,700	3,311,360	2,775,869	3,718,837
Range-Time Deposits ($)	0-4,127,939	170,900-3,077,820	917,627-4,532,499	1,919,892-3,569,966	3,129,000-4,308,674
Average-Interest Deposits ($)	187,495	57,964	153,398	117,172	164,916
Range-Interest Deposits ($)	0-187,495	9,450-152,280	43,545-208,813	80,114-144,740	142,668-187,164
Average-Real Estate Loans ($)	240,041	337,390	219,535	424,777	281,558
Range-Real Estate Loans ($)	89,000-391,083	44,595-987,981	171,403-228,000	344,670-584,661	97,000-466,116
Average-Agriculture Loans ($)	1,100,781	707,779	2,802,185	860,534	1,585,684
Range-Agriculture Loans ($)	561,000-1,640,563	80,168-1,870,720	1,263,576-4,247,000	586,921-1,090,000	1,543,000-1,628,368
Average-Commercial Loans ($)	629,238	231,725	463,578	833,821	366,606
Range-Commercial Loans ($)	203,000-1,055,477	53,289-419,810	99,553-971,182	192,000-1,788,164	302,000-431,213
Average-Installment Loans ($)	585,737	160,900	307,969	615,602	1,008,020
Range-Installment Loans ($)	174,000-997,474	44,695-248,659	99,177-490,732	122,658-1,114,149	587,000-1,429,041
Average-Real Estate Rates (%)	8.00	8.25	8.00	8.75	8.50
Range-Real Estate Rates (%)	8.00-8.00	8.00-8.50	8.00-8.00	8,50-9.00	8.50-8.50
Average-Agriculture Rates (%)	8.00	8.18	8.11	8.25	8.00
Range-Agriculture Rates (%)	8.-0-8.00	8.00-8.50	8.00-8.10	8.00-8.50	8.00-8.00
Average-Commercial Rates (%)	8.00	8.37	8.16	8.00	8.75
Range-Commercial Rates (%)	8.00-8.00	8.00-9.00	8.00-8.25	8.00-8.00	8.50-9.00
Average-Installment Rates (%)	14.75	14.88	11.44	10.76	14.6
Range-Installment Rates (%)	14,75-14,75	12.00-18.00	10.00-12,82	10.00-11.52	11.20-18.00
Average-Advertising Expense ($)	10,203	2,832	5,909	5,701	6,276
Range-Advertising Expense ($)	7,000-13,406	316-7,662	1,876-8,746	2,467-10,303	4,539-8.012

APPENDIX B

BANK MANAGEMENT PLAYERS' INSTRUCTIONS

BANK MANAGEMENT PLAYERS' INSTRUCTIONS

The Bank Situation

As of January 1, you will take over the presidency of a National bank in a rural Oklahoma county where the principal industry is agriculture. Cow-calf, stocker grazing, and wheat production are the major agricultural enterprises in the county. The bank is a member of the Federal Reserve. There are three banks (initially identical) in the county, and you will compete with the other two for deposits and loans. The county is assumed as the total market for the three banks. The primary objective for your bank is to obtain the highest possible level of net income after taxes.

Financial Statements and Other Information

The statement of conditions (Balance Sheet) for your bank, as of December 31, is shown on the first page of the computer output. Most of the items are self explanatory. "Government Securities - to one year" includes six months and one-year securities. On the "Liabilities" side of the balance sheet, the "Federal Funds Purchased" account will show the amount of federal funds borrowed when your bank does not have enough cash to meet the Federal Reserve requirements on deposits. The "Capital Stock" and "Surplus" accounts do not change and each period's net income after taxes is accumulated in the "Undivided Profits" account.

The income statement for the second period of the previous year (six months from July 1 to December 31) is shown on the second page of the computer output.

The third page of computer output shows the decisions that were made by the bank management for the previous six month period. The decisions will be discussed in the Decision section of these instructions.

Also on the third page is "The Table of Portfolio Maturities". Each row shows the amount of cash in the form of principal payments or maturing investments that will come due to the bank at the end of the period designated in the column heading. For example, of the $550,000 of one year government securities that the bank owns, $300,000 are due now and $250,000 will come due at the end of period one. The total for the "0" column indicates the amount of cash from loan principal payments and maturing investments that will be available for re-investment in loans, bonds, or securities at the start of the next period. For example, the total for the "0" column indicates that $1,339,172 will be available for you to invest in the next period.*

The final page of the output shows economic and statistical information to help you make decisions. The top part of the page shows county economic and market data for the previous period. The bottom part of the page shows actual and expected data for the next period. The market data includes averages of a number of decisions made by the three banks and market share information on loans and deposits. The

---

*Total investable funds for each period would also include "cash" (from the Balance Sheet) less reserve requirements on deposits plus any anticipated increase (decrease) in deposits.

actual county personal income, county retail sales, index of farm prices and prime interest rate are expected to fall in the ranges given.

