PROJECTING NEW MONEY REQUESTS FOR THE BALTIMORE FEDERAL INTERMEDIATE CREDIT BANK

by

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CHAPTER I

INTRODUCTION

A discussion of the perceived problem is included in the first section of this chapter. Once the problem is identified, the general framework for the study is presented and specific research objectives are outlined. Results of related work done by other researchers follows. The final section contains a discussion of the organization of this thesis.

Problem Statement

Since 1910, the use of both long and short term agricultural debt has grown rapidly (Table I.1). From January 1, 1970 to January 1, 1975, total farm debt grew at a compounded annual rate of 10.11%. This was well above the 1955-60 rate of 8.6%, the largest growth rate experienced from 1920 until the 1970-75 period. During the ten-year period 1910-20, farm debt grew at a 10.07% compounded annual rate, slightly less than the 1970-75 period mentioned above.

The three largest institutional lenders of agricultural funds are commercial banks, the Farm Credit System (FCS), and life insurance companies. The Farm Credit System has managed to increase its share of the agricultural loan market during recent years. Much of this growth can be attributed to the broader view of agricultural lending taken by the 1971 Farm Credit Act. Thus, commercial banks, once the

Table I.1. Growth in Agricultural Debt, 1910-75

Year (Jan. 1)	Total Farm Debt	Compounded Annual Rate of Change	Real Estate Farm Debt	Compounded Annual Rate of Change	Non-Real Estate Farm Debt	Compounded Annual Rate of Change
	$ million	percent	$ million	percent	$ million	percent
1910	4,558		3,208		1,350	
		10.07		10.17		9.85
1920	11,903		8,449		3,454	
		.23		1.32		-3.00
1930	12,177		9,631		2,546	
		-6.87		-4.67		-17.95
1935	8,531		7,584		947	
		2.37		-2.78		25.96
1940	9,589		6,586		3,003	
		-4.39		-5.59		-1.96
1945	7,661		4,941		2,720	
		6.98		2.46		13.64
1950	10,733		5,579		5,154	
		7.55		8.13		6.90
1955	15,441		8,245		7,196	
		8.86		7.94		9.88
1960	23,610		12,082		11,528	
		8.35		9.35		7.26
1965	35,260		18,894		16,366	
		7.39		9.08		5.28
1970	50,351		29,183		21,168	
		10.11		9.66		10.72
1975	81,514		46,288		35,226	

Source: Agricultural Finance Statistics, Economic Research Service, United States Department of Agriculture, AFS-3, July 1976, pp. 2-3, 21.

largest institutional lender of agricultural funds, have not increased their agricultural loan volume in proportion to agriculture's outstanding debt. At the same time, life insurance companies' growth in real estate debt has been far below the growth of total farm debt. This has been at least partially due to the impact of the Farm Credit System's accelerated lending activity. These effects have served to make the Farm Credit System the largest lender of funds for agriculture in the U.S.

Some economists have speculated that farm real estate debt will soon start leveling and will be surpassed by non-real estate farm debt. In absolute terms, however, during the year that ended January 1, 1975, real estate debt exceeded non-real estate debt by a greater amount than ever before (Table I.1). Nonetheless, non-real estate loans are an extremely important aspect of agricultural loans. During the most recent five-year period, as shown in Table I.1, farm real estate debt increased at a compounded annual rate of 9.7%. Over the same time period, non-real estate farm debt grew at a rate of 10.7%.

The Production Credit Associations (PCAs), short and intermediate term lenders in the Farm Credit System, are the second largest institutional lender of non-real estate debt. Commercial banks continue to be first, but their share has been decreasing since 1973. If the present trends continued, the Production Credit Associations will soon be the largest institutional lender in this category as well.

The Farm Credit System acquires its funds in the financial markets by selling credit instruments. Most of these bonds carry nine-month maturities, but some are term issues with maturities of ten years. During 1975, the System started issuing discount notes which carry maturities of five to 365 days. Since the largest proportion of the bonds are for nine months, the System's funds are constantly being refinanced.

The PCA's volume of both loans made and outstanding loans tends to be highly seasonal. The present system of FICB's estimating monthly bond participations has produced large variances between actual new money loaned and the *a priori* estimates. The net amount of funds obtained in any month from bond sales might be considered the FICB's best estimate of their new money requests. For the purpose of the study, the FICB's prediction error is defined as the difference between actual new money requests during a particular month and the net amount of money obtained from bond sales (the FICB's estimate). Summing the absolute value of this prediction error for July 1976 through June 1977 results in a total absolute error of $75,097,000. Currently the FICB's estimates are based on:

a) loan requests during the same month one year earlier,

b) large volume borrowers' intended loan activity during the month in question, and

c) expected loan requests of some of the larger Production Credit Associations in the district.

Accurate estimation of the FICB's new money requests has been hindered by uncertainty associated with "paydown," the amount of money which an FICB receives from the individual associations. When an association cannot generate enough funds from loan repayments to meet new money requests, the FICB sends a draft supplying additional funds to the PCA. Conversely, if loan repayments are greater than the loanable funds requested by an association, they transfer money back to the FICB (i.e., paydown).

The Baltimore FICB presently does not have a loan repayment schedule for the district PCA's. Baltimore officials feel that this factor alone is responsible for a large portion of the variation of estimated new money requests from actual new money requests.

Other factors compounding the problem of accurately estimating the amount of funds the system will utilize include: the continued substitution of capital for labor in production agriculture, capital-for-capital substitution (using chemical sprays instead of plows), higher costs of production, the changing structure of agriculture, and farmers' changing attitudes about debt.

The FICB's are thus concerned about the accuracy of their estimates for monthly bond sales for several reasons. First, the expected continued growth in agricultural credit combined with the FICB's increase in market share mean that their bond sales must continue to increase to meet these demands. Secondly, past experience indicates that their current forecasting techniques result in large errors. Also, the costs associated with the error may be highly significant, depending on the existing money market conditions. Thus, there is a need for accurate estimation of new money requests at least two months in advance of actual bond sales. More accurate estimates should reduce the Farm Credit System's costs by reducing the amount of error between actual new money requests and the net amount of money available from bond sales. The estimation procedure must be simple, quick, and relatively inexpensive for use of it to be applied on a regular basis.

The Proposed Study

The Baltimore Federal Intermediate Credit Bank and the Farm Credit Administration need workable methods of determining the Production Credit Associations' new money requests. By developing estimation methods for use by the FICB, the FCA would be better able to plan their entries into the financial markets. Estimates of new money requests would then more accurately reflect actual new money requests and variances between estimated new money requests and the amount of funds obtained in the market would be of much lower magnitude. The costs of holding surplus funds and the costs of short term borrowing by FICB's from sources other than the financial markets would be reduced. This in turn can reduce the costs of borrowed funds to farmers.

The Baltimore Farm Credit District is a highly diversified region of agricultural production. Over thirty commodity types are represented within this district with the most common one being dairy. While estimating new money requests by commodity types would appear to be the logical approach, unavailability of data makes this approach infeasible at this time. It therefore seems most practical to consider estimating new money requests by regions within the district which possess certain similar characteristics.

Objectives

The overall objective of this research is to project two months in advance, new money requests for short and intermediate term agricultural loans by the Baltimore Federal Intermediate Credit Bank. In accomplishing this objective, the economic, institutional, and environmental factors which give rise to the monthly changes in new money requests will be identified and the magnitude of their influence will be estimated. Given numerical estimates of these effects, a model will be developed which could be used by policy makers within the Farm Credit System and the Baltimore FICB to project the probable levels of new money requests for the Baltimore District on a monthly basis. Specific research objectives are:

1. to determine the historical monthly deviations between actual bond participation and new money requests,
2. to identify and measure the effect of variables (economic, institutional, and environmental) which give rise to changes in monthly new money requests, and
3. utilizing the information from #1 and #2 above, develop a forecast model in which the level of and direction of changes in monthly new money requests can be projected.

The resulting model should minimize the error between actual new money requests and actual bond participations relative to the prediction error currently experienced by the FICB.

Previous Work

Previous research in this area has dealt primarily with real estate, non-real estate, or total agricultural credit at the national level. Sources and uses of funds analyses have been utilized to estimate future levels of outstanding agricultural credit.

Many previous studies have projected outstanding farm debt for 1980. Emanuel Melichar projected sources and uses of agricultural capital through 1980 and concluded that outstanding farm debt would be between $91 - $137 billion by 1980. In 1968, John R. Brake estimated agricultural investment by 1980 as well as actual investment by farmers. This resulted in a projection of $107 billion to satisfy requests for agricultural credit needs in 1980. He revised his estimate in 1969, however, to $120 - $140 billion. This emphasizes the great change which can occur in a relatively short-time period.

The Economic Research Service of the USDA has attempted, on a number of occasions, to project credit needs for agriculture. Much of this work has been done by David A. Lins and is an attempt to project the aggregate level of loan volume. In 1973, Lins reported the development of a simulation model which included one equation for estimating the PCA and commercial bank debt outstanding nationally. The model proved to be satisfactory on the national level, but has not been useful at the district level [Swackhamer]. An aggregate level model for non-real estate farm debt was also developed by William Herr in 1975. Both of these models have been used for estimation of yearly changes in non-real estate farm debt but on the national level only.

Brake estimated new money requests for the Federal Intermediate Credit Banks and Production Credit Associations for 1980. Assuming different rates of inflation and different market shares, a number of estimates were obtained. Assuming that the PCA's would have twenty percent of the non-real estate agricultural loan market, Brake estimated annual new money requests of $.46 billion for the System by 1980. When Brake assumed that the PCA's would have twenty-five percent of the market, his estimate was $.70 billion [Swackhamer]. In 1970, the Production Credit Service made three estimates of 1980 new money requests. Two of them were based on five and ten-year average ratios of new money requests to loans and discounts. The third was a straight line projection. Their annual estimates were $2.30, $1.86, and $1.15 billion, respectively [Swackhamer]. This wide variation in estimates further illustrates the need for a reliable forecasting model and thus the need for this project.

Thesis Organization

The first chapter has been a discussion of the need for the research project. Chapter II is a discussion of the organization and operations of the Farm Credit System. It also will attempt to give the reader a basic understanding of how the Farm Credit Banks use the nation's financial markets in acquiring their loan funds. Forecasting in general will be discussed in the first part of Chapter III. This explanation will be followed by the presentation of the forecast model. The logic behind the included variables will be explained. Chapter IV will contain the results of the analysis and the statistical tests. Model testing using 1976 and 1977 data will also be included. The concluding chapter, Chapter V, will be a brief discussion of the implications arising from this research. Some shortcomings of the model will also be discussed. Appendix A will be a summary of how the data was collected, regionalized, and used, while

Appendix B will contain the results of the regional estimations. The correlation coefficient matrix is included in Appendix C. The final appendix, Appendix D, includes a discussion of a computerized forecasting program and a listing of the source program.

CHAPTER II

ORIGIN, ORGANIZATION, AND OPERATION OF THE FARM CREDIT SYSTEM

A discussion of the historical development of the Farm Credit System is included at the beginning of this chapter. It is followed by an explanation of the System's current organization and operations. The latter part of the chapter includes a discussion of how the Farm Credit System obtains the money it lends for agricultural purposes. The two major sources of funds, bonds and discount notes, are discussed separately.

Origin

The Farm Credit System consists of thirty-seven banks and nearly 1,000 local associations across the United States and Puerto Rico. The United States is divided into twelve Farm Credit Districts, each having a Federal Land Bank, a Federal Intermediate Credit Bank, and a Bank for Cooperatives. In addition, there is a Central Bank for Cooperatives located in Denver. These banks and associations which make up the Farm Credit System are cooperatively owned and operated by borrowers.

The Federal Land Banks were established by the Federal Farm Loan Act of 1916. This act also provided for the establishment of local Federal Land Bank Associations through which the banks make loans. Federal Land Banks extend long term credit (5 - 40 years) through the more than 500 local associations.

With the passage of the Agricultural Credit Act of 1923, the Federal Intermediate Credit Banks were established. Their initial role was to discount the short and intermediate term agricultural production loans of other financing institutions. This service was not utilized by these financing institutions as much as expected, resulting in the passage of the Farm Credit Act of 1933. This act gave authorization for the establishment of local Production Credit Associations providing short and intermediate term credit of up to seven years for agricultural uses.

The establishment of the thirteen Banks for Cooperatives also came about through the Farm Credit Act of 1933. These banks provided capital for the many agri-business cooperatives which were just getting started at that time. They continue to provide funds for cooperatives today.

All three types of banks were initially capitalized by the United States Government. The Federal Intermediate Credit Banks and the Banks for Cooperatives were designed to provide the additional short and intermediate term capital farmers and cooperatives need because of the changing agricultural situation. Federal Land Banks were designed to provide long term credit for agriculture which was essentially unavailable early in the century. Subsequent acts of Congress allowed for the borrower-members of these banks to pay back the government capital and acquire complete ownership of the system. In 1947, the Federal Land Banks became totally owned by the associations when the last of the initial government capitalization was repaid. Similarly in 1968, both the Production Credit Associations - Federal Intermediate Credit Banks, and the Banks for Cooperatives repaid their government capitalization and thus became member owned.

The present authority for the Farm Credit System comes from the Farm Credit Act of 1971 which supersedes all previous acts.

Organization

As mentioned above, Federal Intermediate Credit Bank and Federal Land Bank borrowers are members of the local associations. Membership is obtained by purchasing stock upon the advent of their initial borrowing. Each borrower must hold stock in proportion to the amount of his loan. Associations then purchase stock in the district banks in proportion to their loans. In the case of the Banks for Cooperatives, the borrowing cooperatives become members of the bank. When the loan is repaid, the stock can be cashed in at par value or the individual may leave his investment in the association, thus maintaining membership.

The local associations of the Farm Credit System can best be compared to the local offices of commercial banks. However, the System's local offices only engage in loan activities as opposed to commercial banks which are generally involved in savings and checking accounts, loans, trusts and other activities. The Farm Credit System's local associations are borrower-member owned as opposed to commercial banks which are generally owned by stockholders who may or may not be borrowers of the bank. District banks of the Farm Credit System are owned jointly by all of the associations in the district as opposed to commercial banks being a member of the Federal Reserve System.

Membership in a local association entitles a member to vote in the election of the local board of directors for the association. The boards are responsible for hiring management and setting local policies. Voting is on the basis of one vote per member.

The district boards consist of seven individuals. Two directors are elected from the membership by each of the following: the boards of the local Federal Land Bank Associations; the boards of the local Production Credit Associations; and the boards of the cooperatives which are members of the Bank of Cooperatives. The seventh member is appointed by the Governor of the Farm Credit Administration upon the approval of the Federal Farm Credit Board. The district directors serve as the joint board for all three banks in their district. As such, they hire management and establish district policies.

One member is elected by each district Farm Credit Board to serve on the board of the Central Bank for Cooperatives. A thirteenth member of this board is appointed by the Governor of the Farm Credit Administration with the advice and consent of the Federal Farm Credit Board.

The Farm Credit Administration

The Farm Credit Administration is an official, independent agency in the Executive Branch of the United States Government and serves as the regulatory agency of the Farm Credit System. The Farm Credit Administration supervises the banks and associations. Its primary functions are to assure the units of the System operate according to the law and the regulations governing their activities, to examine the institutions which comprise the System and to coordinate some of the System's activities in the best interests of the borrowers [FCA, Cir. 36].

The Federal Farm Credit Board directs and supervises the Farm Credit Administration. Other duties include setting national Farm Credit System policies to insure the correct implementation of the Farm Credit Act of 1971. The Board also appoints the Governor of the Farm Credit Administration who serves as its chief executive officer. Each of the joint district boards nominate one person for the President of the United States to consider for appointment to the Federal Farm Credit Board [FCA, Cir. 36]. The President's appointment is subject to approval by the United States Senate. Terms are for six years and directors can only serve one term. Due to staggered terms, there are ordinarily only two directors appointed each year. A thirteenth member is appointed to the Federal Farm Credit Board by the Secretary of the Agriculture to serve as representative and his term is at the pleasure of the Secretary.

Even though the Farm Credit Administration is an official government agency, the funds for its operation come from the banks and associations of the Farm Credit System. Thus, the entire System's operations are paid for by the borrower-members.

Funding the Farm Credit System

The Farm Credit System obtains the majority of its funds through the sale of securities to investors in the nation's money and capital markets. The twelve Federal Land Banks, twelve Federal Intermediate Credit Banks, and thirteen Banks for Cooperatives issue their own consolidated bonds and discount notes through a jointly employed fiscal agent in New York City. The bonds are sold through a nationwide group of securities dealers [FCA, Cir. 36].

A Finance Committee exists for each of the three banking systems in the Farm Credit System. These committees are composed of the District Presidents of the respective banking system. For the Banks of Cooperatives, the President of the Central Bank for Cooperatives is included. Each of the three Finance Committees entrust their powers to a Finance Sub-Committee consisting of three of the District Presidents who serve on a rotating basis. The Sub-Committees approve the amount, maturity, and rate of any sale subject to approval by the Governor of the Farm Credit Administration.

The System's bonds have developed a reputation amongst investors for being of excellent quality and are second only to the securities of the United States Treasury. They are not guaranteed or backed by the government in any way, however.

Discount notes are a second source of funds which have only recently come into use by the Farm Credit Banks. These will be explained more completely below. Basically, they provide very short term credit (5 - 365 days) and prior to September 1, 1977, were the only system-wide security. The sale of membership stock to borrowers also provides some funds to the district banks as well as to the associations.

District Banks most often look first to other banks within the Farm Credit System when they find themselves short of funds. Banks loan money between themselves at cost, thus additional funds can be obtained at the same rate that the funds were obtained in the money market. Because of this, interbank loans are generally the least expensive way of obtaining additional funds. Banks generally look to other Farm Credit Banks within the district and if the funds are not available there, they look to other districts or to the Central Bank for Cooperatives.

A Federal Intermediate Credit Bank may borrow funds from commercial banks if they have a need to obtain these additional funds. Historically, the cost of such funds has been greater than that of funds generated within the System. Federal Intermediate Credit Banks are required to maintain lines of credit with commercial banks for liquidity purposes. Thus, these lines have been used from time to time in the past.

Commercial banks and the Farm Credit System are usually faced with shortages of loanable funds at the same time. They both have excess demands for loan funds during times of tight credit policy imposed by the Federal Reserve System. Commercial banks which have Other Financing Institution (OFI) discount arrangements or participation agreements with the Federal Intermediate Credit Banks, also come to the banks during these periods of tight money in order to obtain an adequate supply of funds for their agricultural lending.[1] This frees the commercial bank's own funds for other lending purposes [Brake]. Therefore, commercial banks are seldom used for obtaining funds especially in periods of tight money even though the Federal Intermediate Credit Banks maintain lines of credit with them for liquidity purposes and more recently to back their discount notes.

Reserves are maintained by both the banks and associations. Certain minimum reserves are required by law, but generally reserves above the minimum amount are held. These surplus reserves are also available for loan operations. Reserves may be held in the form of short term marketable securities. In addition, when surplus funds are on hand, the banks will invest in short term notes and securities. These investments supply additional loan funds.

Bonds

The Federal Intermediate Credit Banks and the Banks for Cooperatives enter the market in monthly bond sales. The Federal Land Banks enter the market quarterly. Bond maturities are normally six

[1] OFI's are rural banks or agricultural credit corporations (established by farm oriented groups to cooperatively loan money to their members) which enter into an agreement with an FICB to obtain discount privileges with the FICB. Rural banks may also enter into participation agreements with an FICB where the bank and the FICB share in agricultural loans above some minimum size. This allows small rural banks to handle larger agricultural loan volumes.

months for Banks for Cooperatives, nine months and term (greater than one year) for Federal Intermediate Credit Banks, and variable for Federal Land Banks.

Before any bond sale, the banks involved notify the Fiscal Agency of their intended participations. This allows the Fiscal Agent to determine the amount of bonds necessary to be sold. He consults the dealers to find out what maturities will be well received in the market and at what price. The selection of an offering of various maturities is partially based on the yield curve. Finally, an offering of different maturities and interest rates is agreed upon by the Finance Sub-Committee, the Fiscal Agent, and the Farm Credit Administration. The Farm Credit System has specific bond pricing days with the sales beginning two days later. Once the bonds are sold to the dealers, the funds are distributed to the banks in accordance to their participation.

Due to the relatively short maturities of bonds which the system uses, most of the funds generated from a bond sale are used to refinance maturing obligations and interest costs. Currently a policy exists to lengthen maturities, thus this may be of less concern in the future.

Discount Notes

Discount notes are a relatively new addition to the fund raising activities of the Farm Credit System, but the program has greatly increased and currently thirty-six of the thirty-seven banks are using it. Discount notes provide financing for terms of five to 365 days. Due to the brevity of their terms, they can add great flexibility to a bank's financing strategy. Depending on money market conditions, the discount notes may provide lower cost funds than bonds. This would occur when a normal yield curve exists. Presently, the amount of discount notes that a bank can have outstanding is limited to three times their unused lines of credit with commercial banks.

Several advantages can be gained by a bank making proper use of discount notes. As mentioned above, a great degree of flexibility can be gained at little additional cost and sometimes at a savings due to the "normal" yield curve. Another advantage is that the discount notes enable the FICB's to utilize their lines of credit to back the notes. Prior to the discount note program, lines of credit were required for liquidity but were seldom used otherwise. In order to keep these lines of credit available, the commercial banks require certain compensating balances. Thus, the opportunity costs on these balances constitute a cost for the line of credit. By using these lines to back discount notes, the cost of the line of credit can be spread over many more dollars and thus is reduced since it allows the bank to obtain large amounts of low cost financing. Costs associated with discount notes are increased somewhat due to transaction costs and the cost of increased lines of credit to back them.

As the banks are becoming increasingly aware of these advantages, they are using the discount notes to a greater degree. It is thought that the discount notes will become a major source of short term financing for the system in the future.

CHAPTER III

FORECASTING AND THE FORECAST MODEL

The material in this chapter is divided into four main sections. The first section includes a discussion of various forecasting techniques. The second section contains the specification of the forecast model developed for forecasting new money requests. A discussion of each variable's expected effect follows. The selection of an appropriate forecasting technique used for estimating the prediction model is contained in the fourth section. A brief explanation of the data base concludes the chapter.

Forecasting Methods

A broad definition of forecasting would state that forecasting includes any projection that is made about an uncertain future event. Planning the future expansion or activities of a business entity is certainly a forecast regardless of the method used to generate the plan. In general, forecasts can be considered to include the entire spectrum from the simplest of suppositions to the most complicated simulation routines.

Predictions (forecasts) may be of several types, the most common of which is <u>ex</u> <u>ante</u> prediction. This type involves forecasting the unknown future using existing data. Another type, unconditional prediction is an unqualified statement about the future as opposed to conditional prediction which assumes occurrence of some outside event as the qualifying statement [Klein, p. 13]. An unconditional prediction is independent of any changes which may occur. Conditional prediction, on the other hand, requires that a certain state exist for the prediction to hold. If this state does not exist, the prediction cannot hold since it is dependent on the existence of that particular state.

Several commonly used forecasting techniques are discussed below. The first method is the simplest of all forecasts. With this method, people well acquainted with the conditions which may affect the forecast are provided with the relevant data and then make their best prediction based on the data and their personal knowledge. This method of forecast has not proved overly satisfactory due to the large variance in the estimates as well as the large magnitude of errors. In addition, human biases are often included by the forecaster. Although human forecasting is not the best method, human judgment is essential for the success of all forecasting methods.

A somewhat more complicated forecast technique involves the use of economic indicators. The National Bureau of Economic Research has been using economic indicators in forecast work for a number of years. Series are collected on economic variables and are usually smoothed and seasonally adjusted.[1] These series are then compared to a series of the variables of interest. Series which contain cycles that are

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[1]If a certain season is consistently high or low, then a ratio of actual to forecast can be developed in order to seasonally adjust future forecasts.

similar to those which occur in the dependent variable are identified. The selected series may show timing of three basic types: leading, coinciding, or lagging. When a turn occurs in a leading indicator, it indicates that a similar turn will occur in the series to be predicted. Thus, a forecast can be made. This prediction is confirmed by a similar turn in the coinciding series while a turn in the lagging series in the same direction gives even more assurance of the validity of the forecast [Klein, pp. 90-92].

Since leading indicators' main relationships are those of timing, they only depict the timing and direction of change but offer little insight into the magnitude of change. They are also limited in that the forecast can extend no farther into the future than the amount of lead time provided by the indicator. In addition, it is hard to ascertain a turn until some time after it has occurred when the coinciding and lagging indicators turn. Another point of concern is the generation of false signals which have occurred in the past [Klein, pp. 90-92].

Various smoothing techniques can be used as a means of forecasting. Smoothing by the use of moving averages is merely a means of letting the next period's forecast be equal to the average of the observed value during the most recent N observation periods. The choice of the number of periods to average (N) is left to the discretion of the forecaster. A similar method is using different weights on the last N actual observations in order to develop a weighted average to be used for the forecast.

Exponential smoothing uses last periods forecast plus some fraction of the observed error for the next periods forecast. Its strengths are the fact that it requires much less stored data than do moving averages. Its proponents also argue that last period's observation should be the best forecast of the forthcoming period. Thus, they argue it is more satisfactory in forecasting than simple moving averages, which weight, all N observations the same.

Another forecasting technique involves the use of input-output models. Input-output analysis has been used extensively where modeling an economic region as a whole is important. This method attempts to identify the basic relationships which exist between different sectors in the region. Input-output models are most useful when used for planning at the level of a national economy. However, they are typically too expensive for single business organizations to use. Their greatest value lies more in the planning stages than in forecasting [Wheelwright and Makridakis, pp. 148-150].

A simple method of forecasting is trend line analysis. The object is to determine the general trend in the variable of interest over time. Trend not only refers to the historical extrapolation but also to the rate of change and any increases or decreases over time [Wheelwright and Makridakis, p. 213]. Determining the trend may be accomplished in one of two ways. First, the variable of interest can be graphed over time and the trend determined from the graph. Secondly, a simple linear model may be estimated with the dependent variable being the variable of interest and the independent variable being time.

Correlation analysis is a statistical method which can be used for forecasting in a manner similar to indicators. The strength of the linear relationship between the dependent and independent variable is measured by computing the simple correlation coefficient. A basic problem is that while many variables may exhibit "strong" linear relationships with the dependent variable (due to general trends upward in most economic variables over time), it is extremely difficult to accurately forecast the magnitude of the variable of interest.

The simple regression model is an extension of correlation analysis but offers more insight into the relationship between the two variables. Regression analysis fits a line to the observed data which minimizes the total amount of squared error between the actual and the estimated value. The slope of the regression line is used to estimate the amount of change in the dependent variable to be expected when the independent variable changes.

Multiple regression allows use of several independent variables in explaining the historical variation in the dependent variable. This results in a more complicated but often more realistic development of the forecast model. Coefficients are simultaneously calculated for each of the independent variables expected to influence the dependent variable. With some knowledge of the independent variable values, this equation can then be used to forecast the dependent variable.

Some limitations of using regression analysis in forecasting include:

a) observations for each independent variable are needed for the forecast period (alternatively, the model must be developed such that current values for the independent variables can be used to forecast the dependent variable),

b) the independent variables may be estimated and the predicted values of the independent variables used in the forecast, but this increases the amount of error, and

c) if the assumptions pertaining to the estimation method used do not hold, then the resulting estimates will probably not be minimum variance, unbiased estimators.

The Forecast Model

As mentioned in Chapter I, emphasis in this study was on the identification and analysis of the historical levels of monthly new money requests by the Baltimore FICB. Measurements for the model variables were chosen so as to permit the ex post use of the estimated model parameters in short-run forecast work. As such, the variable measurements were to be tied to a readily accessible, on-going data base. This would allow for periodic re-estimation and would simplify use of the models for forecasting. A major consideration in the development of the model would be that the final product appear in a form that could be used quickly and easily on a monthly basis and at a fairly low cost to estimate new money requests for the district.

New money requests of the FICB should be attributable to the level of new loans made (total loans made minus the renewed loans) and the level of paydown in a given month. New loans made constitute the only outflow of loan funds from the FICB to the associations. Paydown, on the other hand, is basically the only flow of loan funds from the associations to the FICB. Thus, in order to identify those factors which affect new money requests, those factors which influence new loans made and paydown must be identified and their influence measured.

Since two components (new loans made and paydown) were necessary to determine new money requests, the model to be estimated consisted of two equations, one for each determinant of new money requests. These equations were:

$$(III.1)\quad NLM_t = f\,(NLM_{t-12}, LO_{t-2}, RDIF_{t-2}, PREC_{t-2}, EX_{t-2}, BR_t, SHARE_t, M_2, M_3, M_4, M_5, M_6, M_7, M_8, M_9, M_{10}, M_{11}, M_{12})$$

$$(III.2)\quad PD_t = f\,(NLM_t, PD_{t-12}, IER_{t-2}, RDIF_{t-2}, RR_{t-2}, LO_{t-3}, LO_{t-12}, INF_t, M_2, M_3, M_4, M_5, M_6, M_7, M_8, M_9, M_{10}, M_{11}, M_{12})$$

thus, $NMR_t = NLM_t - PD_t$

where:

NMR_t = new money requests during time period t,

NLM_t = new loans made during time period t,

NLM_{t-12} = new loans made twelve months earlier,

PD_t = paydown in time period t,

PD_{t-12} = paydown twelve months earlier,

LO_{t-2} = loans outstanding two months earlier,

LO_{t-3} = loans outstanding three months earlier,

LO_{t-12} = loans outstanding twelve months earlier,

$RDIF_{t-2}$ = commercial bank interest rate minus the FICB interest rate (both two months earlier),

RR_{t-2} = ratio of the FICB interest rate to the commercial bank interest rate (both two months earlier),

$PREC_{t-2}$ = total precipitation two months earlier,

BR_t = measure of the level of interest rates charged by commercial banks during time period t,

EX_{t-2} = measure of farm expenses two months earlier,

IER_{t-2} = farm income expense ratio two months earlier,

$SHARE_t$ = the PCAs' share of short-term agricultural loans in time period t,

INF_t = measure of the rate of inflation in time period t, and

$M_2 - M_{12}$ = monthly dummy variables using January as the base month.

Due to the time lags involved in the policy-making process of estimating new money requests, relaying that information to the fiscal agency, and then obtaining funds, it was felt by officials in the Farm Credit System that the forecast amounts should be available approximately two months before the funds are to be obtained. In order to satisfy that request, two month or greater lags were used whenever it was possible so that readily available data could be used. In many cases, two month lags seem appropriate for more reasons than just forecasting simplicity, as often lags are observable between acquisition of funds and use of funds.

The New Loans Made Function

The lagged dependent variable (NLM) should depict the trend in new loans made. The magnitude of this variable should also aid in determining the general level of new loans made. Part of the trend element involves prediction of saturation points as well as rates of change and increases and decreases over time [Wheelwright and Makridakis, p. 213].

Loans outstanding (LO) have been steadily increasing over the sample period. It is expected that loans outstanding could depict the basic trend in agricultural credit. If gross new money increases and all else is constant, then loans outstanding during that period should also increase. Thus, loans outstanding two months earlier should reflect any basic changes which may have occurred in the new loan volume.

The difference in interest rates between the FICB and commercial banks (RDIF) was included as a measure of the competiveness of the two institutions. If the FICB rate is less than that charged by commercial banks, it would be expected that the PCAs would receive an increased portion of farmers' loan volume. This would show up as an increase in new loans made. On the other hand, if the FICB rate is higher, some of the new loan volume should shift to the commercial banks, resulting in a decrease in new loans made or at least a decrease in the rate of increase. The two month lag can be justified if one considers the amount of time it takes for information about relative interest rates to flow from the lending institutions to the borrowers, for the borrowers to make comparisons, and finally institute a new loan.

Precipitation (PREC) should influence farmers' production decisions, the quantities they produce, and their financial situation. A drought is expected to decrease a farmer's income causing him to seek out loans to cover operating expenses or to renew existing loans. Adequate precipitation should allow farmers to pay off loans as planned. Excess precipitation may ruin crops, cause flooding and damage, or kill livestock and thus also create a need for renewing or securing a loan. When large variations in normally expected rainfall occur, farmers might first turn to their own financial reserves or alter their current production plans. At the point where their reserves run out or they feel they cannot continue to alter their plans, they will probably turn to lenders for resources. This explanation of their activity is one explanation for the two month lag on precipitation's effect on new loans made.

A variable which also most likely impacts on the level of new loans made is the amount of farm related expenses. Even in prosperous years for farmers, there should exist a demand for credit since in many types of farming, expenses are incurred in blocks throughout the year, but income is only obtained once or twice within the year well after the expense has been incurred. This fact in itself generates a demand for short-term production credit. Many farm suppliers offer sales on credit with no interest charge for thirty, sixty, and sometimes ninety days. This fact provides a rationale for at least a two month lag.

The commercial bank interest rate (BR) was included as a measure of the overall level of the interest rate. The difference in the FICB and the commercial bank rate only compares the two interest rates two months prior. It does not include any information about the relative level of interest rates at that time. It is expected that fewer loans would be made during periods when the interest rate is relatively high (tight money situation). As interest rates decrease, new loans would be expected to increase.

The percentage share of short term agricultural loans that PCAs hold (SHARE) was used to measure the PCAs' loan activity. The market share is based on total loans outstanding. Therefore, for the PCAs to increase their share of the market, they must increase their loans outstanding. This can happen through an increase in new loans made, a decrease in paydown, or an increase in renewed loans. If all else is held constant, changes in the PCAs' share of the market should be positively related to new loans made.

Seasonal adjustment of new loans made is obtained through the use of monthly dummy variables. January was chosen as the base month, and thus eleven zero-one variables were used (M_2 through M_{12}). M_2 is the dummy variable for February. M_2 is equal to one if the month in question is February and it is equal to zero if it is some other month. M_3 through M_{12} were created in the same way.

The Paydown Function

New loans made (NLM) may be inversely related to paydown. During periods of relatively large expenses when farmers are borrowing large quantities of money, they will not increase their paydown and may in fact renew old loans, thus decreasing paydown. During periods when net farm income is relatively high, farmers will probably not borrow as heavily since they will be using their own capital. They will also probably use their excess capital to retire old debts if they have no other plans for it. This will in turn increase paydown at a time when new loans made are relatively low.

The lagged dependent variable (PD) should be an indication of the trend in paydown. As a trend variable, it should predict rates of change and increases and decreases. It should also be indicative of the general level of paydown.

The income expense ratio suggested for the model is one method of measuring the returns earned by the farmer and the resources he commands whose cost was not included as an expense. When this ratio is large, it should indicate that farmers are faring well and paydown will probably be relatively high. A small value for this ratio should mean that farmers as a whole are having financial problems and paydown will probably decrease as farmers renew loans or resort to paying only the interest.

As the commercial bank interest rate minus the FICB interest rate (RDIF) decreases, it is expected that paydown will increase. This results from the fact that farmers can borrow money from commercial banks at a lower interest rate and pay off the PCAs. If the difference increases, the reverse should hold. The same argument with respect to the two month lag can be used here as was used in the new loans made equation. It takes time for information to flow from banks to borrowers, for the borrower to compare rates, make a decision, and then take action. He may also be waiting to see if the difference movement is only temporary or of significant duration.

The ratio of the FICB interest rate to the commercial bank rate (RR) was also used. Although both the difference and the ratio of the two interest rates measure the relative level of the two competing interest rates, they are not the same. Both variables (RDIF and RR) depict changes at basically the same time, however, the rates of change depicted by the two variables differ greatly during the same time period. Thus, both the difference and the ratio were included in the model as different measures of the rates of change between the two rates. Also, the range of the ratio is from zero to infinity, whereas the range of the difference comprises the entire real line. Thus, it is even more obvious that the two measures may yield significantly different results. The same argument again holds regarding the two month lag.

The ratio of the FICB interest rate to the commercial bank rate was included as another measure of the relative level of the two competing interest rates. The same argument again holds regarding the two month lag.

PCA loans have terms of any length less than or equal to seven years. This fact would seem to suggest that a distributed lag on total loans outstanding would be justified. Loans outstanding represent the total amount of loans which have been made but not repaid. As loans outstanding come due, they are repaid (either in installments or as a lump sum) or renewed. Repayment decreases loans outstanding and creates paydown. Thus, a decrease in loans outstanding should be indicative of increased paydown during that period, _ceteris_ paribus. However, a decrease in loans outstanding in any month should result in paydown being decreased in later months since fewer loans are outstanding to be repaid. The twelve month lag was chosen to help account for the level of paydown arising from loans outstanding with longer terms. The three month lag was used to depict the expected paydown from very short term loans.

The general state of the economy was portrayed in the measure of the rate of inflation. It was expected that during inflationary periods, paydown should decrease. This follows from the idea that if the interest rate is less than the rate of inflation, borrowers gain while lenders lose.

Monthly dummy variables were included in the specification of paydown to account for any monthly seasonality which exists with respect to paydown. The method of inclusion was the same as with the new loans made specification. January was used as the base month and zero-one variables were used to adjust for the other months.

Normally repayment is scheduled to fit the farmer's particular situation, allowing him to make payments at the time his crops, livestock, or other products are sold. However, there is considerable flexibility allowed in the repayment of loans. For instance, borrowers are allowed to repay their loans early without penalty. If borrowers can convince the PCAs that it is to the advantage of both the borrower and the PCA to alter the loan repayment schedule, the PCAs are accommodating. Thus, loan repayments may be delayed or rescheduled.

The Method of Estimation

Because of the planned use of the forecast generated by this study, a forecast technique had to be used that would make available accurate monthly estimates two months in advance of the forecast period. Since a major objective was to decrease the error of the present forecast method, and since more than timing and direction of change was needed, multiple regression analysis was selected as an appropriate forecast method. This forecast method provides the best information for development of models that are both structurally and predictively correct. It allows the inclusion of the many independent variables which are hypothesized to influence the dependent variable. It also allows the use of seasonal variables so that seasonal adjustments can be included in the model.

Numberous techniques are available for estimating the parameters of multiple regression models. One of the more widely used is ordinary least squares (OLS). This procedure utilizes these basic assumptions for the regression model: (a) the error term is normally distributed, (b) the error term has a mean of zero, (c) every disturbance term has the same variance which is unknown, (d) the errors are nonautoregressive (i.e., uncorrelated), (e) all values of the explanatory variables must be controllable or predictable, (f) the number of observations exceeds the number of coefficients to be estimated, and (g) none of the independent variables are perfectly linearly related [Kmenta, pp. 202-203, 348].

Since the sample used is large relative to the number of independent variables assumption (f) holds. The sample is also large enough that assumptions (a), (b), and (g) should hold. Due to the way the model was specified and the independent variables were chosen, assumption (e) also holds. There is no reason to believe that assumptions (c) and (d) are not fulfilled. Thus, the OLS technique is an appropriate method. If all of these assumptions are met, the resulting estimators are best, linear minimum variance, unbiased estimators. Where appropriate, the basic assumption will be tested.

Data Base

Data necessary for estimation was collected on a regional basis for the Baltimore District. The regions were selected so as to include groups of associations with fairly homogeneous commodity sales and similar agricultural climate and terrain. The associations included in each region are listed in Table III.1. Regionalization of the data is discussed in Appendix A. The regional data is reported in Appendix Tables A.6, A.7, and A.8.

The model parameters were estimated for each region. The data was then pooled and the parameters were estimated for the pooled model (the pooled model included all of the data reported in Appendix Tables A.6, A.7, and A.8). The results obtained from the regional estimations do not differ greatly from the pooled estimates. As expected, the regional models were capable of explaining a slightly greater amount of the variation in new money requests. Since a major objective of the research was to develop a model that would be usable by the Baltimore FICB, the pooled model was selected for forecast use. Therefore, the discussion in Chapter IV is limited to the

Table III.1. Associations Comprising the Study Regions

Region I	Region II	Region III
Berks - Lehigh Valley (Pa.)	Meadeville (Pa.)	West Virginia (WVa.)
York (Pa.)	Butler (Pa.)	Potomac Valley (WVa.)
Lancaster (Pa.)	West Central (Pa. - WVa.)	Central Valley (Va. - WVa.)
Southeast (Pa.)	Wellsboro/Coudersport (Pa.)	Staunton (Va.)
Frederick (Md.)	Northeastern (Pa.)	Roanoke (Va. - WVa.)
Bel Air - Towson (Md.)		Southwest (Va.)
Denton (Md.)		
Delaware (Del.)		
Salisbury - Marva (Md. - Va.)		
Southern Maryland (Md.)		
Warrenton (Va.)		
Richmond (Va.)		
Farmville (Va.)		
Waverly - Southside (Va.)		

results of the pooled model. However, for completeness the results of the regional estimations are reported in Appendix B.

CHAPTER IV

RESULTS AND VALIDATION OF THE FORECAST MODEL

A discussion of the results obtained from estimating the parameters of the regression model begins this chapter. Also included are comments on each of several tests that were used to determine the extent of the forecasting ability of the model. Application of the model to an actual forecast situation is presented in the concluding section.

Slope and Intercept Shifters

New money requests were graphed over the time period of the sample space. Inspection of this graph revealed that the earlier years in the sample space (1971-73) seemed to possess a specific seasonal pattern while the seasonal pattern of latter years differed greatly. It was hypothesized that a structural change occurred somewhere during the 1973-74 time period that affected the borrowing and repayment patterns of the borrowers in the Baltimore District. Further analysis supported this supposition. No variables were identified that should be included in the model specification that would account for this distinct change in the pattern.

In order to account for the change described above, a dummy variable was added to the specification of each equation. This dummy variable was set equal to one (1) for all observations prior to 1974 and set equal to zero (0) for all observations after December 1973 (the base period). All independent variables were multiplied by the dummy variable thus creating dummy independent variables to account for slope changes. The general form of the equations to be estimated is illustrated by equation IV.1.

$$\text{(IV.1)} \quad Y = (1 + \delta_0)\,\alpha + (\beta_1 + \delta_1)\,X_1 + \ldots + (\beta_n + \delta_n)\,X_n$$

Implications arising from the use of this method are discussed in Chapter V. The deltas (δ_i) merely represent the difference in the change that occurs in the intercept and slopes between the two time periods. Equation IV.2 is the general form of the equation during the base period only.

$$\text{(IV.2)} \quad Y = \alpha + \beta_1 X_1 + \ldots + \beta_n X_n$$

[Havlicek, Chapter 4].

The procedure for dealing with a slope change dramatically decreased the total squared error, thus increasing the fit of the regression equations. (The results of the regional estimation procedure were also improved and are shown in Appendix B.) Since this is a prediction model, all variables were left in the final specification of the model as it was felt that inclusion of all justified variables would enhance the overall predictive ability of the model.

Regional intercept shifters were included in the pooled model. Region I was used as the base region and dummy variables were used to account for regional differences in the intercept. These dummy variables were labeled RD2, the intercept shifter for Region II, and RD3, the intercept shifter for Region III.

The New Loans Made Equation

Table IV.1 is a summary of the results of the estimation procedure for the new loans made equation. It includes the estimated coefficients, their standard errors, R-square, F, and Durbin-Watson statistics. The structural change is depicted by the changes in signs and magnitudes of coefficients that occur between the two time periods. The coefficients of the monthly dummy variables indicate the necessary increment to reflect the actual seasonal level of new loans made.