Decision Alternatives

Each bank will fill out a decision form for each six month period. The first set of decisons are made for period one, year one. After your decisions are made, you will receive a copy of new output statements. The decisions are described below.

1. The time deposit rate represents an average annual percentage rate for all classes of time and savings deposits. The maximum time deposit rate you can pay is 6.5 percent.

2. Loan Officers' Salaries includes the President's salary and must be at least $20,000 for each six month period.

3. The service charge is expressed as a percent of demand deposits and there is no restriction on the rate. A typical range is from 0.0 percent to 1.00 percent.

4. Advertising and promotion on loans and deposits for each six months can be set at any desired level.

5. Interest rates charged on new loans, expressed as the annual percentage rate, cannot exceed 18 percent.

--The agricultural ten year loan is a ten year agricultural real estate loan with ten equal principal payments.

--The agricultural one year loan is a one year agricultural production loan with one lump sum principal payment.

--The commercial loan is a two year loan with one-half of the principal paid at the end of each year.

--The consumer installment loan is made for a two year maturity with one-fourth of the principal paid in each six month period.

6. The loan volume decision represents the maximum desired outstanding balance of each class of loans for the next six months.

Your outstanding balance for each class of loans as of January 1 will be the total for the loan class minus the amount maturing at the end of the 0 period (see table of portfolio maturities). For example, the January 1 outstanding balance for the one year agricultural loan is $704,611 ($934,611 minus $230,000).

If you do not want to make any new loans for the loan class, your decision should equal the current outstanding balance as calculated above.

If you want to decrease your outstanding balance, your decision should be less than the current outstanding balance. Loans will be sold at a 2 percent discount, selling the oldest loans first.

If you want to make additional loans and increase your outstanding balance, your decision should be greater than your current outstanding balance. The desired maximum outstanding balance may not be met if it is greater than your market share which is affected by your interest rate and advertising decisions compared with your competitors.

7. Investments are the actual dollar amount purchased or sold for each class of investments. A positive decision is the addition to your outstanding balance of investments. A negative decision indicates that you wish to sell the oldest of your existing investments before they mature. A 2 percent discount will be applied if investments are sold before maturity. Investments are automatically sold at maturity.

Interest earned on investments is paid during each six month period. The interest on municipal bonds is tax exempt.

Regulations

1. Income taxes - The bank is taxed as a corporation with the rate of 22 percent for the first $25,000 of net income per year and 48 percent for all net income above $25,000 per year.* Income from municipal bonds is exempt from taxation.

2. Federal Reserve Requirements - Federal Reserve requirements on demand deposits are 8 percent on the first $2,000,000, 10 percent on the next $8,000,000, and 12 percent on the next $90,000,000. Reserve requirements on time deposits are 3 percent. If the bank does not have sufficient cash on hand to meet the Reserve requirements, forced borrowing of federal funds occurs. The amount of federal funds borrowed in any period is indicated on the balance sheet. The amount of the forced borrowing of federal funds plus the interest will be repaid automatically at the beginning of the next six month period.

3. Capital and Liquidity Requirement - The bank's capital structure (capital stock and surplus and undivided profits) must be at least 80 percent of the calculated capital requirements. If this requirement is not met, a warning is printed on the bank's balance sheet. On the second warning, the appropriate volume of the bank's loans will automatically be sold to reduce the capital requirement.

---

*Since the results are computed for six month periods, the 22 percent rate is applied on the first $12,500 of income for each six month period. The 48 percent rate is applied on all net income in each period above $12,500.

4. Long-Term loan to time deposit ratio - Long-term loans (ten year agricultural loans) cannot exceed 70 percent of the bank's time deposits. If the requirement is not met, a warning is printed. On the second warning, there is a forced sale of long-term loans.

VITA

Glen Davis Fisher

Candidate for Degree of

Master of Science

Thesis: THE DEVELOPMENT OF A MANAGEMENT GAME FOR OKLAHOMA RURAL BANKS

Major Field: Agricultural Economics

Biographical:

Personal Data: Born in Childress, Texas, February 5, 1947, the son of L. F. and Pauline Fisher.

Education: Graduated from Lorenzo High School, Lorenzo, Texas in May, 1965; received Bachelor of Science degree from Texas Tech University in December, 1971, with a major in Agricultural Economics; completed the requirements for the Master of Science degree from Oklahoma State University in December, 1973, with a major in Agricultural Economics.

Professional Experience: Served as a Research Assistant at Oklahoma State University from June, 1972, to present date.

Professional Organizations: Member of the American Agricultural Economics Association and Southern Agricultural Economics Association.