The two equations for new loans made for the two time periods were:

(IV.3) New Loans Made Equation for 1971-73:

$$NLM_t = -2661.90 + 598.83\ NLM_{t-12} + 323.93\ RDIF_{t-2} + 0.06\ LO_{t-2} - 0.41\ PREC_{t-2} + 6.60\ BR_t + 157.96\ SHARE + 0.78\ EX_{t-2} - 17.32\ M_2 + 487.72\ M_3 + 576.39\ M_4 + 704.96\ M_5 + 204.66\ M_6 - 120.97\ M_7 + 346.08\ M_8 - 191.24\ M_9 + 264.25\ M_{10} - 34.79\ M_{11} - 98.92\ M_{12} - 881.04\ RD_2 - 992.62\ RD_3$$

(IV.4) New Loans Made Equation for 1974 - June 1976:

$$NLM_t = 484.59 + 498.50\ NLM_{t-12} + 290.91\ RDIF_{t-2} + 33.43\ LO_{t-2} - 254.86\ PREC_{t-2} - 67.90\ BR_t +$$

Table IV.1. Estimation Results: New Loans Made

R-square = 0.9416
F = 65.34
D.W. = 2.13

	1974-June 1976		Adjustment for 1971-73	
	Estimate	Standard Error	Estimate	Standard Error
Intercept	484.59	6925.19	-3146.49	6091.03
NLM_{t-12}	498.50	112.37	100.33	193.05
$RDIF_{t-2}$	290.91	180.02	33.02	298.94
LO_{t-2}	33.43	13.65	-33.37	16.15
$PREC_{t-2}$	-254.86	105.15	254.45	125.64
BR_t	-67.90	141.52	74.51	173.89
$SHARE_t$	13.02	190.63	144.94	191.35
EX_{t-2}	-2.18	3.62	2.96	5.64
M_2	78.95	478.59	-96.27	649.68
M_3	980.46	473.53	-492.74	672.07
M_4	1949.75	480.92	-1373.36	679.25
M_5	1550.68	486.90	-845.72	670.20
M_6	1230.19	442.70	-1025.53	634.24
M_7	983.78	612.16	-1104.75	782.67
M_8	76.57	567.99	269.51	726.02
M_9	628.24	528.06	-819.48	690.26
M_{10}	1309.34	574.27	-1045.09	771.86
M_{11}	336.44	608.76	-371.23	770.54
M_{12}	1519.95	542.74	-1618.87	751.03
RD2	-881.04	1033.00		
RD3	-992.62	943.50		

$$13.02 \text{ SHARE} - 2.18 \text{ EX}_{t-2} + 78.95 \text{ M}_2 + 980.46 \text{ M}_3 + 1949.75 \text{ M}_4 + 1550.68 \text{ M}_5 + 1230.19 \text{ M}_6 + 983.78 \text{ M}_7 + 76.57 \text{ M}_8 + 628.24 \text{ M}_9 + 1309.34 \text{ M}_{10} + 336.44 \text{ M}_{11} + 1519.95 \text{ M}_{12} - 881.04 \text{ RD}_2 - 992.62 \text{ RD}_3$$

Coefficients for the slope shifters indicated that a shift occurred in the loans outstanding and precipitation variables as well as the April, June, and December dummy variables. These shifts helped explain the change in seasonality that occurred.

The Paydown Equation

Table IV.2 summarizes the results of the estimation of the paydown equation. Dummy variables are interpreted the same as in the new loans made equation. The structural change is again depicted through changes in the coefficients of the slope shifters.

The resulting two equations for the two time periods for the paydown equation were:

(IV.5) Paydown Equation for 1971-73:

$$\text{PD}_t = 11{,}588.68 + 676.27 \text{ PD}_{t-12} - 73.94 \text{ NLM}_t + 297.69 \text{ IER}_t - 108.34 \text{ RR}_{t-2} - 1135.52 \text{ RDIF}_{t-2} + 90.88 \text{ LO}_{t-3} - 25.78 \text{ LO}_{t-12} - 67.97 \text{ INF}_t + 56.31 \text{ M}_2 + 271.95 \text{ M}_3 + 797.59 \text{ M}_4 + 606.24 \text{ M}_5 + 469.72 \text{ M}_6 + 61.17 \text{ M}_7 + 474.90 \text{ M}_8 + 56.98 \text{ M}_9 + 366.27 \text{ M}_{10} + 159.73 \text{ M}_{11} - 34.72 \text{ M}_{12} + 3621.98 \text{ RD}_2 + 3682.81 \text{ RD}_3$$

Table IV.2. Estimation Results: Paydown

R-square = 0.9491
F = 70.94
D.W. = 1.53

	1974-June 1976		Adjustment for 1971-73	
	Estimate	Standard Error	Estimate	Standard Error
Intercept	23404.84	7062.21	-11816.16	9551.85
NLM_t*	274.19	157.41	-348.13	252.50
PD_{t-12}	143.85	101.10	532.42	167.58
IER_{t-2}	-90.40	456.66	388.09	610.87
RR_{t-2}	-266.38	80.70	158.04	101.12
$RDIF_{t-2}$	-2354.51	658.95	1218.99	1136.53
LO_{t-3}	0.68	14.85	90.20	28.26
LO_{t-12}	64.57	15.59	-90.35	28.86
INF_t	-18.13	21.90	-49.84	35.23
M_2	-586.52	355.06	642.83	492.24
M_3	-780.14	374.92	1052.09	555.81
M_4	-882.97	585.80	1680.56	759.15
M_5	-1470.74	515.62	2076.98	705.20
M_6	-1449.59	511.52	1919.31	692.88
M_7	-396.17	554.47	457.34	737.77
M_8	-288.70	394.95	762.79	535.59
M_9	109.25	382.66	-52.27	518.68
M_{10}	-44.36	461.27	410.63	640.01
M_{11}	1102.31	417.10	-942.58	582.97
M_{12}	338.64	502.05	-373.36	658.59
RD2	3621.98	1113.82		
RD3	3682.81	1070.98		

*Estimated using the new loans made equation.

(IV.6) Paydown Operation for 1974 - June 1976

$$PD_t = 23404.84 + 274.19\ NLM_t + 143.85\ PD_{t-12} - 90.40\ IER_{t-2} - 266.38\ RR_{t-2} - 2354.51\ RDIF_{t-2} + 0.68\ LO_{t-3} + 64.57\ LO_{t-12} - 18.13\ INF_t - 586.52\ M_2 - 780.14\ M_3 - 882.97\ M_4 - 1470.74\ M_5 - 1449.59\ M_6 - 396.17\ M_7 - 288.70\ M_8 + 190.25\ M_9 - 44.36\ M_{10} + 1102.31\ M_{11} + 338.64\ M_{12} + 3621.98\ RD_2 + 3682.81\ RD_3$$

Of the slope shifters, it appeared that definite changes occurred in the coefficients of the lagged dependent variables, both of the loans outstanding variables, and the March, April, May, and June dummy variables. These slope changes in conjunction with those that occurred in the new loans made equation account for the change in the pattern of new money requests that was observed.

Causes of the Structural Change

The large shifts that occurred in the slopes of some of the variables between the two time periods caused some concern. However, the data base extended over a time period in which many severe economic shocks occurred. Prior to and including 1973, the farm economy was fairly stable. Thus farmer's new money requests followed a set pattern. Starting in late 1973 and continuing into 1974 and 1975, many economic shocks occurred in the farming sector. Massive grain exports, escalating prices, short run shortages of inputs, and the energy crisis are just a few examples. These shocks caused farmer's new money requests to change from their previous pattern. Farmers become responsive to the rapidly fluctuating economic conditions and were less dependent on the historical level and pattern of new money requests.

The Presence of Multicollinearity

Multicollinearity exists when there is a strong linear relationship between any of the independent variables. The strength of the linear relationship is measured by the statistical correlation. The correlation coefficient matrix is included as Appendix C. The presence of multicollinearity causes the estimates of the regression coefficients to be highly imprecise due to the large variances of the least squares estimators. These large variances are caused by the linear relationship between independent variables [Kmenta, pp. 384-391]. Thus, the individual effects of each exogenous variable cannot be identified.

Of the variables in the new loans made equation, loans outstanding two months earlier was highly correlated with the PCAs' share of the market (0.95), new loans made twelve months earlier (0.93), and farm production expenses two months earlier (.76). The PCAs' share was also highly correlated with new loans made twelve months prior (.89) as were farm production expenses (.71). Farm production expenses were also closely associated with the share variable (.70). The measure of the commercial bank interest rate was highly negatively correlated with the difference in interest rates two months earlier (-.89) and positively correlated with the measure of inflation (.68).

In the paydown equation, the highest correlation was between loans outstanding three months earlier and twelve months earlier (.99). Paydown twelve months earlier was also very highly correlated with both loans outstanding variables (.93). The ratio of interest rates two months earlier was closely associated with the difference in interest rates two months earlier (.73) and the rate of inflation (-.63). Thus, it is fairly obvious that a high degree of multicollinearity exists in both equations in the model. Nonetheless, multicollinearity was not an overriding concern since the model was developed entirely for predictive purposes.

Testing the Model

Coefficients of Multiple Determination

The coefficient of determination (R-square) for the new loans made equation was 0.9416, indicating that 94.16 percent of the variation in new loans made was explained by the model. The paydown equation had an R-square of 0.9491, thus 94.91 percent of the variation in paydown was explained.

Since new money requests, the difference between new loans made and paydown, is the variable of interest, an R-square for the estimated new money requests was calculated. This was done by calculating the total variation in actual new money requests experienced by the PCAs by using the following formula:

$$\text{(IV.7)} \quad SST = \sum_{i=1}^{n} (Y_i - \bar{Y})^2.$$

where:

SST = total sum of squares of the model,

Y_i = actual new money requests during time period i,

$\bar{Y}$ = average new money requests, and

n = number of observations in the sample.

The total amount of squared error (SSE) was calculated by use of equation IV.8.

$$\text{(IV.8)}\quad SSE = \sum_{i=1}^{n} (Y_i - \hat{Y}_i)^2.$$

where:

$\hat{Y}_i$ = estimated new money requests generated by the model.

Since,

$$\text{(IV.9)}\quad SST = SSR + SSE,$$

where:

SSR = sum of squares due to the regression, and

$$\text{(IV.10)}\quad R^2 = \frac{SSR}{SST},$$

it follows that:

$$\text{(IV.11)}\quad R^2 = \frac{SST - SSE}{SST}.$$

The result was an R-square of 0.8359. Thus, 83.59 percent of the variation in new money requests is explained by the model.

<u>The F-Test</u>

The F-values of 65.34 for the new loans made equation and 70.94 for the paydown equation were both significant at the 0.0001 level. Since the F statistic is a test of the statistical significance of the linear model, the highly significant values indicate that at least one of the estimated parameters of each of the two equations differ from zero.

Theil's Inequality Coefficient

Theil's inequality coefficient (U) is a measure of the predictive ability of a model. A value between zero and one indicates that the model performs more accurately than naive no-change extrapolations. A value greater than one indicates that no-change extrapolation would be more accurate for prediction than would the model [Theil, pp. 26-29]. The Theil inequality coefficient calculated for new money requests was 0.7541, thus the model performs better than no-change extrapolation.[1]

Turning Point Analysis

The difference between the actual new loans made that was experienced by the FICB and the actual paydown which the FICB received represents the actual new money requests to be financed by the FICB. Since new loans made are an outflow of funds from the FICB and paydown is an inflow of funds, the difference should be the net amount of loanable funds the FICB needs to obtain in any one month. The actual amount of new money requests during a month is never known until after the month has ended and all reports are in. The model developed through this research is capable of forecasting new loans made and paydown two months before they occur. Thus, the difference between the predicted new loans made and predicted paydown is the predicted new money requests.

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[1] $U^2 = \frac{\Sigma(P_i - A_i)^2}{\Sigma A_i^2}$ where (P_i, A_i) stands for a pair of predicted and observed changes [Theil, p. 28].

Actual new money requests experienced by the FICB and the predicted new money requests obtained from the model are presented in Figure IV.1. Actual new money requests had thirty-five turning points over the time period in the sample. Of these, the model indicated twenty-two turning points at the same time and in the same direction as the turn that occurred. Two turns were indicated one month earlier than they actually happened (January and August 1974). Only one turning point was predicted that did not occur. The rest of the turning points not picked up by the model were generally quick turns of only one month's duration. The model merely smoothed these short changes out. Turning point analysis indicates that the model closely tracks the actual observed values of new money requests.

Testing for Autocorrelation

Durbin-Watson statistics were computed for both equations. The new money loaned equation had a Durbin-Watson statistic of 2.13 while the paydown equation resulted in a Durbin-Watson statistic of 1.53. The Durbin-Watson statistic is one measure of the first order autocorrelation between disturbance terms. The acceptance region gets smaller as the sample size and the number of explanatory variables increases. Generally tabled values to be used when running the Durbin-Watson test do not go beyond 100 observations and five explanatory variables. However, Durbin-Watson values near two (2) indicate that the hypothesis that no autocorrelation exists should not be rejected. The computed value of the Durbin-Watson statistic for the new loans made equation leads to the conclusion that no significant autocorrelation exists in the new loans made equation. The Durbin-

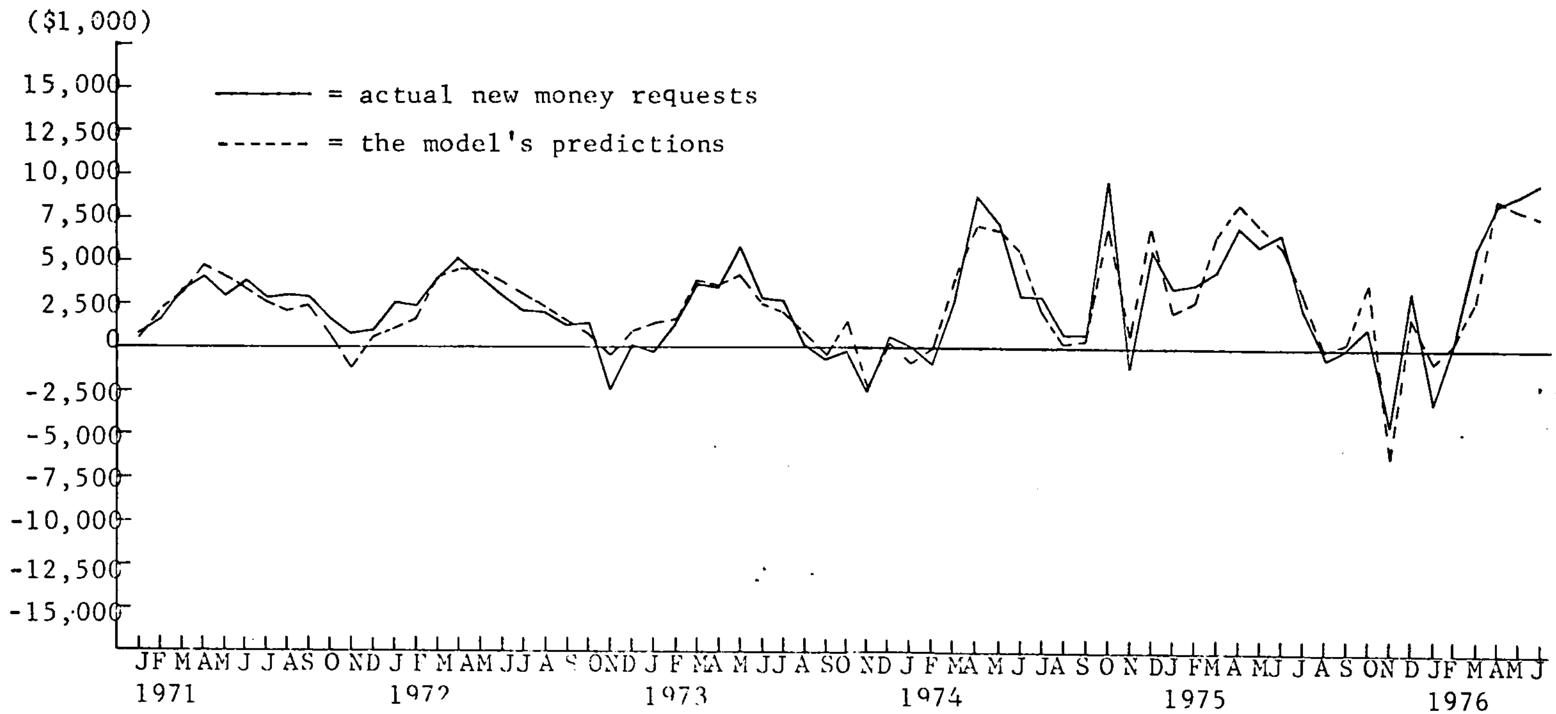

Figure IV.1. Comparing Actual New Money Requests with the Model's Predictions

Watson statistic for paydown falls into the inconclusive range, but may be indicative of negative serial correlation.

The values of the Durbin-Watson statistic calculated for the pooled model may not be accurate measures of the autocorrelation for two reasons. First, since the data was pooled, it is conceivable that by simply rearranging the order of the regions in the pooled data set, that the Durbin-Watson statistic could be altered. Also, if the errors in each region were similar, pooling of the data would result in a pattern becoming discernible in the disturbance term, indicating autocorrelation when it did not actually exist. Thus, the regional Durbin-Watson statistics are more meaningful. Secondly, the Durbin-Watson test is not valid when the model includes a lagged dependent variable as one of the independent variables. Since both equations contained lagged dependent variables, and due to the other conditions described above, little faith can be placed in the results of this test.

Testing the Forecast Model Beyond the Sample Space

Once the model parameters were estimated, data were collected and the predictive ability of the model was tested by forecasting new money requests for the twelve months immediately following the original sample space. This was considered an important test since it simulated actual use of the model. After the predictions were made, they were compared to the actual new money requests. An R-square and a Thiel inequality coefficient were computed for the twelve month test period. The resulting R-square was 0.7656 indicating that 76.56 percent of the variation in new money requests was accounted for by the model. Thiel's inequality coefficient was 0.2549 for the test period. This indicated that the model was much more accurate than no-change extrapolation.

Figure IV.2 is a comparison of the graph of actual new money requests to the predicted new money requests during the test period. Table IV.3 contains the actual new money requests to be financed by the FICBs (column 1), the model's predictions for new money requests (column 2), and the amount of error resulting from application of the model's predictions (column 3). In addition, Table IV.3 also includes the net amount of funds the FICB obtained from bond sales, which for purposes of this study, have been defined as the FICB's estimate of new money requests (column 4). The difference between actual new money requests and the FICB's estimates is called the FICB's prediction error and is reported in column 5 of Table IV.3. Also, of the six turning points observed, the model only predicted two of them. The September turning point was predicted one month later, while the December and January turning points were smoothed resulting in no predicted turn. It seems that the model had the most problems during August and September. It also appears that the model consistently under-estimated during the test period.

Comparing the Model to the FICB's Estimates

In order to determine the value of the model to the Baltimore Federal Intermediate Credit Bank, the error from predictions of the model were compared to the actual error experienced in the past by

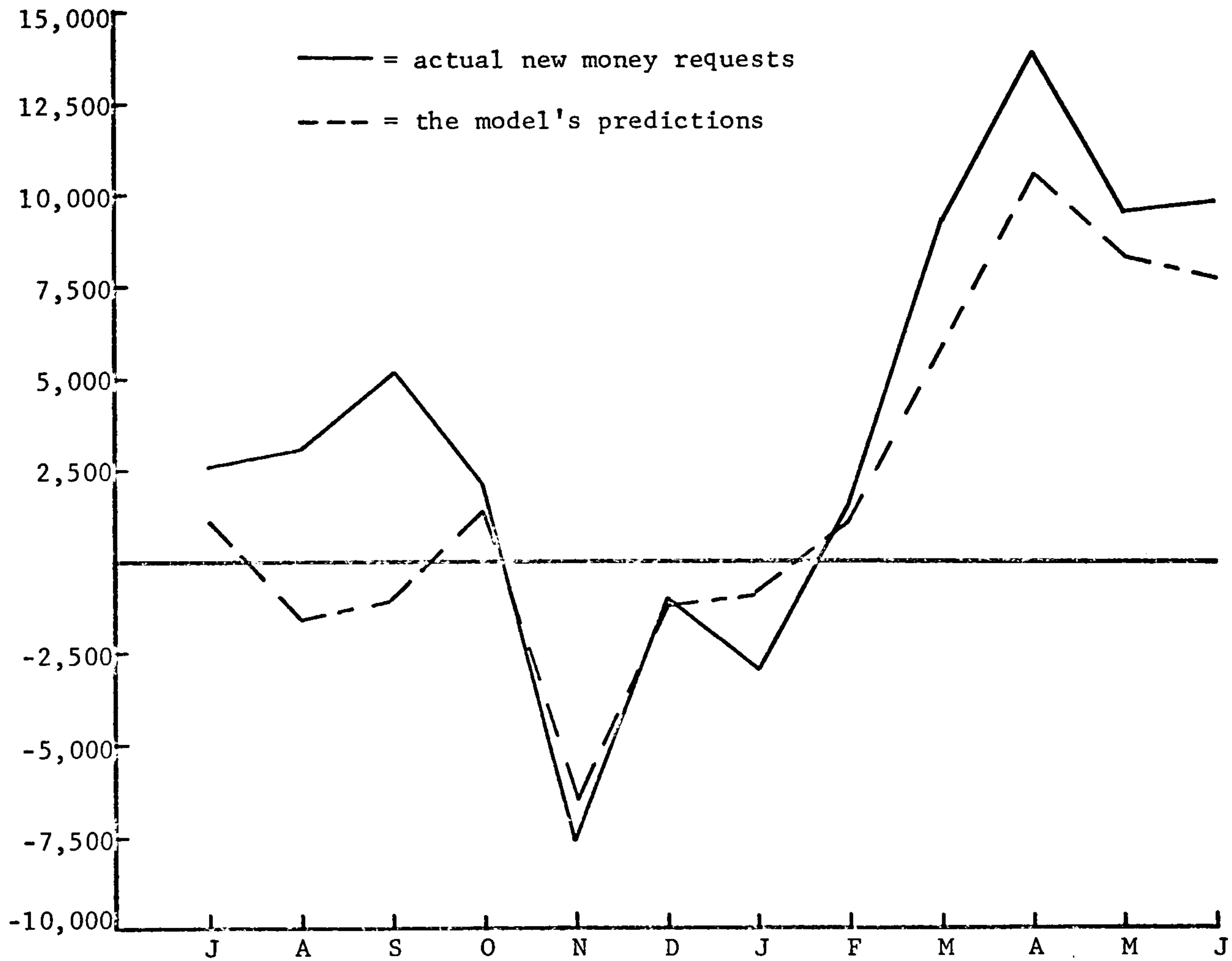

Figure IV.2. Comparing Actual New Money Requests with the Model's Predictions During the Test Period

Table IV.3. Results of Testing the Model Beyond the Data

Month	(1) Actual New Money Requests ($1000)	(2) Model's Predicted New Money Requests ($1000)	(3) Model's Prediction Error ($1000)	(4) FICB's Predicted New Money Requests ($1000)	(5) FICB's Prediction Error ($1000)
		R-square[a]	= 0.7656		
		U[b]	= 0.2549		
July	2560	1104.9	1455.1	9058	-6498
August	3118	-1568.0	4686.0	1195	1923
September	5174	-1047.8	6221.8	8884	-3710
October	1785	1350.7	434.3	3302	-1517
November	-7718	-6358.3	-1359.7	-8267	549
December	-998	-1142.9	144.9	6217	-7215
January	-2888	-812.9	-2075.1	-687	-2201
February	1636	1131.4	504.6	-10626	12262
March	9257	5927.9	3329.1	-8063	17320
April	13976	10590.5	3385.5	8293	5683
May	9539	8380.8	1158.2	-739	10278
June	9918	7822.4	2095.6	15859	-5941

[a]R-square is reported for the model only.

[b]U = Theil's inequality coefficient, reported for the model only.

the FICB. The net amount of money obtained by the FICB from any bond sale is equal to the amount of the FICB's participation in the bond sale less the amount of matured bonds that are repaid, less the interest paid on outstanding bonds. Bond sales provided 88.8 percent of the FICB's funds during 1975 [1975 Annual Report, p. 10]. Since maturing bonds and interest to be paid are both known well in advance of the bond sales, the net money obtained can be considered to be a measure of the FICB's estimate of their new money requests during a given month.

A graph of the FICB's net money obtained, compared with actual new money requests, is included in Figure IV.3. Upon inspection of the graph, it becomes clear that the model's predictions more closely track actual new money requests than does the FICB's estimate (net money obtained from bond sales). Not only does the model more accurately depict the timing and direction of turns, it also does a much better job of predicting the magnitude of change than the FICB's estimate. The FICB's estimate also possesses a greater frequency and magnitude of fluctuation than does either the model's predictions or the actual new money requests.

The total absolute error was calculated for the results generated by the model and for the FICB's estimates.[2] The total absolute error for the FICB from January 1971 through June 1976 was

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[2]Total absolute error = $\sum_{i=1}^{n} |E_i|$ where E_i = error term associated with the ith observation.

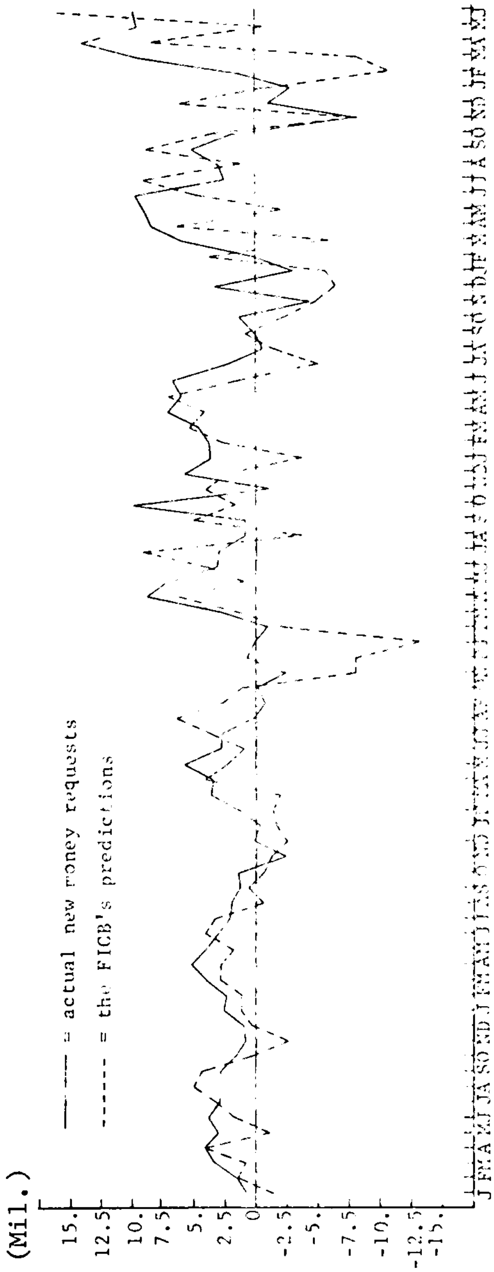

Figure IV.3. Comparison of Actual New Money Requests with the FICB's Estimates

$215,986,000 compared with a total absolute error of $63,858,490 for the model's predictions. Extending this type of analysis through the test period, the total absolute error of the FICB's estimates was $291,083,000, while the total absolute error of the model was $90,708,390.

The difference in the model's error and the FICB's error may not be of the magnitude indicated above as the FICB often hedges against expected changes in the rate of interest paid. Thus, at times when they expect interest rates to increase, they purposely enter the bond market to a greater extent than their monthly new money requests indicate in order to obtain a lower real cost of money. The opposite occurs when interest rates are expected to decline in the future. Therefore during any month, the net amount of money obtained in the bond market may vary a great deal from the FICB's actual estimates of new money requests. Since the inception of the discount note program, bond sales have been altered to make room for use of the discount notes. Since the notes are in maturities of five to 365 days, they are highly flexible and may also be used in interest hedging. Due to the great flexibility the FICB has in obtaining funds within the Farm Credit System and via discount notes and other sources, it is difficult to place an accurate cost estimate on prediction errors. However, it seems reasonable that smaller prediction errors are less costly than larger prediction errors. Thus, utilization of the forecast model should provide the Baltimore FICB more accurate estimates of new money requests.

Once the forecast model was developed for new money requests, the model was developed into a computerized projection model in order to simplify the use of the model in short run forecast work. The computerized projection model was designed to minimize the amount of input data to be provided by the user. Estimates of new loans made, paydown, and new money requests are provided by the program. A complete description of the computer program, an explanation of its use, and a source program listing are included in Appendix D.

CHAPTER V

SUMMARY

This concluding chapter begins with a general summary of the research project. The research objectives are reiterated and methods utilized in accomplishing each objective are summarized. The second section contains a discussion of the weaknesses of the model. A brief conclusion is included in the final section.

Recapitulation

The Farm Credit System has been concerned about the accuracy of their monthly forecasts for new money requests for the Federal Intermediate Credit Banks. The FICB obtains the majority of its funds from bond sales in the nation's money and capital markets. During 1975, 88.8 percent of the funds obtained by the Baltimore FICB came from bond sales. Because of this fact, the study emphasized forecasts of participation in bond sales. The funds obtained by the FICB's are passed on to Production Credit Associations which make short and intermediate term agricultural loans. Due to the current level of the FICBs' lending activity, as well as the expected trends in agricultural lending, the Farm Credit System is seeking ways with which to increase the accuracy of their forecasts. This research project is one attempt at reducing the error of forecasts for new money requests of the Baltimore FICB.

Specific research objectives established for this project were:

1. to determine the historical monthly deviations between actual bond participation and new money requests,

2. to identify and measure the effect of variables (economic, institutional, and environmental) which give rise to changes in monthly new money requests, and

3. utilizing the information from #1 and #2 above, develop a forecast model with which the level of and direction of change in monthly new money requests can be projected.

Information on new loans made, paydown, bond sales, and other variables was obtained from the Baltimore FICB. By definition, new money requests are equal to new loans made minus paydown. The net amount of money obtained from bond sales is by definition, total bond participations less matured bonds less interest paid.

Actual new money requests were plotted over time on the same graph as the FICB's estimates of new money requests (net money obtained from bond sales). The difference between these two lines is the historical deviation between actual bond participations and actual new money requests (see Figure IV.3). In addition, the absolute error experienced by the FICB each month was computed and summed over the sample space to obtain the total absolute error. Total absolute error for 1971 through June 1977 was $215,986,000. Objective one was accomplished through this analysis. Further discussion of this procedure may be found in the section of Chapter IV entitled "Comparing the Model to the FICB's Estimates".

Objective two was accomplished through the use of multiple regression analysis. Parameters of the two components of new money requests, new loans made and paydown, were estimated. Both of the estimated equations had R-squares greater than ninety-four percent, indicating a good fit for both equations. The independent variables included in the specification of the new loans made equation and those included in the specification of the paydown equation were identified as the variables giving rise to the monthly changes in new loans made and paydown. Under the assumptions of multiple regression analysis, the parameter estimates for each of the variables are a measure of the variable's effect on the dependent variable. However, due to the multicollinearity present in the two equations, the independent effects of individual variables cannot be identified. Even though measurement of each variable's effect is not possible, multicollinearity was not an overriding concern since the model is to be used entirely for forecasting.

In order to accomplish objective three, a forecast model was developed by utilizing the results of the multiple regression analysis. Since, by definition, new money requests are equal to new loans made minus paydown, the vector of estimated new money requests can be obtained by calculating the difference between the estimated vector of new loans made and the estimated vector of paydown. The computed R-square for new money requests was 83.59 percent. In addition to the R-square, Theil's inequality coefficient was calculated and turning point analysis was performed. The model was also tested beyond the data base. Estimates of new money requests were obtained from the model for July 1976 through June 1977. These estimates were compared to actual new money requests resulting in an R-square of 76.56

percent while Theil's inequality coefficient was 0.2549. Even though the estimates generated by the model resulted in relatively large errors during several of the months, the model's estimates were more accurate than the FICB's estimates. The results of these tests all indicated that the model's estimates of new money requests closely track actual new money requests.

Weaknesses of the Model

A major factor not accounted for by the model is the hedging activity of the FICB with regards to expected changes in future interest rates. Interest rates vary considerably over time, thus the FICB is constantly looking ahead at possible future movements in interest rates. If they foresee an increase in rates in future months, they may acquire more funds than are necessary and invest them at a short term loss, withdrawing them later when bond interest rates are higher, for a net gain. If they expect a decline in the interest rate, they may acquire only a minimum of funds and allow their liquidity to decrease, knowing that they will enter the bond market more heavily in the future when expected interest rates are lower. While the model does include measures of the existing and expected interest rate, it does not include any measures to account for this hedging activity.

With the information presently at hand, it is difficult to determine the true cost of inaccurate forecasts. FICB officials tend to think of this cost as including only the interest rate loss. Interest rate loss is the cost incurred by the FICB when the interest rate on funds over and above their monthly operating needs is greater than the rate these funds can be invested at. On the other hand, when the FICB must obtain additional funds, interest rate loss would be incurred when the rate paid on the additional funds obtained is greater than the rate paid on their bond participations. Interest rate loss, however, is but one component of the cost of inaccurate forecasts. The other component is transaction costs. Transaction costs generally include brokerage fees, telephone calls, the time involved by bank officials in determining the amount and type of transactions, the time involved by bank officials and other employees in actually making the transactions, and any other costs that are incurred. The more transactions that are made, the more time that is spent by officials making these transactions, resulting in more employees being needed to handle the operations of the FICB. Thus, to the extent that transaction costs vary with the Baltimore FICB's bond market activity, a decrease in activity will lower operating costs. These transaction costs which are often overlooked may in fact result in a sizable cost to the FICB. Thus, even if the interest rate loss is zero, there is a cost to inaccurate forecasts.

From a structural standpoint, the multicollinearity existing in the model is a major drawback.[1] A suggestion for possible future work with the model would be to attempt to decrease the linear relationships between variables while maintaining the overall level of

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[1]This precludes an isolation of the individual effects of each independent variable.

predictive ability. This might be achieved by respecification or transformation of variables. Once the multicollinearity in the model is eliminated, the estimated model parameters should be more useful. They could then be used to estimate the respective elasticities. Such information would be useful to the PCAs in determining what factors most greatly affect borrowing and repayment of loans.

Another improvement which could be made in the model would be to identify the cause of the structural change which was hypothesized to occur between 1973 and 1974. If a variable could be identified that caused the change in slopes, it should be included in the model specification and the parameters reestimated.

The multicollinearity precludes isolation of the individual effects of each of the exogenous variables. However, the results do indicate that borrowers of the Production Credit Associations react to the economic variables included. More specific conclusions would be invalid.

The model managed to account for most of the seasonal variation. However, most of the seasonal effect was accounted for primarily by use of monthly dummy variables. It would improve the model structurally if more variables affecting borrower behavior that exhibit seasonal qualities could be found and included in the model. This would relate the seasonal effects to actual variables instead of dummy variables.

The model was developed entirely for predictive purposes. Because of this fact, the weaknesses discussed above, and the constant rapid changes which are occurring in agricultural production and finance, it is suggested that the forecast model be updated at least annually. In any attempt at modeling a dynamic system, the predictive accuracy can be expected to decrease as one gets further from the data base used to estimate the model parameters.

Conclusions

In summary, the results of the model presented in Chapter IV indicate that the model should be useful in forecast work. None of the shortcomings of the model discussed above are of a serious nature considering its intended use. Implementation of the model in short-run forecast work by the Baltimore FICB should prove beneficial. But as mentioned previously, the results of some of the tests can only be justly considered while taking into account exterior forces on the FICB's past behavior.

As with any statistical model, the results cannot be blindly applied without some analysis of outside factors. Model results might best be used as one input into the entire process used to determine bond participations. Other factors should be considered, of course, and should include those currently in use by the FICB to estimate new money requests. If the model does nothing else, it will provide estimates of new loans made and paydown, information which is presently not available on a current monthly basis. Incorporation of the information generated by the model should help increase the accuracy of the FICB's estimates.

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APPENDIX A

DEVELOPMENT AND REGIONALIZATION OF DATA

APPENDIX A

DEVELOPMENT AND REGIONALIZATION OF DATA

The purpose of this appendix is to present the reader with a basic understanding of where the data used in the model was obtained and what manipulation was done to obtain regional values. This is especially important for cash receipts and expenses since methods had to be developed to obtain regional estimates. A procedure also had to be developed to obtain monthly estimates for the expense values since only annual values are reported.

Cash Receipts

Monthly cash receipts by states are available from Farm Income Statistics published annually by the Economic Research Service of the United States Department of Agriculture (ERS, USDA). In order to regionalize cash receipts, the composition of cash receipts in each state was determined. Major commodity groups were selected on the basis of their contribution to total cash receipts over the five year time period (1971-75). Only those commodities which, on the average, accounted for one percent or more of state cash receipts were selected. The following commodity groups were chosen: beef, hogs, dairy, eggs, broilers, wheat, corn, hay, barley, tobacco, soybeans, peanuts, potatoes, and applies. Sales of these major commodity groups generally accounted for greater than ninety percent of total cash receipts for each state in the Baltimore District and should, therefore, be considered a highly representative as measures of total cash receipts.

Once the commodity groups were selected, the cash receipts from each commodity had to be distributed among the regions in the District. Production data by counties were obtained for 1971-75 from annual summaries prepared by the Statistical Reporting Service of the USDA working in conjunction with State Departments of Agriculture. Values of commodities produced were used when they were available. In the absence of this data, however, actual quantities produced were used. For those states which had counties in more than one region, county totals by commodity were obtained for those counties within each region. These county totals within a region were divided by state totals to obtain the proportion of State production of each commodity within the respective region. These proportions were averaged over the five year time period, resulting in the five year average crop proportions. State total cash receipts by commodity were then distributed (for each of the five years) on the basis of the five year average crop proportions calculated above. These estimated commodity cash receipts for the counties of the state in each region were summed over all commodities for each of the five years. These totals were then divided by total cash receipts from farm products for each respective year yielding the proportion of state cash receipts in each region. These proportions were averaged to obtain the average proportion of state cash receipts in each region as shown in Table A.1.[1] Regional cash receipts per month were determined by distributing monthly cash receipts using the five year average proportions. These values appear under the CRT column in Tables A.6, A.7, and A.8 at the end of this appendix.

Farm Production Expenses

State farm production expenses are published annually in State Farm Income Statistics by the Economic Research Service. Since the model required monthly farm production expenses, a method had to be developed to obtain monthly regional farm production expenses from annual state farm production expenses. Several assumptions were necessary to accomplish this task. First, it was assumed that each commodity group would account for the same proportion of total state expenses as it did of state cash receipts.[2] It follows that state expenses would be divided among regions in the same proportions as cash receipts and that each commodity would account for the same proportion of total regional expenses as it did total regional cash receipts.

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[1]Since five year averages were used, variations in crop proportions within the time period in question were not accounted for.

[2]Assuming perfect competition, in the long run MR = MC at the point where long run profit equals zero. For this to hold, obviously expenses must equal income. This implies that returns to resources are the same for all commodities.

Table A.1. Average Proportion of State Cash Receipts in Each Region

State	Percent of State Cash Receipts in Region I	Percent of State Cash Receipts in Region II	Percent of State Cash Receipts in Region III
Delaware	100.00	---	---
Maryland	96.42	---	3.58
Pennsylvania	50.93	49.07	---
Virginia	48.96	---	51.04
West Virginia	---	3.99	96.01

As a means of distributing annual commodity expenses per region over months, budgets for each commodity were obtained that were thought to be characteristic of the entire district. Most of the budgets were products of the budget generator currently used by extension specialists at VPI&SU. Other budgets were obtained from budgets prepared by extension personnel familiar with a specific commodity.[3]

Poultry scientists indicated that the major cause of monthly variation in expenses related to production of poultry products was variation in the amount of production during the year. Thus, layer and broiler expenses were distributed to months on the basis of the quantities of eggs and broiler meat produced.[4]

The second assumption was that actual cash expenses were incurred at the time the input was used. This may differ between farmers depending on the credit arrangements of the farm supply dealers they buy from, as well as farmers' utilization of this credit. However, this was felt to be a reasonable assumption and any deviation should have been accounted for by the lag used on this variable.

Once monthly production expenses for each commodity and region were determined, total regional expenses per month were calculated by summing over all commodities. This was done for all five years in

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[3]Apple budgets, for example, came from research conducted by Dr. Joe M. Johnson, Extension Specialist, VPI&SU. Hog budgets were provided by Gerald G. Gallimore, Farm Management Extension Agent.

[4]Production was measured using the total numbers of cartons of eggs and pounds of meat produced or obtained from various issues of <u>Poultry and Egg Situation</u>, ERS, USDA.

the sample set. The regional monthly proportions of production expenses shown in Table A-2 were determined by dividing monthly regional expenses by annual regional expenses. These monthly regional expense percentages were then multiplied by the index of prices paid for production items for that month. The result was a measure of the relative magnitude (REX) of each month's expenses within a region. This method implicitly assumes that the proportion of regional expenses incurred in any month will remain constant over time.

In order for differences and ratios between receipts and expenses to be meaningful, a measure of expenses needed to be developed of equal magnitude to actual expenses. Coefficients of simple linear regression equations were computed for each month of the year for each region. These equations were of the form:

(A.1) $EXP_{ij} = \alpha_{ij} + \beta_{ij} (REX_{ij})$

where:

i = month = 1, 2, 3, ... 12.

j = region = 1, 2, 3.

EXP_{ij} = estimate of monthly farm production expenses for the region in millions of dollars.

REX_{ij} = relative expense measure for the region.

REX_{ij} = (monthly expense proportion) x (index of prices paid) example for January, Region I. REX_{ij} = (.0584) x (322) = 18.80.

The actual regression equations appear in Tables A.3, A.4, and A.5 for Regions I, II, and III, respectively. With these equations, estimates of the actual expenses in any month can be obtained by picking the regression equation for that region and month and inserting that month's

Table A.2. Monthly Proportions of Annual Production Expenses

Month	Region I	Region II	Region III
	---------- percent ----------		
January	5.84	7.52	5.99
February	5.84	8.08	6.02
March	7.65	9.70	8.13
April	8.07	10.24	11.38
May	18.61	10.09	8.57
June	5.50	5.23	4.94
July	5.75	5.72	6.20
August	7.38	5.75	9.07
September	6.62	7.17	8.43
October	13.22	14.58	18.06
November	9.40	7.76	7.27
December	6.11	8.14	5.96

Table A.3. Equations for Estimating Actual Monthly Expenses (Region I)

Month	Intercept (α)	Slope (B)	r^2
January	-4.91579	4.11145	.94255
February	-9.03870	4.28359	.95187
March	-20.54842	4.53984	.95930
April	-13.14543	4.19850	.97984
May	-30.43883	4.16687	.97660
June	-8.00809	4.04905	.97397
July	-9.56164	4.09216	.98641
August	-7.36386	3.84066	.98719
September	-4.26716	3.73474	.99573
October	-13.64007	3.83647	.99305
November	-7.81764	3.75824	.99458
December	-6.47362	3.77245	.98824

Table A.4. Equations for Estimating Actual Monthly Expenses (Region II)

Month	Intercept (α)	Slope (B)	r^2
January	-3.80825	1.60720	.95304
February	-7.05428	1.69051	.97022
March	-10.32972	1.72551	.98001
April	-8.18250	1.63910	.98555
May	-8.01227	1.62324	.98040
June	-3.93008	1.58415	.97355
July	-4.52568	1.59189	.98690
August	-2.95720	1.48886	.98175
September	-2.83118	1.45200	.99492
October	-7.92202	1.49134	.99217
November	-3.65255	1.46169	.99538
December	-4.53270	1.46795	.98819

Table A.5. Equations for Estimating Actual Monthly Expenses (Region III)

Month	Intercept (α)	Slope (B)	r^2
January	2.31447	1.21876	.93903
February	0.58949	1.28595	.95925
March	-0.41437	1.31170	.97250
April	1.68868	1.24774	.97766
May	1.27991	1.23727	.97414
June	0.85681	1.20797	.97122
July	0.83971	1.21632	.98593
August	3.01098	1.14126	.98846
September	5.62462	1.11086	.99808
October	5.62089	1.14248	.99752
November	2.74611	1.11726	.99786
December	1.79035	1.12506	.99373

relative expense measure (REX) and calculating the estimate. This greatly simplifies estimation of the equations in the finalized models. All that is needed to obtain an accurate measure of actual expenses is an estimate of the index of prices paid for production items for that particular month. The estimated regional monthly expenses appear under the EXP columns of Tables A.6, A.7, and A.8.

Weather Data

Total monthly precipitation is collected by climatological divisions established by the National Oceanic and Atmospheric Administration (NOAA). Generally, the regional boundaries used in this study and NOAA's divisional boundaries coincided. Thus, in order to obtain average regional precipitation in any month, the total precipitation (water equivalent) for all weather divisions within that region were averaged.

Between Regions I and III, two weather divisions in Virginia crossed regional boundaries and had to be split. For the original data base, a central weather station was selected for each county in each of the two divisions. Those counties inside of Region I from each of the divisions in both Region I and III were averaged and used as one weather division. The same was done for Region III. Since this resulted in a great deal of data collection and computations, it is suggested that the two divisions which need to be split, be averaged and the average used as one division in calculating Region I's precipitation and again used as one division in calculating Region II's precipitation. Due to the number of other divisions in each region that are averaged together, this time saving process results in very little difference in the final average regional precipitation. The regional values for precipitation appear in Tables A.6, A.7, and A.8 in the PREC column.

Loan Data

Data on new loans made, paydown, and loans outstanding was obtained from the Baltimore FICB. All data were on the association level and by month. Values from associations in each region (see Table III.1) were summed and these regional totals used in the model. Puerto Rico was not included in any of the regions due to the unavailability of comparable data and the differences in the types of agricultural production. The regionalized values of new loans made, paydown, and loans outstanding appear in the NM, PD, and LO columns, respectively of Tables A.6, A.7, and A.8.

The interest rate charged the PCAs by the FICB was also obtained from the Baltimore FICB. Most PCAs merely add 50 to 150 basis points to the FICB rate to determine the rate they charge borrowers. Thus, one percent (100 basis points) was added to the FICB rate to obtain the rate charged borrowers by the PCAs (FR). The same rate was used in all three regions. Values of this rate appear in the FR column of Tables A.6, A.7, and A.8.

Inflation

The measure of inflation that was used was the Implicit Gross National Product Price Deflator. Since this was an aggregate measure, the same rate was used for all regions. This indicator is reported on a quarterly basis only. In order to get monthly observations, the monthly values were extrapolated. This was done by letting the recorded value be the value associated with the middle month of the quarter (i.e., February, May, August, November). The difference between the two quarterly values was split into thirds so that the monthly change between quarterly values would be constant. Values of this variable appear in the INF columns of Tables A.6, A.7, and A.8.

PCAs' Share of Loan Volume

The total loan volume of short term agricultural loans held by each category of institutional lender in each state is published annually by the ERS in Agricultural Finance Statistics. The PCA loan volume and the total short term agricultural loan volume in each state in the district were split in the same proportions as cash receipts. This made it possible to obtain annual regional values. These annual values were then used to compute the PCAs' share of total short term agricultural loans in each region held by institutional lenders. Since this is also an annual value, it was assumed to be the annual average. This value was assigned to the month of June and monthly estimates were obtained by extrapolating and smoothing between the annual data. The result was the SHARE values in Tables A.6, A.7, and A.8.

The Commercial Interest Rate

The measure of the commercial bank interest rate used was the rate on short term business loans at seven northeast centers as reported by the Federal Reserve Bulletin. The same rate was used in all three regions. Tables A.6, A.7, and A.8 contain the values of this variable under the column heading BR.

Table A.6. Region I. Data

OBS	NM	PD	LO	CRT	PREC	FR	BR
1	4102	4485	96.650	.	.	.	.
2	5142	3817	97.975	.	.	.	.
3	6625	5783	98.817	.	.	.	.
4	6311	3168	101.960	.	.	.	.
5	4682	3620	103.022	.	.	.	.
6	5239	3598	104.563	.	.	.	.
7	4198	4104	104.657	.	.	.	.
8	3724	3136	105.245	.	.	.	.
9	6314	3892	107.657	.	.	.	.
10	6303	5934	108.036	.	.	.	.
11	3962	5237	106.761	114.326	4.42	9.09	7.18
12	6268	6265	106.764	98.427	3.19	8.91	7.18
13	4489	4074	114.467	95.792	2.87	8.66	7.18
14	5480	3888	116.059	88.886	5.22	8.23	6.80
15	7565	5403	118.221	100.343	3.41	7.78	6.80
16	7444	5165	120.500	103.925	1.87	7.38	6.80
17	6048	4860	121.688	101.945	6.47	7.10	6.25
18	6732	4709	123.711	103.053	2.16	6.93	6.25

OBS	EXP	SHARE	INF	ROI	RATEDIF	RR
1	.	.	.	.	.	.
2	.	.	89.31	.	.	.
3	.	.	90.18	.	.	.
4	.	.	90.51	.	.	.
5	.	.	90.91	.	.	.
6	.	.	91.19	.	.	.
7	.	.	91.46	.	.	.
8	.	.	91.74	.	.	.
9	.	.	92.16	.	.	.
10	148.14	.	92.57	.	.	.
11	104.89	.	92.99	1.08996	-1.91	126.602
12	67.50	.	93.46	1.45818	-1.73	124.095
13	72.38	35.98	93.93	1.32346	-1.48	120.613
14	72.26	36.06	94.40	1.23009	-1.43	121.029
15	93.04	36.14	94.84	1.07849	-0.98	114.412
16	98.32	36.22	95.29	1.05701	-0.58	108.529
17	225.45	36.30	95.73	0.45218	-0.85	113.600
18	66.17	36.38	96.00	1.55740	-0.68	110.880

Table A.6--Continued.

OBS	NM	PO	LO	CRT	PREC	FR	RR
19	5347	4496	124.562	112.552	3.60	6.87	6.25
20	5345	4200	125.707	109.961	7.37	6.85	6.77
21	6615	4575	127.747	136.059	4.18	6.85	6.77
22	6606	6795	127.558	156.181	6.62	6.85	6.77
23	6573	6808	127.323	138.205	3.93	6.92	6.40
24	8415	8116	128.930	108.884	1.67	6.98	6.40
25	7209	4902	131.237	100.409	2.89	7.16	6.40
26	6051	4392	132.896	95.316	5.21	7.08	5.72
27	8298	4875	136.319	104.656	2.67	6.87	5.72
28	8215	5100	139.434	103.422	4.14	6.80	5.72
29	7178	5392	141.220	113.068	4.61	6.73	5.81
30	6622	4935	142.907	106.423	10.28	6.67	5.81
31	4929	4238	143.598	114.856	3.46	6.61	5.81
32	5630	6101	143.177	119.825	2.78	6.63	6.14
33	6327	5522	143.932	151.558	2.75	6.66	6.14
34	7793	6640	145.135	175.300	4.39	6.69	6.14
35	6186	8363	142.958	141.823	6.82	6.86	6.61
36	8384	8345	142.997	116.994	5.30	7.03	6.61

OBS	EXP	SHARE	INF	ROI	RATEDIF	RR
19	68.56	36.46	96.26	1.64166	-0.62	109.920
20	87.04	36.55	96.53	1.26334	-0.08	101.182
21	78.05	36.64	96.81	1.74323	-0.08	101.182
22	154.74	36.73	97.10	1.00931	-0.08	101.182
23	110.53	36.82	97.38	1.25038	-0.52	108.125
24	70.75	36.91	97.84	1.53900	-0.58	109.062
25	76.24	37.00	98.30	1.31701	-0.76	111.875
26	76.03	37.09	98.76	1.25366	-1.36	123.776
27	97.90	37.18	98.99	1.07105	-1.15	120.105
28	102.73	37.27	99.22	1.00674	-1.08	118.881
29	236.32	37.35	99.45	0.47845	-0.92	115.835
30	69.05	37.43	99.73	1.54125	-0.86	114.802
31	72.57	37.45	100.01	1.58269	-0.80	113.769
32	91.57	37.47	100.29	1.30856	-0.49	107.980
33	83.50	37.49	100.67	1.81507	-0.52	108.469
34	167.94	37.51	101.06	1.04383	-0.55	108.958
35	119.70	37.53	101.44	1.18482	-0.25	103.782
36	78.60	37.55	101.97	1.48847	-0.42	106.354

Table A.6--Continued.

OBS	NM	PD	LO	CRT	PREC	FR	BR
37	6712	6774	142.935	125.849	3.11	7.10	6.61
38	7145	6696	143.384	110.943	3.24	7.15	6.89
39	9491	6702	146.173	128.646	3.30	7.29	6.89
40	8455	6502	148.126	132.955	5.51	7.49	6.89
41	9935	6469	151.592	134.675	4.24	7.72	7.71
42	7124	6701	153.732	133.114	4.20	7.93	7.71
43	7177	5650	155.259	161.560	2.80	8.01	7.71
44	7623	9595	155.828	179.650	5.19	8.35	9.49
45	6695	8174	156.195	217.845	3.57	8.85	9.49
46	9255	11536	154.860	269.434	2.96	9.12	9.49
47	6734	10104	152.455	205.669	1.45	9.19	10.51
48	7856	7634	152.677	155.506	6.14	9.36	10.51
49	8895	8476	152.431	159.660	3.56	9.32	10.51
50	6063	7176	151.318	151.690	1.78	9.46	10.28
51	7661	6239	152.760	152.198	4.31	9.46	10.28
52	12452	6313	158.878	152.943	2.71	9.50	10.28
53	10136	6504	162.511	154.911	4.18	9.53	11.65
54	7863	5984	164.390	140.491	4.29	9.47	11.65

OBS	EXP	SHARE	INF	ROI	RATEDIF	RP
37	86.07	37.57	102.51	1.46217	-0.49	107.413
38	87.51	37.59	103.04	1.26778	-0.26	103.774
39	117.33	37.61	103.64	1.09645	-0.40	105.806
40	122.05	37.63	104.24	1.08935	-0.60	108.708
41	286.70	37.65	104.84	0.46974	-0.01	100.130
42	87.31	37.66	105.47	1.52461	-0.22	102.853
43	90.70	37.63	106.10	1.78126	-0.30	103.891
44	120.45	37.60	106.73	1.49149	1.14	87.987
45	104.75	37.56	107.49	2.07967	0.64	93.256
46	209.03	37.52	108.25	1.28897	0.37	96.101
47	147.27	37.48	109.01	1.39654	1.32	87.441
48	96.78	37.45	109.87	1.60680	1.15	89.058
49	105.76	37.42	110.72	1.50964	1.19	88.677
50	107.05	37.39	111.58	1.41700	0.82	92.023
51	141.30	37.35	112.48	1.07713	0.82	92.023
52	149.17	37.32	113.38	1.02462	0.78	92.412
53	339.45	37.28	114.26	0.45636	2.12	81.803
54	99.33	37.24	115.42	1.41439	2.18	81.288

Table A.6--Continued.

OBS	NM	PD	LD	CRT	PREC	FR	BR
55	11414	8453	162.827	168.746	2.18	9.63	11.65
56	7446	7480	164.728	185.336	5.04	9.60	13.17
57	9817	9851	164.694	213.453	4.87	9.69	13.17
58	13139	7129	186.117	291.322	1.33	9.78	13.17
59	8537	9745	184.875	208.331	1.51	9.84	12.22
60	13551	8068	175.830	152.934	4.49	9.92	12.22
61	10582	7913	178.499	162.731	4.38	9.93	12.22
62	8948	5535	181.912	133.833	2.95	9.72	10.31
63	8971	6851	184.555	141.781	5.62	9.31	10.31
64	13681	8931	189.315	154.806	3.09	8.92	10.31
65	11160	7951	192.524	158.642	4.39	8.93	8.37
66	12293	7708	197.099	158.228	5.23	8.70	8.37
67	8268	7132	198.235	181.116	7.27	8.65	8.37
68	7747	3498	197.484	200.653	3.59	8.48	8.43
69	9541	9242	197.783	249.243	8.68	8.44	8.43
70	12895	11496	199.182	299.866	3.41	8.45	8.43
71	8154	11995	195.341	216.901	2.79	8.44	8.53
72	16361	13002	198.700	173.766	3.08	8.45	8.53

OBS	EXP	SHARE	INF	ROI	RATEDIF	RR
55	105.76	37.37	116.56	1.59556	2.02	82.661
56	133.04	37.50	117.70	1.34263	3.57	72.893
57	125.03	37.64	118.95	1.70721	3.48	73.576
58	252.65	37.77	120.20	1.15504	3.39	74.260
59	177.99	37.90	121.45	1.17046	2.38	80.524
60	115.23	38.03	122.48	1.32721	2.30	81.178
61	120.65	38.16	123.52	1.34679	2.29	81.260
62	120.03	38.29	124.55	1.11541	0.59	94.277
63	158.32	38.43	125.01	0.89553	1.00	90.301
64	164.41	38.56	125.47	0.94159	1.39	86.518
65	380.54	38.69	125.93	0.41689	-0.56	106.691
66	112.05	38.82	126.64	1.41212	-0.33	103.943
67	116.31	38.95	127.36	1.55718	-0.28	103.345
68	145.42	39.08	126.07	1.37982	-0.05	100.593
69	131.23	39.21	128.80	1.89928	-0.01	100.119
70	259.21	39.34	129.54	1.15685	-0.02	100.237
71	186.48	39.47	130.27	1.16313	0.09	98.945
72	120.77	39.60	130.61	1.43882	0.08	99.062

Table A.6--Continued.

OBS	NM	PD	LO	CRT	PREC	FR	BR
73	8991	11472	196.219	169.526	4.87	8.58	8.53
74	9266	8582	196.904	154.688	1.66	8.49	7.93
75	14485	10122	201.367	161.527	2.32	8.48	7.93
76	16976	11115	207.228	160.527	1.58	8.49	7.93
77	13020	7518	212.730	165.766	4.09	8.33	7.79
78	15551	9246	219.035	173.854	2.92	8.17	7.79
79	10666	9302	220.400	186.697	3.91	8.12	7.79
80	10409	7852	222.958	203.850	3.46	8.03	8.18
81	13119	8817	227.260	298.839	4.55	8.01	8.18
82	12323	10018	229.564	290.744	8.04	7.94	8.18
83	10182	15592	224.154	227.978	1.05	7.94	7.62
84	16918	16846	224.226	215.350	2.41	7.89	7.62
85	13098	15028	222.296	178.039	1.97	7.87	7.62
86	13244	11203	224.337	179.104	1.28	7.87	7.24
87	17820	11491	230.666	173.863	3.83	7.77	7.24
88	20063	10157	240.572	181.256	3.21	7.70	7.24
89	18118	10073	248.617	174.041	2.19	7.60	7.39
90	18646	11032	256.231	187.100	.	7.59	7.72

OBS	EXP	SHARE	INF	ROI	RATEDIF	RR
73	128.10	39.60	130.95	1.32339	-0.05	100.586
74	130.55	39.62	131.29	1.18489	-0.56	107.062
75	175.33	39.64	131.85	0.92127	-0.55	106.936
76	179.98	39.66	132.40	0.89192	-0.56	107.062
77	410.02	39.68	132.96	0.40429	-0.54	106.932
78	120.27	39.70	133.44	1.44553	-0.38	104.878
79	126.44	38.71	133.92	1.47657	-0.33	104.236
80	155.05	38.71	134.40	1.31474	0.15	98.166
81	136.91	38.71	135.08	2.18274	0.17	97.922
82	273.42	38.71	135.76	1.06336	0.24	97.066
83	187.90	38.71	136.44	1.21329	-0.32	104.199
84	122.37	38.71	137.12	1.75983	-0.27	103.543
85	131.71	38.71	137.57	1.35175	-0.25	103.281
86	135.55	38.71	138.13	1.32131	-0.63	108.702
87	181.93	38.71	138.87	0.95566	-0.53	107.320
88	187.44	38.71	139.62	0.96701	-0.46	106.354
89	430.18	38.71	140.36	0.40458	-0.21	102.842
90	122.94	38.71	141.10	1.52188	0.13	98.316

Table A.7. Region II Data

OBS	NM	PD	LC	CRT	PREC	FR	BR
1	715	1367	39.414	.	.	.	.
2	837	928	39.323	.	.	.	.
3	1370	1307	39.386	.	.	.	.
4	1862	983	40.265	.	.	.	.
5	1398	1060	40.603	.	.	.	.
6	1675	929	41.349	.	.	.	.
7	1415	1012	41.752	.	.	.	.
8	1513	1201	42.064	.	.	.	.
9	1435	961	42.538	.	.	.	.
10	1706	1144	43.100	.	.	.	.
11	1300	1343	43.057	40.620	4.16	9.09	7.18
12	1282	1500	42.839	41.606	3.47	9.91	7.18
13	955	889	35.617	42.994	2.72	8.66	7.18
14	1006	994	35.629	39.376	4.36	8.23	6.80
15	1997	1298	36.328	45.447	2.51	7.78	6.80
16	2228	1109	37.447	43.953	1.18	7.38	6.80
17	2384	1097	38.734	41.135	3.77	7.10	6.25
18	2131	1156	39.709	39.661	2.86	6.93	6.25

OBS	EXP	SHARE	INF	ROI	RATEDIF	RR
1	.	.	89.81	.	.	.
2	.	.	90.18	.	.	.
3	.	.	90.54	.	.	.
4	.	.	90.91	.	.	.
5	.	.	91.19	.	.	.
6	.	.	91.46	.	.	.
7	.	.	91.74	.	.	.
8	.	.	92.16	.	.	.
9	.	.	92.57	.	.	.
10	61.44	.	92.99	.	.	.
11	32.52	.	93.46	1.24906	-1.91	126.602
12	33.82	.	.	1.23022	-1.73	124.095
13	35.10	27.73	93.93	1.22490	-1.48	120.613
14	37.34	27.79	94.40	1.05453	-1.43	121.029
15	44.40	27.85	94.84	1.02358	-0.98	114.412
16	47.04	27.91	95.29	0.93437	-0.58	108.529
17	46.04	27.97	95.73	0.89346	-0.85	113.600
18	23.67	28.03	96.00	1.67558	-0.68	110.880

Table A.7--Continued.

OBS	NM	PD	LO	CRT	PRFC	FR	BR
19	1871	868	40.712	42.883	4.59	6.87	6.25
20	1892	1089	41.515	46.770	3.80	6.85	6.77
21	1675	1083	42.107	48.451	4.95	6.85	6.77
22	3007	1208	43.906	50.889	2.15	6.85	6.77
23	1621	1397	44.130	47.420	3.25	6.92	6.40
24	1431	1308	44.253	43.749	3.15	6.98	6.40
25	1494	1234	44.513	46.885	2.54	7.16	6.40
26	1621	1291	44.843	44.339	3.83	7.08	5.72
27	1721	1558	45.006	47.792	3.32	6.87	5.72
28	2290	1597	45.699	44.327	4.53	6.80	5.72
29	2849	1475	47.073	42.645	4.46	6.73	5.81
30	2220	2081	47.212	39.914	10.20	6.67	5.81
31	2006	1321	47.897	41.185	3.85	6.61	5.81
32	1994	1220	48.671	45.203	2.56	6.63	6.14
33	1940	1179	49.432	49.392	3.13	6.66	6.14
34	1998	1336	50.094	51.585	2.64	6.69	6.14
35	1862	1832	50.124	49.364	5.03	6.86	6.61
36	1500	1762	49.862	49.213	4.61	7.03	6.61

OBS	EXP	SHARE	INF	ROI	RATEDIF	RR
19	25.70	28.09	96.26	1.66879	-0.62	109.920
20	25.55	28.15	96.53	1.83053	-0.08	101.182
21	31.84	28.22	96.81	1.52170	-0.08	101.182
22	64.27	28.29	97.10	0.79180	-0.08	101.182
23	34.35	28.36	97.38	1.38049	-0.52	108.125
24	35.50	28.42	97.64	1.23237	-0.58	109.062
25	37.05	28.48	98.30	1.26545	-0.76	111.875
26	39.38	28.54	98.76	1.12593	-1.36	123.776
27	46.75	28.61	98.99	1.02229	-1.15	120.105
28	49.22	28.68	99.22	0.90059	-1.08	118.881
29	48.33	28.74	99.45	0.88237	-0.92	115.835
30	24.90	28.80	99.73	1.60297	-0.86	114.802
31	27.25	28.80	100.01	1.51138	-0.80	113.769
32	26.92	28.81	100.29	1.67916	-0.49	107.980
33	32.67	28.81	100.67	1.51154	-0.52	108.469
34	69.93	28.81	101.06	0.73767	-0.55	108.958
35	37.29	28.82	101.44	1.32379	-0.25	103.782
36	39.56	28.82	101.97	1.24401	-0.42	106.354

Table A.7--Continued.

OBS	NM	PD	LO	CRT	PREC	FR	BR
37	1805	2020	49.647	52.555	2.46	7.10	6.61
38	1890	1580	49.957	47.514	2.40	7.15	6.89
39	2291	2121	50.127	53.187	2.84	7.29	6.89
40	2316	1951	50.992	49.117	5.20	7.49	6.89
41	3229	1916	52.305	48.332	4.53	7.72	7.71
42	3018	1717	53.606	46.835	4.75	7.93	7.71
43	2046	1579	54.073	52.034	3.63	8.01	7.71
44	2568	2541	54.100	62.894	3.70	8.35	9.49
45	2263	1846	54.517	66.885	4.28	8.85	9.49
46	2864	2020	55.361	73.817	3.43	9.12	9.49
47	2173	1638	55.896	66.101	2.81	9.19	10.51
48	1709	1520	56.085	64.890	4.50	9.36	10.51
49	1831	2092	55.824	71.543	3.60	9.32	10.51
50	1854	2052	55.626	65.995	1.81	9.46	10.28
51	2463	2122	55.947	66.462	4.42	9.46	10.28
52	3348	2554	56.761	63.796	2.77	9.50	10.28
53	3546	1687	58.620	59.018	4.49	9.53	11.65
54	2685	2400	58.905	51.256	5.34	9.47	11.65

OBS	EXP	SHARE	INF	ROI	RATEDIF	RR
37	42.00	28.82	102.51	1.25131	-0.49	107.413
38	45.67	28.82	103.04	1.04038	-0.26	103.774
39	56.12	28.82	103.64	0.94774	-0.40	105.806
40	58.79	28.83	104.24	0.83547	-0.60	108.708
41	58.98	28.83	104.84	0.81946	-0.01	100.130
42	31.52	28.83	105.47	1.48588	-0.22	102.853
43	34.27	28.92	106.10	1.51835	-0.30	103.891
44	35.65	29.02	106.73	1.76421	1.14	87.987
45	43.08	29.12	107.49	1.55258	0.64	93.256
46	87.54	29.22	108.25	0.84324	0.37	96.101
47	46.15	29.32	109.01	1.43231	1.32	87.441
48	49.00	29.42	109.87	1.32429	1.15	89.058
49	51.91	29.52	110.72	1.37821	1.19	88.677
50	56.32	29.62	111.58	1.17179	0.82	92.023
51	67.66	29.71	112.48	0.98229	0.82	92.023
52	72.22	29.80	113.38	0.88336	0.78	92.412
53	70.11	29.90	114.28	0.84179	2.12	81.803
54	36.01	30.00	115.42	1.42338	2.18	81.288

Table A.7--Continued.

OBS	NM	PD	LD	CRT	PREC	FR	BR
55	2716	2103	59.661	64.127	3.94	9.63	11.65
56	2429	1069	60.274	63.370	3.89	9.60	13.17
57	2953	1593	61.634	64.837	4.66	9.69	13.17
58	3148	2082	48.138	72.108	1.29	9.78	13.17
59	2409	2087	48.494	65.365	2.79	9.84	12.22
60	2126	2201	62.947	63.467	4.21	9.92	12.22
61	2436	2216	63.167	71.529	3.52	9.93	12.22
62	2254	1805	63.616	57.883	3.70	9.72	10.31
63	3341	2103	64.321	61.387	3.75	9.31	10.31
64	3822	3133	65.010	61.323	2.60	8.92	10.31
65	3660	2205	66.465	61.298	4.34	8.93	8.37
66	3001	1882	67.584	57.780	5.40	8.70	8.37
67	2646	2305	67.925	63.580	3.28	8.65	8.37
68	2351	2057	68.219	70.972	5.72	8.48	8.43
69	2687	2513	68.393	73.874	6.98	8.44	8.43
70	2891	2304	68.980	77.781	3.40	8.45	8.43
71	2128	2446	68.662	72.258	2.40	8.44	8.53
72	2467	2961	68.168	72.102	3.32	8.45	8.53

OBS	EXP	SHARE	INF	ROI	RATEDIF	RR
55	40.09	30.17	116.56	1.59958	2.02	82.661
56	40.96	30.35	117.70	1.54712	3.57	72.893
57	51.62	30.53	118.95	1.25604	3.48	73.576
58	106.24	30.71	120.20	0.67873	3.39	74.260
59	56.01	30.89	121.45	1.16702	2.38	80.524
60	58.56	31.06	122.48	1.08379	2.30	81.178
61	59.40	31.23	123.52	1.20419	2.29	81.260
62	63.42	31.41	124.55	0.91269	0.59	94.277
63	75.88	31.59	125.01	0.80900	1.00	90.301
64	79.77	31.77	125.47	0.76875	1.39	86.518
65	78.80	31.95	125.93	0.77789	-0.56	106.691
66	40.73	32.12	126.64	1.41861	-0.33	103.943
67	44.19	32.29	127.36	1.43879	-0.28	103.345
68	43.18	32.46	128.07	1.64363	-0.05	100.593
69	54.22	32.63	128.80	1.36249	-0.01	100.119
70	109.06	32.80	129.54	0.71319	-0.02	100.237
71	58.73	32.97	130.27	1.23034	0.09	98.945
72	61.42	33.14	130.61	1.17392	0.08	99.062

Table A.7--Continued.

OBS	NM	PD	LO	CRT	PREC	FR	BR
73	1699	2317	67.550	77.704	3.57	8.58	8.53
74	2130	2574	67.106	70.745	2.46	8.49	7.93
75	3600	2961	67.746	74.468	2.93	8.48	7.93
76	4600	3000	69.346	66.298	2.09	8.49	7.93
77	4571	2641	71.275	72.145	3.24	8.33	7.79
78	4144	2785	72.633	64.705	4.98	8.17	7.79
79	3243	2592	73.285	69.474	4.39	8.12	7.79
80	2937	2552	73.669	73.131	3.22	8.03	8.18
81	3527	2675	74.521	88.164	3.81	8.01	8.18
82	2640	2667	74.494	82.440	6.77	7.94	8.18
83	2792	3437	73.849	76.233	0.99	7.94	7.62
84	2233	2995	73.087	91.739	2.08	7.89	7.62
85	1894	2405	72.577	79.726	1.53	7.87	7.62
86	2370	3118	71.828	78.040	1.60	7.87	7.24
87	4411	3377	72.862	77.500	5.10	7.77	7.24
88	4972	3156	74.678	75.033	3.95	7.70	7.24
89	4770	3241	76.207	65.585	1.89	7.60	7.39
90	5052	2957	78.302	68.165	.	7.59	7.72

OBS	EXP	SHARE	INF	RCI	RATECIF	RR
73	63.15	33.15	130.95	1.23047	-0.95	100.586
74	69.16	33.15	131.29	1.02292	-0.56	107.062
75	84.07	33.16	131.85	0.88579	-0.55	106.936
76	87.49	33.16	132.40	0.75778	-0.56	107.062
77	85.02	33.17	132.96	0.84958	-0.54	106.932
78	43.79	33.17	133.44	1.47762	-0.38	104.878
79	48.10	32.00	133.92	1.44437	-0.33	104.236
80	46.10	32.00	134.40	1.58636	0.15	98.166
81	56.61	32.00	135.08	1.55739	0.17	97.922
82	115.15	32.00	135.76	0.71594	0.24	97.066
83	59.19	32.00	136.44	1.23794	-0.32	104.199
84	62.26	32.00	137.12	1.47429	-0.27	103.543
85	64.96	32.00	137.57	1.22731	-0.25	103.281
86	71.90	32.00	138.13	1.08540	-0.63	108.702
87	87.25	32.00	138.87	0.88825	-0.53	107.320
88	91.18	32.00	139.62	0.82291	-0.46	106.354
89	89.28	32.00	140.36	0.73460	-0.21	102.842
90	44.79	32.00	141.10	1.52188	0.13	98.316

Table A.8. Region III Data

OBS	NM	PD	LO	CRT	PREC	FR	BR
1	1209	1266	31.878	.	.	.	.
2	1101	965	32.014	.	.	.	.
3	1696	1162	32.548	.	.	.	.
4	1924	1310	33.162	.	.	.	.
5	1718	919	33.961	.	.	.	.
6	1932	1000	34.893	.	.	.	.
7	1670	1179	35.384	.	.	.	.
8	1648	1042	35.990	.	.	.	.
9	1927	1660	36.257	.	.	.	.
10	2252	2812	35.697	.	.	.	.
11	2226	2311	35.612	45.256	3.30	9.09	7.18
12	1883	1570	35.925	33.708	3.29	8.91	7.18
13	1666	1380	36.211	25.023	3.20	8.66	7.18
14	1208	1140	36.279	22.023	3.80	8.23	6.80
15	1718	1188	36.809	23.362	2.30	7.78	6.80
16	2574	1773	37.610	25.097	2.01	7.38	6.80
17	1915	1343	38.182	22.917	6.46	7.10	6.25
18	2240	1364	39.058	26.553	3.40	6.93	6.25

OBS	EXP	SHARE	INF	ROI	RATEDIF	RR
1	.	.	.	.	.	.
2	.	.	89.81	.	.	.
3	.	.	90.18	.	.	.
4	.	.	90.54	.	.	.
5	.	.	90.91	.	.	.
6	.	.	91.19	.	.	.
7	.	.	91.46	.	.	.
8	.	.	91.74	.	.	.
9	.	.	92.16	.	.	.
10	71.44	.	92.57	.	.	.
11	28.66	.	92.99	1.57906	-1.91	126.602
12	23.31	.	93.46	1.44607	-1.73	124.095
13	25.82	29.71	93.93	0.96913	-1.48	120.613
14	25.76	29.86	94.40	0.85493	-1.43	121.029
15	34.46	29.01	94.84	0.67795	-0.98	114.412
16	48.40	29.16	95.29	0.51853	-0.58	108.529
17	36.27	29.31	95.73	0.63184	-0.85	113.600
18	20.73	29.46	96.00	1.28090	-0.68	110.880

Table A.8--Continued.

OBS	NM	PD	LD	CRT	PREC	FF	BR
19	2014	949	40.123	32.807	5.03	6.87	6.25
20	2101	1019	41.205	31.492	3.47	6.85	6.77
21	2056	1695	41.566	48.781	5.43	6.85	6.77
22	2834	2777	41.623	72.291	3.84	6.85	6.77
23	3223	2383	42.463	55.129	2.54	6.92	6.40
24	2339	1687	43.115	33.595	1.51	6.98	6.40
25	1660	1600	43.175	27.107	3.36	7.16	6.40
26	1842	1364	43.653	23.983	4.97	7.08	5.72
27	2343	1866	44.130	27.233	2.38	6.87	5.72
28	3173	1731	45.572	28.594	4.87	6.80	5.72
29	2734	1386	46.420	25.841	4.85	6.73	5.81
30	2746	1463	47.703	28.753	7.21	6.67	5.81
31	1975	1221	48.457	37.231	4.72	6.61	5.81
32	3172	1501	50.128	35.023	3.43	6.63	6.14
33	1938	2184	49.882	61.268	3.33	6.66	6.14
34	3473	3811	49.544	80.614	4.09	6.69	6.14
35	2989	3176	49.357	53.704	5.06	6.86	6.61
36	2675	2363	49.669	36.005	5.36	7.03	6.61

OBS	EXP	SHARE	INF	ROI	RATEDIF	RR
19	25.87	29.61	96.26	1.26815	-0.62	109.920
20	37.48	29.76	96.53	0.84023	-0.08	101.182
21	34.81	29.91	96.81	1.40135	-0.08	101.182
22	74.12	30.06	97.10	0.97532	-0.08	101.182
23	29.95	30.21	97.38	1.84070	-0.52	108.125
24	24.26	30.36	97.84	1.38479	-0.58	109.062
25	26.99	30.51	98.30	1.00433	-0.76	111.875
26	26.91	30.66	98.76	0.89123	-1.36	123.776
27	35.95	30.80	98.99	0.75892	-1.15	120.105
28	50.25	30.95	99.22	0.56903	-1.08	118.881
29	37.75	30.10	99.45	0.68453	-0.92	115.835
30	21.62	31.25	99.73	1.32993	-0.86	114.802
31	27.16	31.34	100.01	1.37080	-0.80	113.769
32	39.13	31.43	100.29	0.89504	-0.49	107.980
33	36.87	31.52	100.67	1.66173	-0.52	108.469
34	79.43	31.61	101.06	1.01427	-0.55	108.958
35	32.06	31.70	101.44	1.67511	-0.25	103.782
36	26.53	31.80	101.97	1.35714	-0.42	106.354

Table A.8--Continued.

OBS	NM	PD	LO	CRT	PREC	FR	BR
37	2185	2156	49.698	35.779	2.14	7.10	6.61
38	2197	1619	50.276	29.219	2.87	7.15	6.89
39	2958	2198	51.040	34.447	3.90	7.29	6.89
40	3401	2689	51.752	36.428	5.46	7.49	6.89
41	2985	1925	52.812	31.296	4.66	7.72	7.71
42	2877	1728	53.961	37.188	3.46	7.93	7.71
43	2577	1792	54.746	49.496	4.37	8.01	7.71
44	4382	2196	56.932	49.962	3.68	8.35	9.49
45	2434	2048	57.318	77.915	2.91	8.85	9.49
46	4025	2688	57.709	109.819	4.26	9.12	9.49
47	3745	3324	57.165	88.027	3.33	9.19	10.51
48	2928	2582	57.511	50.679	4.88	9.36	10.51
49	2365	2407	58.134	43.610	4.62	9.32	10.51
50	2505	2039	58.600	37.776	2.09	9.46	10.28
51	3108	1974	59.734	40.571	3.92	9.46	10.28
52	4443	2514	61.663	40.470	2.80	9.50	10.28
53	4016	2190	63.489	35.143	5.20	9.53	11.65
54	2490	1526	64.453	37.553	5.93	9.47	11.65

OBS	EXP	SHARE	INF	ROI	RATEDIF	RR
37	29.98	31.89	102.51	1.19343	-0.49	107.413
38	30.47	31.98	103.04	0.95894	-0.26	103.774
39	41.93	32.07	103.64	0.82154	-0.40	105.806
40	58.35	32.16	104.24	0.62430	-0.60	108.708
41	44.65	32.25	104.84	0.70092	-0.01	100.130
42	26.39	32.34	105.47	1.40917	-0.22	102.853
43	32.96	32.25	106.10	1.50170	-0.30	103.891
44	49.70	32.16	106.73	1.00527	1.14	87.987
45	44.93	32.06	107.49	1.73414	0.64	93.256
46	96.20	31.97	108.25	1.14157	0.37	96.101
47	38.41	31.88	109.01	2.29177	1.32	87.441
48	31.83	31.79	109.87	1.59216	1.15	89.058
49	35.96	31.70	110.72	1.21274	1.19	88.677
50	36.51	31.61	111.58	1.03468	0.82	92.023
51	49.29	31.51	112.48	0.82311	0.82	92.023
52	69.70	31.41	113.38	0.58063	0.78	92.412
53	51.86	31.32	114.28	0.67765	2.12	81.803
54	29.62	31.23	115.42	1.26783	2.18	81.288

Table A.8--Continued.

OBS	NM	PD	LO	CRT	PREC	FR	BR
55	2270	2764	65.440	51.243	3.26	9.63	11.65
56	3366	3810	66.006	55.212	4.04	9.60	13.17
57	2288	2732	65.562	75.231	3.25	9.69	13.17
58	4379	2182	67.408	108.985	1.81	9.78	13.17
59	3069	3222	67.255	73.015	2.31	9.84	12.22
60	2526	2107	67.674	49.359	3.86	9.92	12.22
61	2993	2277	68.390	42.572	3.70	9.93	12.22
62	2145	2243	68.292	33.012	3.18	9.72	10.31
63	2853	1545	69.600	35.658	6.63	9.31	10.31
64	3967	2266	71.301	37.762	3.51	8.92	10.31
65	3977	2613	72.665	36.887	5.24	8.93	8.37
66	3134	2099	73.700	42.249	4.11	8.70	8.37
67	3108	2246	74.562	53.521	3.88	8.65	8.37
68	2449	2537	74.474	53.600	4.45	8.48	8.43
69	2723	3132	74.065	33.773	6.09	8.44	8.43
70	3253	3973	73.345	114.062	3.14	8.45	8.43
71	2975	3111	73.209	79.068	2.03	8.44	8.53
72	3701	3248	73.662	55.023	2.84	8.45	8.53

OBS	EXP	SHARE	INF	ROI	RATEDIF	RR
55	37.79	31.35	116.56	1.35599	2.02	82.661
56	56.11	31.47	117.70	0.98400	3.57	72.893
57	52.60	31.60	118.95	1.43025	3.48	73.576
58	113.82	31.73	120.20	0.95752	3.39	74.260
59	45.47	31.86	121.45	1.60578	2.38	80.524
60	37.20	31.98	122.48	1.32685	2.30	81.178
61	40.50	32.11	123.52	1.05116	2.29	81.260
62	40.53	32.23	124.55	0.81451	0.59	94.277
63	54.51	32.35	125.01	0.65416	1.00	90.301
64	76.09	32.47	125.47	0.49628	1.39	86.518
65	57.48	32.60	125.93	0.64174	-0.56	106.691
66	33.03	32.72	126.64	1.27911	-0.33	103.943
67	41.19	32.84	127.36	1.29937	-0.28	103.345
68	58.81	32.96	128.07	1.08247	-0.05	100.593
69	54.95	33.08	128.80	1.52453	-0.01	100.119
70	116.62	33.20	129.54	0.97807	-0.02	100.237
71	47.43	33.32	130.27	1.66705	0.09	98.945
72	38.80	33.44	130.61	1.41812	0.08	99.062

Table A.8--Continued.

OBS	NM	PD	LO	CRT	PREC	FR	BR
73	2710	2629	73.743	42.070	3.55	8.58	8.53
74	2693	2588	73.848	36.167	2.01	8.49	7.93
75	3900	2981	74.767	41.305	2.85	8.48	7.93
76	3741	2718	75.790	42.375	1.29	8.49	7.93
77	4174	2660	77.304	38.588	3.60	8.33	7.79
78	4712	2730	79.285	43.341	4.28	8.17	7.79
79	3055	2510	79.831	53.729	4.02	8.12	7.79
80	2680	2504	80.006	93.126	2.59	8.03	8.18
81	3253	3233	80.026	104.198	4.67	8.01	8.18
82	3509	4002	79.534	109.452	8.02	7.94	8.18
83	2921	4584	77.870	84.011	1.23	7.94	7.62
84	3485	3793	77.563	52.762	2.39	7.89	7.62
85	2803	3250	77.116	47.335	1.69	7.87	7.62
86	2677	2334	77.459	55.156	1.07	7.87	7.24
87	4183	2289	79.353	45.037	3.17	7.77	7.24
88	5953	3699	81.607	43.111	4.20	7.70	7.24
89	4265	4300	81.572	36.774	1.81	7.60	7.39
90	4308	4099	81.781	47.832	.	7.59	7.72

OBS	EXP	SHARE	INF	ROI	RATEDIF	RR
73	42.76	33.45	130.95	0.98386	-0.05	100.586
74	43.79	33.45	131.29	0.82592	-0.56	107.062
75	59.73	33.46	131.85	0.69153	-0.55	106.936
76	82.62	33.46	132.40	0.51289	-0.56	107.062
77	61.51	33.47	132.96	0.62735	-0.54	106.932
78	35.23	33.47	133.44	1.23023	-0.38	104.878
79	44.43	33.19	133.92	1.20930	-0.33	104.236
80	62.32	33.19	134.40	1.49432	0.15	98.166
81	57.10	33.19	135.08	1.82483	0.17	97.922
82	122.40	33.19	135.76	0.89422	0.24	97.066
83	47.74	33.19	136.44	1.75976	-0.32	104.199
84	39.27	33.19	137.12	1.34357	-0.27	103.543
85	43.85	33.19	137.57	1.07948	-0.25	103.281
86	45.33	33.19	138.13	1.21677	-0.63	108.702
87	61.76	33.19	138.87	0.72923	-0.53	107.320
88	85.75	33.19	139.62	0.50275	-0.46	106.354
89	64.26	33.19	140.36	0.57227	-0.21	102.842
90	35.94	33.19	141.10	1.33088	0.13	98.316

APPENDIX B

RESULTS OF THE REGIONAL REGRESSION EQUATIONS

APPENDIX B

RESULTS OF THE REGIONAL REGRESSION EQUATIONS

This appendix reports the estimated coefficients, their standard errors and the R-square, F, and Durbin-Watson statistic (D.W.) for both the new loans made and paydown equation for each region alone. Tables B.1, B.3, and B.5 contain the results of the new loans made equation for Regions I, II, and III, respectively. Tables B.2, B.4, and B.6 contain the results of the paydown equation for Regions I, II, and III, respectively.

The estimates under the 1974 - June 1976 column are the betas (β_i), while the estimates under the Adjustment for 1971-73 column are the deltas (δ_i) associated with each beta (see Chapter IV).

Table B.1. Region I Estimation Results: New Loans Made

R-square = 0.9277
F = 9.70
D.W. = 2.09

	1974 - June 1976		Adjustment for 1971-1973	
	Estimate (β_i)	Standard Error	Estimate (δ_i)	Standard Error
Intercept	-168546.15	52398.51	69817.63	106121.34
NLM_{t-12}	117.44	245.82	-128.62	505.06
$RDIF_{t-2}$	806.46	483.35	132.79	787.25
LO_{t-2}	-45.89	65.84	-78.87	151.82
$PREC_{t-2}$	-292.55	212.03	280.53	253.32
BR_t	595.13	423.16	-242.75	656.80
$SHARE_t$	5230.85	1593.61	-2018.96	3295.06
EX_{t-2}	-130.91	51.08	137.84	61.60
M_2	-7951.28	2978.50	8268.85	3418.25
M_3	-5149.38	2709.67	7878.54	3262.34
M_4	-1443.34	2870.31	3824.53	3333.91
M_5	1414.90	1216.18	399.31	1691.20
M_6	2340.17	1098.30	-1404.44	1615.97
M_7	27626.20	9961.48	-28639.24	11023.18
M_8	-8674.34	3444.36	9123.70	4036.75
M_9	-6666.04	3248.75	7453.39	3836.99
M_{10}	-1148.05	2179.16	2408.25	2688.95
M_{11}	-6861.32	2626.97	6869.01	3204.32
M_{12}	14721.36	3995.19	-13575.89	4551.20

Table B.2. Region I Estimation Results: Paydown

R-square = 0.9308
F = 8.97
D.W. = 2.34

	1974 - June 1976		Adjustment for 1971-1973	
	Estimate (β_i)	Standard Error	Estimate (δ_i)	Standard Error
Intercept	60498.74	23382.59	-61500.43	40122.90
NLM_t^a	599.31	344.63	-2436.34	922.91
PD_{t-12}	16.43	240.93	238.09	449.39
IER_{t-2}	-6566.38	5206.86	-24.29	6868.53
RR_{t-2}	-370.86	230.67	432.28	288.29
$RDIF_{t-2}$	-3844.92	1928.72	7350.55	3406.11
LO_{t-3}	8.99	73.76	-78.03	121.45
LO_{t-12}	50.19	47.90	50.91	149.06
INF_t	-168.85	221.63	347.52	430.13
M_2	139.28	1434.32	1703.29	2139.04
M_3	-975.09	1272.53	6134.91	2658.42
M_4	-3939.30	1852.57	7781.69	2572.78
M_5	-5484.63	1795.57	7015.19	2279.84
M_6	-5520.76	1771.44	4839.98	2063.46
M_7	-6855.40	4356.41	-521.58	5683.04
M_8	1090.69	1375.22	1162.32	2080.77
M_9	2525.64	2110.97	429.84	2961.80
M_{10}	-360.63	1590.84	3369.85	2147.40
M_{11}	7085.45	3404.54	-2580.97	4524.55
M_{12}	-1135.31	1731.93	3357.47	2674.58

[a]Estimated using the new loans made equation (Table B.1).

Table B.3. Region II Estimation Results: New Loans Made

R-square = 0.9361
F = 11.08
D.W. = 2.32

	1974 - June 1976		Adjustment for 1971-73	
	Estimate (β_i)	Standard Error	Estimate (δ_i)	Standard Error
Intercept	7055.50	6469.82	-8032.97	13207.79
NLM_{t-12}	182.81	364.98	-287.42	447.10
$RDIF_{t-2}$	-18.51	123.83	307.35	214.44
LO_{t-2}	9.76	23.85	12.74	42.08
$PREC_{t-2}$	141.10	129.15	-110.50	137.11
BR_t	9.56	114.87	28.91	149.15
$SHARE_t$	-500.84	288.90	556.93	529.70
EX_{t-2}	171.99	53.91	-179.24	62.71
M_2	-550.32	407.63	697.65	480.98
M_3	174.35	539.62	626.86	649.69
M_4	177.64	774.18	1124.24	894.86
M_5	-2166.02	1492.68	3867.70	1617.45
M_6	-3181.77	1477.84	4445.68	1612.06
M_7	-3288.85	1381.10	3943.36	1498.17
M_8	2546.17	744.11	-1996.66	892.77
M_9	2637.35	673.57	-2239.22	789.79
M_{10}	2707.22	719.55	-1800.52	885.57
M_{11}	161.36	477.45	-15.92	577.51
M_{12}	-8517.94	2687.60	8624.10	2914.61

Table B.4. Region II Estimation Results: Paydown

R-square = 0.9322
F = 9.17
D.W. = 1.78

	1974 - June 1976		Adjustment for 1971-73	
	Estimate (β_i)	Standard Error	Estimate (δ_i)	Standard Error
Intercept	12320.74	7384.39	-7568.08	10095.16
NLM_t[a]	385.83	395.56	-107.29	1044.34
PD_{t-12}	-418.79	187.38	-293.02	341.30
IER_{t-2}	-1367.65	1305.34	158.46	1870.36
RR_{t-2}	-69.29	73.98	55.40	92.25
$RDIF_{t-2}$	-837.73	623.67	867.92	1120.00
LO_{t-3}	-2.98	19.99	76.15	44.42
LO_{t-12}	39.68	23.42	-19.63	37.28
INF_t	-25.36	25.81	-14.28	65.09
M_2	-342.36	226.25	77.70	329.83
M_3	-250.90	507.11	479.02	783.82
M_4	-404.91	835.31	298.30	1388.35
M_5	-1598.09	959.35	1162.69	1719.28
M_6	-1259.78	829.54	1033.47	1429.90
M_7	-1071.45	752.14	225.84	1126.82
M_8	-755.28	334.74	1069.72	736.85
M_9	-359.96	519.39	328.72	720.42
M_{10}	535.83	642.60	-475.30	1125.93
M_{11}	423.92	365.54	-114.30	487.35
M_{12}	-396.96	747.55	-181.81	1119.26

[a] Estimated using the new loans made equation (Table B.3).

Table B.5. Region III Estimation Results: New Loans Made

R-square = 0.9090
F = 7.56
D.W. = 2.29

	1974 - June 1976		Adjustment for 1971-73	
	Estimate (β_i)	Standard Error	Estimate (δ_i)	Standard Error
Intercept	-41595.74	23727.88	43915.40	24650.11
NLM_{t-12}	-606.83	236.94	971.23	392.36
$RDIF_{t-2}$	-42.04	149.55	143.91	239.64
LO_{t-2}	-250.53	75.62	324.16	94.96
$PREC_{t-2}$	172.02	98.09	-110.36	117.95
BR_t	331.25	157.84	-189.68	196.18
$SHARE_t$	1364.19	863.86	-1468.27	906.27
EX_{t-2}	325.56	85.10	-393.43	96.64
M_2	2328.36	657.99	-2708.68	795.80
M_3	2437.69	461.78	-2226.53	581.65
M_4	3868.74	608.88	-3236.08	766.54
M_5	-936.89	1108.09	1847.49	1207.31
M_6	-8376.72	2816.70	10196.35	3000.39
M_7	-2951.98	1344.78	3478.47	1428.30
M_8	5612.39	1158.99	-5500.83	1322.23
M_9	1942.28	601.37	-2456.11	740.87
M_{10}	-1267.94	1184.39	2526.12	1324.92
M_{11}	-1957.16	887.61	2821.30	1015.99
M_{12}	-21929.37	5912.74	25324.59	6308.73

Table B.6. Region III Estimation Results: Paydown

R-square = 0.9041
F = 6.29
D.W. = 2.05

	1974 - June 1976		Adjustment for 1971-73	
	Estimate (β_i)	Standard Error	Estimate (δ_i)	Standard Error
Intercept	24603.90	21831.58	-10652.90	26106.38
NLM_t^a	-183.46	268.41	211.51	612.51
PD_{t-12}	-594.25	298.81	339.15	664.02
IER_{t-2}	-807.53	1425.95	1392.30	1840.91
RR_{t-2}	31.63	99.65	-151.57	137.38
$RDIF_{t-2}$	367.29	876.57	-2098.91	1620.29
LO_{t-3}	407.21	426.21	-235.65	439.81
LO_{t-12}	199.24	150.58	-291.67	218.61
INF_t	-498.98	472.27	450.50	499.30
M_2	-280.62	484.00	79.46	684.24
M_3	-639.23	817.30	1070.95	1195.49
M_4	-62.01	1081.08	1177.86	1613.15
M_5	-391.04	1258.72	1199.80	1770.39
M_6	-1585.47	1620.01	2272.48	2178.10
M_7	-1176.69	1890.76	1514.10	2308.60
M_8	-5.38	1427.11	144.12	1692.54
M_9	-540.44	1270.06	1088.05	1386.58
M_{10}	-551.39	1628.91	2733.67	2161.04
M_{11}	674.71	943.87	531.35	1264.83
M_{12}	-315.84	1112.27	924.54	1450.41

[a]Estimated using the new loans made equation (Table B.5).

APPENDIX C

CORRELATION COEFFICIENTS

APPENDIX C

CORRELATION COEFFICIENTS

This appendix reports the correlation coefficients between all pairs of both the dependent and independent variables. The coefficients shown are the correlations for the pooled data set.

Table C.1. Correlation Coefficient Matrix

	NLM_t	NLM_{t-12}	PD_t	PD_{t-12}	LD_{t-2}	LD_{t-3}	LD_{t-12}	RR_{t-2}	$RDIF_{t-2}$	IER_{t-2}
NLM_t	1.0000	.9457	.9022	.8744	.9261	.9225	.9231	-.1751	-.2011	.0770
NLM_{t-12}		1.0000	.9062	.8901	.9345	.9340	.9322	-.1343	-.2069	.8984
PD_t			1.0000	.9177	.9390	.9401	.9380	-.1697	-.1580	.2112
PD_{t-12}				1.0000	.9331	.9341	.9315	.7256	-.2331	.2103
LO_{t-2}					1.0000	.9986	.9942	-.1690	-.1989	.1440
LO_{t-3}						1.0000	.9942	-.1695	-.1988	.1596
LO_{t-12}							1.0000	-.1294	-.1901	.1409
RR_{t-2}								1.0000	.7256	-.1237
$RDIF_{t-2}$									1.0000	.0276
IER_{t-2}										1.0000
EX_{t-2}										
$PREC_{t-2}$										
$SHARE_t$										
INF_t										
BR_t										
M_2										
M_3										
M_4										
M_5										
M_6										
M_7										
M_8										
M_9										
M_{10}										
M_{11}										
M_{12}										
RD_2										
RD_3										

Table C.1--Continued.

	EX_{t-2}	$PREC_{t-2}$	$SHARE_t$	INF_t	BR_t	M_2	M_3	M_4	M_5	M_6
NLM_t	.7224	.0051	.8814	.3103	.1944	-.0910	.0048	.0937	.0443	.0022
NLM_{t-12}	.7107	.0745	.8947	.3033	.1858	-.0973	.0174	.0892	.0431	-.0103
PD_t	.6932	.1111	.8970	.2669	.1869	-.0816	-.0504	-.0114	-.0396	-.0548
PD_{t-12}	.6851	.0423	.8900	.2502	.2348	-.0686	-.0355	-.0209	-.0435	-.0533
LO_{t-2}	.7562	.1064	.9527	.2979	.1868	-.0290	-.0262	-.0227	-.0151	-.0033
LO_{t-3}	.7486	.1055	.9528	.2929	.1843	-.0303	-.0265	-.0236	-.0202	-.0124
LO_{t-12}	.7447	.0608	.9497	.2375	.1586	-.0289	-.0214	-.0097	.0012	.0090
RR_{t-2}	-.1824	.0992	-.1357	-.6258	-.8484	-.0892	.0581	.1884	.1135	.0670
$RDIF_{t-2}$	-.2122	.1203	-.1586	-.7741	-.8923	-.0452	-.0823	-.0551	-.0046	.0291
IER_{t-2}	-.2741	.0647	.1160	-.0443	.0978	.1506	.0409	-.1058	-.2428	-.3288
EX_{t-2}	1.0000	.0098	.6992	.2705	.1892	-.1150	-.0949	-.0881	-.0003	.0460
$PREC_{t-2}$		1.0000	.1275	.0715	-.0957	.0039	-.1456	-.1083	-.0555	-.0968
$SHARE_t$			1.0000	.2860	.1410	-.0239	-.0234	-.0171	-.0166	-.0050
INF_t				1.0000	.6783	-.0649	-.0526	-.0403	-.0282	-.0147
BR_t					1.0000	-.0513	-.0513	-.0513	-.0570	-.0570
M_2						1.0000	-.0909	-.0909	-.0909	-.0909
M_3							1.0000	-.0909	-.0909	-.0909
M_4								1.0000	-.0909	-.0909
M_5									1.0000	-.0909
M_6										1.0000
M_7										
M_8										
M_9										
M_{10}										
M_{11}										
M_{12}										
RD_2										
RD_3										

Table C.1--Continued.

	M_7	M_8	M_9	M_{10}	M_{11}	M_{12}	RD_2	RD_3
NLM_t	-.0444	-.0456	-.0222	.0932	-.0320	.0658	-.3706	-.4786
NLM_{t-12}	-.0400	-.0306	-.0172	.1068	-.0177	.0440	-.4969	-.3681
PD_t	-.0573	.0003	.0184	.0967	.1237	.0888	-.4921	-.3849
PD_{t-12}	-.0566	.0074	.0140	.0914	.1302	.0662	-.5077	-.3820
LO_{t-2}	.0074	.0162	.0204	.0246	.0273	.0330	-.4862	-.4549
LO_{t-3}	-.0004	.0105	.0194	.0237	.0280	.0307	-.4869	-.4560
LO_{t-12}	.0133	.0192	.0226	.0295	-.0037	.0007	-.4923	-.4696
RR_{t-2}	.0819	.0556	.0545	-.1736	-.1371	-.1118	0.0000	0.0000
$RDIF_{t-2}$	.0333	.0502	.0464	.0411	.0096	-.0122	0.0000	0.0000
IER_{t-2}	-.4659	.2066	.2674	.1173	.3535	-.2003	.0133	-.1692
EX_{t-2}	.3104	-.1384	-.1144	-.0421	-.0547	.2924	-.3138	-.3763
$PREC_{t-2}$	.1711	.2666	.0070	.0457	.1325	-.1437	-.0665	-.0099
$SHARE_t$	.0018	.0088	.0158	.0228	.0299	.0369	-.6399	-.2821
INF_t	-.0011	.0126	.0282	.0439	.0596	.0940	0.0000	0.0000
BR_t	-.0570	.0570	.0570	.0570	.0638	.0638	0.0000	0.0000
M_2	-.0909	-.0909	-.0909	-.0909	-.0909	-.0909	0.0000	0.0000
M_3	-.0909	-.0909	-.0909	-.0909	-.0909	-.0909	0.0000	0.0000
M_4	-.0909	-.0909	-.0909	-.0909	-.0909	-.0909	0.0000	0.0000
M_5	-.0909	-.0909	-.0909	-.0909	-.0909	-.0909	0.0000	0.0000
M_6	-.0909	-.0909	-.0909	-.0909	-.0909	-.0909	0.0000	0.0000
M_7	1.0000	-.0909	-.0909	-.0909	-.0909	-.0909	0.0000	0.0000
M_8		1.0000	-.0909	-.0909	-.0909	-.0909	0.0000	0.0000
M_9			1.0000	-.0909	-.0909	-.0909	0.0000	0.0000
M_{10}				1.0000	-.0909	-.0909	0.0000	0.0000
M_{11}					1.0000	-.0909	0.0000	0.0000
M_{12}						1.0000	0.0000	0.0000
RD_2							1.0000	-.5000
RD_3								1.0000

APPENDIX D

FORECASTING MONTHLY FICB NEW MONEY REQUESTS COMPUTER PROGRAM USER'S GUIDE

APPENDIX D

FORECASTING MONTHLY FICB NEW MONEY REQUESTS COMPUTER PROGRAM USER'S GUIDE

This appendix is a user's guide for a computerized projection model to be used for forecasting two months in advance monthly new money requests for the Baltimore Federal Intermediate Credit Bank. The model was designed as a cross-sectional time series model.. The cross sections were regions within the Baltimore District and the time period was monthly observations from 1971 to 1977. The data were pooled, resulting in one set of estimation equations for all regions. In order to simplify use of the model by the FICB, the user's program presented here utilizes aggregate data for the Baltimore Farm Credit District.

This appendix includes the model parameters. A description and listing of the source and form of input data follows. Instructions for the use of the computer program are included. In the final section, actual program statements are listed.

The model parameters were estimated over the sample space starting with January, 1971, and containing monthly observations through June, 1977. The parameter estimates, their standard errors, and the R-square, F, and Durbin-Watson statistics for the equations are reported in Tables D.1 for the new loans made equation, and D.2 for the paydown equation. The R-square computed for new money

Table D.1. Estimation Results: New Loans Made

R-square = 0.9552
F = 105.86
D.W. = 1.96

	1974 - June 1977		Adjustment for 1971-73	
	Estimate (β_i)	Standard Error	Estimate (δ_i)	Standard Error
Intercept	6804.86	5236.61	-10307.22	4292.74
NLM_{t-12}	657.92	74.23	-66.58	173.54
$RDIF_{t-2}$	391.75	172.40	-118.91	293.74
LO_{t-2}	43.11	8.19	-37.16	13.17
$PREC^2_{t-2}$	-255.76	68.38	252.22	96.64
BR_t	-166.83	124.56	163.44	159.95
$SHARE_t$	-202.64	127.55	364.16	136.25
EX_{t-2}	-3.19	2.74	4.02	5.10
M_2	90.93	401.13	-114.99	594.24
M_3	892.57	399.89	-408.37	621.77
M_4	1720.55	415.52	-1151.13	634.10
M_5	1490.55	409.98	-797.92	615.78
M_6	1220.71	385.00	-1029.99	594.24
M_7	924.47	486.17	-1063.95	688.32
M_8	175.90	461.14	159.88	645.38
M_9	839.63	442.10	-1047.68	626.92
M_{10}	464.63	439.10	-179.35	674.66
M_{11}	177.23	471.40	-205.42	665.79
M_{12}	1383.25	478.52	-1482.44	705.36
RD^2_2	-350.47	992.04		
RD^2_3	-446.58	897.21		

Table D.2. Estimation Results: Paydown

R-square = 0.9404
F = 73.88
D.W. = 1.36

	1974 - June 1977		Adjustment for 1971-73	
	Estimate (β_i)	Standard Error	Estimate (δ_i)	Standard Error
Intercept	16348.19	6319.09	-6664.43	9972.37
NLM_t[a]	119.08	104.28	-234.24	257.83
PD_{t-12}	375.43	89.52	309.32	181.86
IER_{t-2}	178.04	435.45	105.11	651.86
RR_{t-2}	-193.34	71.49	96.71	102.91
$RDIF_{t-2}$	-1742.78	573.64	752.76	1251.54
LO_{t-3}	24.59	15.20	-53.06	32.07
LO_{t-12}	27.18	16.33	-48.66	32.98
INF_t	-9.85	19.94	-35.88	37.01
M_2	-608.42	355.45	648.70	541.20
M_3	-696.79	395.84	979.29	629.24
M_4	-579.17	532.57	1367.73	784.01
M_5	-784.12	514.39	1374.77	769.84
M_6	-806.42	523.42	1249.15	764.01
M_7	-329.90	542.39	346.86	795.81
M_8	-895.49	388.93	1368.42	581.31
M_9	-544.77	382.01	591.00	566.43
M_{10}	-521.28	399.56	917.01	664.77
M_{11}	691.44	410.56	-523.14	636.56
M_{12}	561.14	473.94	-592.92	695.59
RD_2	2615.25	1028.36		
RD_3	2686.34	988.36		

[a]Estimated using new loans made equation (Table D.1).

requests (the difference between new loans made and paydown) over the entire sample space was 0.8480. Thus, 84.80 percent of the variation in new money requests was explained by the model.

The Computer Program

The computer program is written in FORTRAN IV and consists of basically three sections. First is the data storage section which is followed by the input generator. The last section is the output generator.

The data storage section greatly simplifies use of the program since it reduces the amount of input data to be provided by the user. The data stored in the REAL data arrays changes only when new values become available. As updated information is obtained, all that is needed to update the model is to replace the record containing the old values with a record containing the updated values.[1]

The following data are stored in arrays:

REAL NMBETA/ This data array contains the estimated parameters for the new loans made equation. Twenty-one values are stored in this array, one for each of the twenty exogenous variables plus the intercept term. The values are stored in the same order as they are listed in Table D.1./

REAL PDBETA/ The values stored in this array are the estimated coefficients of the paydown equation. Twenty-two values are stored, one for each of the twenty-one exogenous variables

---

[1]A record is one line of a program. Thus, a card can be substituted in the program or if the program is run on an interactive terminal, it can be edited and the value changed.

plus the intercept term. They are stored in the same order as they appear in Table D.2./

REAL EXRG1/ This data array contains the coefficients used to estimate monthly farm production expenses for Region I. The first pair of values are the intercept and slope coefficients, respectively for estimating farm production expenses for January for Region I. The second pair of values corresponds to February, the third pair, March, etc. The exogenous variable used to predict expenses is the product of the index of prices paid and the monthly percentage of total annual farm production expenses (stored in REAL REP1)./

REAL EXRG2/ The twenty-four values stored here are used to estimate monthly farm production expenses for Region II in the same way as the values stored in EXRG1 (except values from REP2 are now used)./

REAL EXRG3/ This array contains twenty-four more values for Region III to be used in the same way as those in EXRG1 and EXRG2./

REAL REP1/ This array consists of twelve monthly regional expense proportions. The first value is the percent of annual regional expenses normally incurred in January. The twelfth value corresponds to December's percentage of annual expenses. These values are used in conjunction with the index of prices paid for farm production items and the values stored in EXRG1 to determine monthly regional expenses for Region I./

REAL REP2/ The twelve values stored in this array are used in the exact same way for estimating monthly farm production expenses in Region II as the values in REP1 are used in Region I./

REAL REP3/ The twelve values in this array are the same for Region III as the values in REP1 and REP2 are for Regions I and II./

REAL PREAVG/ This array contains twelve values. Each value is the average monthly total precipitation over the continental portion of the Baltimore District for the time period 1971 to 1975. The first value corresponds to January, the second to February, etc./

REAL PRESTD/ The twelve values in this array are the standard deviations in monthly total precipitation in the District for the same time period as the averages. The same convention holds for relating a value to a specific month.

REAL FMON/ This data array contains twelve three letter alpha-labels, one for each month of the year./

The input generator section utilizes the input data provided by the user and the data stored in the arrays to prepare a data set to be used for estimation. Once the user's input data is read by the computer, monthly dummy variables are created within the program. The next step is to determine regional monthly farm production expenses and sum them to obtain total monthly expenses for the District. Following this step, the data is scaled and values are computed for variables that are differences or ratios between two other variables. Once this is done, estimates for new loans made and paydown are generated by multiplying each variable's value by its respective coefficient and the results are summed. The last thing to be done is to calculate estimated new money requests by subtracting estimated paydown from estimated new loans made. After the estimates are calculated, the report generator outputs the estimates for new loans made, paydown, and new money requests two months in advance.

Data Requirements

A major objective of the research project and this computerized forecasting model was that all user supplied input be tied to a readily accessible on-going data base. In order to use this forecasting program, thirteen pieces of data are required plus the number and year of the forecast month. Seven of these data are obtained from records of the FICB and thus pose no problem. Five U.S. government publications provide the other six data items needed. The data items and their sources are listed below.

The FICB maintains historical series on the following variables.

1. New loans made (new money) in thousands of dollars should be collected for the month twelve months before the forecast month. Puerto Rico's new loans made should be subtracted from the district total and only that portion of new money actually occurring in the continental portion of the district used. For example, when forecasting January 1977, the total new loans made for January 1976 would be collected (13828) and Puerto Rico's amount subtracted (428) resulting in a value of 13400 to be used in the forecast.

2. Paydown (in thousands of dollars) should be collected for the month twelve months prior to the forecast month. Puerto Rico's paydown should be subtracted from the district total to obtain the value used in the forecast. For example, for forecasting January 1977, total paydown from January 1976 (16786) should be collected and Puerto Rico's paydown (368) subtracted resulting in a value of 16418.

3. The FICB's total loans outstanding twelve months prior to the forecast month is needed. This data item should exclude Puerto Rico and be in thousands of dollars. For example, loans outstanding for January 1976 were $362657 (in thousands) less Puerto Rico's loans outstanding of $25145 (in thousands) resulting in a value of $337512 to be used in the forecast for January 1977.

4. District loans outstanding three months prior to the forecast in thousands of dollars, for the month is also needed. Thus, for the January 1977 forecast, total loans outstanding for October 1976 (408825) must be collected. Once again Puerto Rico's loans outstanding during October (25233) must be subtracted from the district total resulting in a value of 383592 to be used for the January forecast.

5. The third loans outstanding variable needed is loans outstanding two months before the forecast month. Once again Puerto Rico is excluded and all values are in thousands. For example, loans outstanding for November 1976 (401044) would be collected and Puerto Rico's loans outstanding (25171) subtracted resulting in a value of 375873 to be used for the January 1977 forecast.

6. United States Department of Agriculture, Inputs and Finance Program Area, NEAD/ERS, Washington, D.C. 20250, Agricultural Finance Statistics, annual issues.

This publication reports total loans outstanding by state, by type of lender, as of January 1 of each year. It is published annually and is available in July. The PCAs' share of short term agricultural loan volume can be obtained by summing the total loans outstanding to the PCAs for the five states in the Baltimore District and dividing this sum by the total loans outstanding to all lenders in the five state area. This data is contained in the section of the publication entitled "Nonreal Estate Farm Debt". Since the FICB should be well aware of their market share, this publication should only be needed as a test of their own measures of market share. Generally the most recent value available is used since this variable does not fluctuate a great deal. For example, when preparing the January 1977 forecast, a value of 35.88 percent would be used. (Puerto Rico is excluded when calculating this value.)

7. The interest rate charged the PCAs by the FICB two months prior to the forecast month can be readily obtained within the FICB. For example, when forecasting new money requests for January 1977, the rate charged during November (6.94%) would be used.

8 & 9. Board of Governors of the Federal Reserve System, Washington, D.C. 20551, Federal Reserve Bulletin, monthly issues.

Many financial series are included in this publication. The series that is needed is the interest rate charged on short term business loans in Table A-26. The average rate for all sizes of loans at seven northeast centers should be collected each month. This rate is only reported every three months however.

Since the Farm Credit System stays closely informed about the financial markets, and since they have a fiscal agent in New York City, it seems reasonable that the Baltimore FICB should be able to obtain information on this interest rate through their fiscal agent or the Federal Reserve System. The rate charged on short term business loans in seven northeast centers might also be estimated using the following simple linear regression equation:

(D.1) $BR_t = 1.2402 + 0.9598\ PR_t \qquad r^2 = 0.9101$

where:

BR_t = interest rate on short term business loans at seven northeast centers, and

PR_t = the prime rate.

For example, when preparing the January 1977 forecast, the rate charged on short term business loans during November 1976 (7.62%) would be collected. Since this rate is only reported every three months and won't be reported again until February, 7.62% can be used as the expected rate during January 1977 also.

10. Cash receipts from farm products by states on a monthly basis can be obtained in two ways. The Farm Income section of the Inputs and Finance Program, NEAD/ERS/USDA, publishes this data on the fifteenth of the month following the reporting period. The monthly report can be obtained by sending self-addressed stamped envelopes to the following address and requesting it.

C. F. Wells or E. L. Lewis
ERS/USDA
Room 102
500 12th Street, S.W.
Washington, D.C. 20250

The other alternative is to call each month and obtain the data over the telephone. It can be obtained by contacting either C. F. Wells or E. L. Lewis at the following phone number:

(202) 447-7689

For example, the cash receipts from farm products for November 1976 for the five states in the Baltimore District should be collected when preparing the forecast for January 1977. The value used in the January forecast would be 388222 (in thousands of dollars).

11. United States Department of Agriculture, Statistical Reporting Service, Crop Reporting Board, Agricultural Prices, monthly issues.

This publication generally is released by the end of the month. Of the numerous indexes of prices paid by farmers for production items (1910 - 14 = 100). This index should be collected each month.

When preparing the forecast for January 1977, the value of the index for November 1976 is needed. Thus, the value used in the January forecast would be 554.

12. U. S. Government Printing Office, Washington, D.C., Economic Indicators, monthly issues.

This publication contains series of a number of measures of the general economy. It is published in the month following the reporting period. Page 2 typically reports the Gross National Production, in current dollars and the implicit GNP price deflator. The implicit

GNP price deflator should be collected each month to be used as the measure of inflation.[2] This deflator is only reported on a quarterly basis. The model was developed using smoothed values of the deflator for the forecast month. Due to the lag time involved in forecasting, this value will often not be available until after the forecast is made. Therefore, the most recent value of the implicit GNP price deflator that is available should be used. For example, the value reported during November 1976 of 136.44 would be used when preparing the January 1977 forecast.

13. National Oceanic and Atmospheric Administration (NOAA), Environmental Data Service, U. S. Department of Commerce.

National Climatic Center
Federal Building
Ashville, N. C. 28801

NOAA publishes state weather data each month. In order to obtain district average precipitation, total monthly precipitation (water equivalent) should be averaged over all weather divisions (32 of them) in the five states comprising the Baltimore District.

Due to the many time lags involved, the published information may not be available in time for use in the estimation procedure. Therefore, the model was designed to make use of the FICB's observations on general weather conditions. This procedure is described in the next section.

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[2]Observations on this variable can also be obtained from: U. S. Department of Commerce, Bureau of Economic Analysis, Survey of Current Business, p. S-2.

Instructions for Use

The program is designed to be interactive. In monthly forecast work, the user will access the program currently titled FICB via computer terminal. Once accessed, the computer will print a message asking the user if he would like to have a table describing the lines of input data required, as shown in Table D.3. If the user answers yes (by typing "1"), the sheet will be provided. The user should then disconnect the terminal and fill in the necessary data on the data entry sheet.

If the user's answer to the question is no ("0"), the computer will proceed into the data entry portion of the program. The next response will be ENTER LINE 1. This line consists of the number of the month for which the forecast is to be made. The program is designed such that the input data is read in a free format.

The second line of input data is the year of the forecast month. Thus, in response to ENTER LINE 2, the user should type the year of the month which is being estimated.

After the second line has been entered, the computer will respond with ENTER LINE 3. This line consists entirely of data from the FICB's records. It is composed of new money and paydown twelve months before the forecast month, and loans outstandings two, three, and twelve months prior to the forecast month. All data should be district totals excluding Puerto Rico. It should be rounded to the nearest thousand dollars and entered in thousands of dollars. It is <u>not</u> necessary to punch the decimal. Individual data items must be separated by a space and be in the proper order.

Table D.3. Data Entry Sheet

Line			
1	Number of the forecast month.	--	1
2	Year of the forecast month.	----	2
3	Total new money 12 months before forecast month, in thousands (excluding Puerto Rico).	------	3
	Total paydown 12 months before forecast month, in thousands (excluding Puerto Rico).	------	4
	Total loans outstanding 12 months before forecast month, in thousands (excluding Puerto Rico).	------	5
	Total loans outstanding 3 months before forecast month, in thousands (excluding Puerto Rico).	------	6
	Total loans outstanding 2 months before forecast month, in thousands (excluding Puerto Rico).	------	7
4	PCAs' share of market in hundreths of a percent.	------	8
	Interest rates charged PCAs by FICB 2 months before forecast month, in basis points (100 pts. = 1%).	------	9
	Interest rate charged by commercial banks 2 months before forecast month, in basis points.	------	10
	Expected commercial bank interest rate during forecast month, in basis points.	------	11
5	Total cash receipts from farming 2 months before forecast month, in thousands (excluding Puerto Rico).	------	12
	Index of prices paid for production items 2 months before forecast month (1910 - 14 = 100).	------	13
	Most recent GNP deflator, in hundreths.	------	14
	Precipitation's deviations from normal 2 months before forecast month.	------	15

Following entry of this data, the computer's response will be ENTER LINE 4. This line consists of the PCAs' share of the short term agricultural loan market, the interest rate the FICB charged PCAs two months prior to the forecast month, the interest rate charged by commercial banks on short term business loans two months prior to the forecast month, and the expected commercial bank rate during the forecast month.

The PCAs' share of the market should be the district weighted average rate excluding Puerto Rico. The dollar volume of loans should be used as the weighting factor. The share value used should be the most recent value available or the FICB's best estimate. It should be entered in hundreths of a percent. For example, if the most recent report indicates that PCAs have 35.88% of the market, then 3588 should be entered.

The interest rate the FICB charged PCAs two months in advance of the forecast month and the commercial bank rate during the same period and its estimate during the forecast month should also be entered as hundreths of a percent (i.e., in basis points). Thus, a rate of 7.62% would be entered as 762.

The next response from the computer will be ENTER LINE 5. The data included on this line are cash receipts from farming two months before the forecast month, the index of prices paid by farmers (1910 - 14 = 100), the implicit GNP price deflator, and the deviation from normal precipitation (in standard deviations). Each of these items is explained in more detail below.

Cash receipts from farming should be the total of the monthly cash receipts of the five states in the Baltimore District two months before the forecast month. This data should be rounded to the nearest thousand and entered as thousands of dollars.

The index of prices paid should be entered exactly as it is reported (i.e., 554 when forecasting January 1977).

The implicit GNP price deflator is only published once each quarter. Therefore, the most recent value that is available should be used. It should be entered in hundreths (i.e., if a value of 137.57 is reported, it should be entered as 13757).

The final value to be entered is the deviation that precipitation is from normal measured in standard deviations away from the monthly average. As mentioned previously, there are two options. The first option is to use actual data. It would thus be necessary to collect monthly precipitation data (water equivalent) by weather divisions in the five state area. This data would then have to be averaged and the number of standard deviations determined as follows:

$$\text{(D.2)} \quad NSD = \frac{DAP - AVG}{S}$$

where:

NSD = number of standard deviations away from the month average,

DAP = district average precipitation observed and calculated by the user,

AVG = month's average precipitation from Table D.4, and

S = month's standard deviation from Table D.4.

Table D.4. Average Monthly Precipitation and Standard Deviations

Month	Average[a]	Standard Deviation[a]
January	3.24	0.69
February	3.43	1.16
March	3.69	1.21
April	3.48	1.39
May	4.79	0.77
June	5.26	2.38
July	3.99	1.17
August	4.18	1.23
September	4.60	1.66
October	3.25	1.36
November	3.27	1.57
December	3.93	1.33

[a]Based on 1971-75 data.

Example:

If district average precipitation (DAP) was observed to be 1.09 inches during November 1976, then the value used for the January 1977 forecast would be computed as follows:

$$NSD = \frac{1.09 - 3.27}{1.57}$$

$$= -1.4$$

Thus, the value of -1.4 would be entered in Line 4 (the decimal must be punched). If the sign is negative, it must be punched since the sign is very important.

The other option is for the FICB to make general observations on weather conditions through the district and enter the estimated number of standard deviations from normal that the month's precipitation was. Thus, if precipitation was considered to be near normal, a value of zero (0) would be entered in Line 4. A value of -1.0 might indicate dry conditions persist while -2.0 would be indicative of extremely dry weather. On the other hand, a value of 1.0 would suggest fairly wet weather and 2.0 would indicate extremely wet conditions. Table D.5 contains the amounts of precipitation that would be indicative of each level. The results of this method depends a great deal on the month involved since the averages and standard deviations vary between months. It should be noted that the model is very sensitive to variability in precipitation.

The first option is by far the most accurate. The time and work involved, plus the fact that the precipitation data may not be available in time for forecast use, make it less desirable. The

Table D.5. Levels of Precipitation to be Used in the Forecasting Procedure

Month	Extremely Dry Enter -2.0	Dry Enter -1.0	Normal Enter 0	Wet Enter 1.0	Extremely Wet Enter 2.0
	----------------------	----------	inches	----------	----------------------
January	1.86	2.55	3.24	3.93	4.62
February	1.11	2.27	3.43	4.59	5.75
March	1.27	2.48	3.69	4.90	3.69
April	0.70	2.09	3.48	4.87	6.26
May	3.25	4.02	4.79	5.56	6.33
June	0.50	2.88	5.26	7.64	10.02
July	1.65	2.82	3.99	5.16	6.33
August	1.72	2.95	4.18	5.41	6.64
September	1.28	2.94	4.60	6.26	7.92
October	0.53	1.89	3.25	4.61	5.97
November	0.13	1.70	3.27	4.84	6.41
December	1.27	2.60	3.93	5.26	6.59

second option is quick and simple, but much less accurate. Due to the large variation in estimated new money requests which could result, it is suggested that new money requests be estimated several times with different values entered for precipitation's standard deviations from normal. This would give an estimated range for new money requests depending on the actual average precipitation which did occur two months prior to the forecast month.

A sample data entry is included in Table D.6. This sheet contains the values of the input data exactly as they should be entered into the computer. Use of these numbers would result in forecasts of $16,872,000 for new loans made, $18,998,000 for paydown, and $-2,126,000 for new money requests. The concluding section of this user's package is a listing of the source program used to generate the monthly estimates.

Table D.6. Sample Data Entry Sheet

Line			
1	Number of the forecast month.	1	1
2	Year of the forecast month	1977	2
3	Total new money 12 months before forecast month, in thousands (excluding Puerto Rico).	13400	3
	Total paydown 12 months before forecast month, in thousands (excluding Puerto Rico).	16418	4
	Total loans outstanding 12 months before forecast month, in thousands (excluding Puerto Rico).	337512	5
	Total loans outstanding 3 months before forecast month, in thousands (excluding Puerto Rico).	383592	6
	Total loans outstanding 2 months before forecast month, in thousands (excluding Puerto Rico).	375873	7
4	PCAs' share of market in hundreths of a percent.	3588	8
	Interest rates charged PCAs by FICB 2 months before forecast month, in basis points (100 pts. = 1%).	694	9
	Interest rate charged by commercial banks 2 months before forecast month, in basis points.	762	10
	Expected commercial bank interest rate during forecast month, in basis points.	762	11
5	Total cash receipts from farming 2 months before forecast month, in thousands (excluding Puerto Rico).	388222	12
	Index of prices paid for production items 2 months before forecast month (1910 - 14 = 100).	554	13
	Most recent GNP deflator, in hundreths.	13757	14
	Precipitation's deviations from normal 2 months before forecast month.	-1.4	15

Source Program Listing

```
C
C        PROJECTING FICB NEW MONEY REQUESTS (SEPTEMBER, 1976)
C           PROGRAM AUTHOR: C. MCCHEYNE SWORTZEL
C                           GRADUATE STUDENT
C                           AG ECON DEPT
C                           VPI & SU
C                           BLACKSBURG, VA. 24061
C
C
C
         REAL M,NMVAR,NML12,LOL12,LOL3,LOL2,IPPL2,INF,NMES,NMR
          INTEGER YR
           DIMENSION M(11),NMVAR(22),PDVAR(22),IFORM(17)
          REAL NMBETA(21)/6304.86,657.92,391.75,43.11,-255.76,-166.83,-202.6
        14,-3.19,90.93,892.57,1720.55,1490.55,1220.71,924.47,175.90,839.63,
        2464.63,177.23,1383.25,-350.47,-446.58/
          REAL PDBETA(22)/16348.19,119.08,375.43,178.04,-193.34,-1742.78,24.
        159,27.18,-9.85,-606.42,-696.79,-579.17,-784.12,-806.42,-329.90,895
        2.49,-544.77,-521.28,691.44,561.14,2615.25,2686.34/
          REAL EXRG1(24)/-4.92,4.11,-9.04,4.23,-20.55,4.54,-13.15,4.20,
        1-30.44,4.
        217,-8.01,4.05,-9.56,4.09,-7.36,3.84,-4.27,3.73,-13.64,3.84,-7.32,3
        3.76,-6.47,3.77/
          REAL EXRG2(24)/-3.31,1.61,-7.05,1.69,-10.33,1.73,-8.18,1.64,-5.01,
        11.62
        2,-3.93,1.58,-4.53,1.59,-2.96,1.49,-2.63,1.45,-7.92,1.49,-3.65,1.46
        3,-4.53,1.47/
          REAL EXRG3(24)/2.31,1.22,0.59,1.29,-0.41,1.31,1.69,1.25,1.28,1.24,
        10.86
        2,1.21,0.84,1.22,3.01,1.14,3.62,1.11,5.62,1.14,2.75,1.12,1.79,1.13/
          REAL REP1(12)/5.84,5.84,7.65,8.07,18.61,5.50,5.75,7.38,6.62,13.22,
        19.40
        2,6.11/
          REAL REP2(12)/7.52,8.08,9.70,10.24,10.09,5.23,5.72,5.75,7.17,14.58
        1,7.7
        26,8.14/
          REAL REP3(12)/5.99,6.02,8.13,11.36,8.57,4.94,6.20,9.07,6.43,16.06,
        17.27
        2,5.96/
          REAL PREAVG(12)/3.24,3.43,3.69,3.48,4.79,5.26,3.99,4.18,4.60,5.25,
        13.27
        2,3.93/
          REAL PRESTD(12)/0.69,1.16,1.21,1.39,0.77,2.38,1.17,1.23,1.66,1.36,
        11.57
        2,1.33/
          REAL FMON(12)/3HJAN,3HFEB,3HMAR,3HAPR,3HMAY,3HJUE,3HJUL,3HAUG,
        13HSEP,3HOCT,
        23HNOV,3HDEC/
           WRITE(6,110)
           READ(8,112,END=114)IAN
           IF(IAN .EQ. 0)GO TO 114
  116      READ(9,117,END=114)IFORM
           WRITE(6,117)IFORM
           GO TO 116
  114      WRITE (6,109)
           READ (8,*) MON
           IF(MON .EQ. 0)GO TO 118
            READ(8,*)YR
           WRITE (6,111)
```

Source Program Listing -- Continued

```
      READ (8,*) NML12,PDL12,LOL12,LOL3,LOL2
      WRITE (6,113)
      READ (8,*) SHARE,FRL2,BRL2,BR
      WRITE (6,115)
      READ (8,*) CRTL2,IPPL2,INF,PREC
C
C     CREATING MONTHLY DUMMY VARIABLES
C
      DO 1002 I=1,11
      M(I)=0
 1002 CONTINUE
      DO 1003 J=2,12
      IF(MON.EQ.J) M(J-1)=1.0
 1003 CONTINUE
C
C     DEVELOPING REGIONAL MONTHLY FARM PRODUCTION EXPENSES
C
      IT=MON-2
      IF(IT.EQ.0) IT=12
      IF(IT.EQ.-1) IT=11
      R1EX=EXRG1(2*IT-1)+(EXRG1(2*IT))*(REP1(IT))*IPPL2/100.0
      R2EX=EXRG2(2*IT-1)+(EXRG2(2*IT))*(REP2(IT))*IPPL2/100.0
      R3EX=EXRG3(2*IT-1)+(EXRG3(2*IT))*(REP3(IT))*IPPL2/100.0
      EXL2=(R1EX+R2EX+R3EX)*1000.0
C
      DO 1004 K=1,22
      NMVAR(K)=0
      PDVAR(K)=0
 1004 CONTINUE
C
C     ASSIGNING VALUES OF EXOGENOUS VARIABLES TO THE VARIABLE ARRAY FOR
C     NEW MONEY
C
      NMVAR(1)=3.0
      NMVAR(2)=NML12/1000.0
      NMVAR(3)=(BRL2-FRL2-100.0)/100.0*3.0
      NMVAR(4)=LOL2/1000.0
      NMVAR(5)=(PREAVG(IT)+PREC*PRESTD(IT))*3.0
      NMVAR(6)=BR/100.0*3.0
      NMVAR(7)=SHARE/100.0*3.0
      NMVAR(8)=EXL2/1000.0
      DO 1005 L=9,19
      NMVAR(L)=M(L-8)*3.0
 1005 CONTINUE
      NMVAR(20)=1.0
      NMVAR(21)=1.0
C
C     ESTIMATING NEW MONEY
C
      NMES=0
      DO 1006 I=1,21
      PROD=NMBETA(I)*NMVAR(I)
      NMES=NMES+PROD
 1006 CONTINUE
C
C     ASSIGNING VALUES OF EXOGENOUS VARIABLES TO THE VARIABLE ARRAY FOR
C     PAYDOWN
C
      PDVAR(1)=3.0
```

Source Program Listing -- Continued

```
      PDVAR(2)=NMES/1000.0
      PDVAR(3)=PDL12/1000.0
      PDVAR(4)=(CRTL2/EXL2)*3.0
      PDVAR(5)=((FRL2+100.0)/BRL2)*3.0*100.0
      PDVAR(6)=NMVAR(3)
      PDVAR(7)=LOL3/1000.0
      PDVAR(8)=LOL12/1000.0
      PDVAR(9)=(INF/100.0)*3.0
      DO 1007 N=10,20
      PDVAR(N)=M(N-9)*3.0
 1007 CONTINUE
      PDVAR(21)=1.0
      PDVAR(22)=1.0
C
C     ESTIMATING PAYDOWN
C
      PDES=0
      DO 1008 I=1,22
      PROD=PDBETA(I)*PDVAR(I)
      PDES=PDES+PROD
 1008 CONTINUE
C
C     ESTIMATING NEW MONEY REQUESTS
C
      NMR=NMES-PDES
C
      WRITE (6,104) FMON(MON),YR
      WRITE (6,105)
      WRITE (6,106) NMES,PDES,NMR
      WRITE (6,107)
C
C     FORMAT STATEMENTS
C
  104 FORMAT (1X,/////,28X,'PREDICTIONS FOR',1X,A3 ,',',1X,I4)
  105 FORMAT (1X,///,13X,'NEW MONEY',10X,'PAYDOWN',10X,'NEW MONEY REQUES
     1TS')
  106 FORMAT (1X,//,14X,F7.0,11X,F7.0,12X,F10.0)
  107 FORMAT (//////////,30X,'**** NORMAL END ****'//////////)
  109 FORMAT (/,1X,'ENTER LINE 1')
  111 FORMAT (/,1X,'ENTER LINE 2')
  113 FORMAT (/,1X,'ENTER LINE 3')
  115 FORMAT (/,1X,'ENTER LINE 4')
  110 FORMAT(/,1X,'COPY OF INPUT SHEET NEEDED (1=YES,0=NO)')
  112 FORMAT(I1)
  117 FORMAT(6X,16A4,A2)
  118 STOP
      END
```

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PROJECTING NEW MONEY REQUESTS FOR THE BALTIMORE FEDERAL INTERMEDIATE CREDIT BANK

by

C. McCheyne Swortzel

(ABSTRACT)

A short term forecast model is developed for use by the Baltimore FICB in estimating their new money requests two months in advance. New money requests are the difference between new loans made and paydown. New money requests were forecasted by estimating two separate equations, one for new loans made and one for paydown. Ordinary least squares was used to estimate the parameters. Results of the estimation are reported.

The forecast model developed in the study accounts for 83.59 percent of the monthly variation within the data base in new money requests. Tests of the model include Theil's inequality coefficient, turning point analysis, and forecasting beyond the data base. The results of these tests indicate that the model's estimates closely track actual new money requests. Due to the presence of multicollinearity, the individual effects of the independent variables are not identified. Multicollinearity was not a concern, however, since the model is to be used exclusively for forecasting.

In addition to the statistical results, a computerized forecasting program is developed. The program can be used to predict new

money requests for the Baltimore FICB two months in advance. It incorporates the results of the research into an easy to use package requiring a minimum of user supplied input.