FORECASTING FLOWS OF FUNDS FOR THE BANKING INDUSTRY

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Introduction

During the past several years much concern has been expressed regarding the ability of the banking industry to withstand the shocks of a drastically changing economy. The model, presented in this paper, can be used to forecast the aggregate balance sheet for the commercial banking industry. It has been designed to rely primarily on macroecnomic (as opposed to banking) independent variables so as to avoid problems of simultaneity and to facilitate its use in conjunction with large scale econometric models of the U.S. economy.

Much of the previous work in this field has related monetary policy to various components of bank portfolio shifts so as to gain insights into the effectiveness of alternative policies. Additionally, these and other studies have relied primaril on flow of funds or sample data rather than an aggregation of individual bank data. This research departs from the majority of earlier studies in that it both relies on an aggregation of actual bank balance sheets and incorporates the balance sheet constraints discussed by Brainard and Tobin (1968). Aigner (1973) and Goldfeld (1966) among others have econometrically modeled bank portfolio behavior, however, they used significantly different data bases. Aigner used weekly data for twenty-seven individual banks for the period June 1957-

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* Economist, Federal Deposit Insurance Corporation. The views expressed herein do not necessarily reflect those of the FDIC. The author would like to acknowledge the research assistance of Ann Mooney and Mary Stevens in the development of the model.

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1964 to estimate the relationship between selected asset and liability items and aggregate economic variables. Goldfeld's study modeled commercial bank portfolios and selected liabilities using aggregate data divided into country and reserve city banks. The exclusion of nonmember bank data and certain balance sheet items limits the usefulness of Goldfeld's findings for forecasting the balance sheet of the banking industry in the aggregate.

More recently Hunt (1976) and others have included elements of bank portfolio models within the financial sector of large econometric models. The major shortcoming of these models has been the data bases on which they have been estimated. They have relied on either data from the weekly reporting banks or flow of funds data. Both of these series tend to exclude small banks and do not accurately reflect certain key liability and asset items.[1] Perhaps more importantly, these models tend to ignore the basic accounting requirements essential to forecasting balance sheet changes.

Model Framework

The purpose of the model is to forecast the aggregate balance sheet for the commercial banking industry. Consequently, certain key items were chosen and accounting relationships were employed to estimate the rest. The balance sheet items estimated by the model presented in this paper are given in Table 1.

1/ Data Resources Inc., for example, had an econometric model of the banking industry which was estimated using flow of funds data and, as such, did not agree with the published aggregate data compiled by the FDIC.

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Table 1

Assets	Liabilities
U.S. Govt. Securities*	Demand Deposits*
Municipal Securities	
Total Securities*	Time and Savings Deposits*
C & I Loans*	Net Fed Funds Purchased*
Real Estate Loans*	
Consumer Loans*	Other Liabilities
Other Loans	
Total Loans*	Total Liabilities*
Other Assets	Capital Accounts (Net Worth)*
Total Assets	

Those items marked with an asterick are projected using the equations presented in the next section of the paper. The other items are derived from the estimated values using basic accounting relationships. Specifically, these relationships are defined as follows:

(1) Municipal Securities = Total Securities - U.S. Govt. Securities

(2) Other Loans = Total Loans - C&I Loans - Real Estate Loans - Consumer Loans

(3) Other Assets = Total Assets - Total Securities - Total Loans

(4) Total Assets = Total Liabilities + Capital Accounts

(5) Other Liabilities = Total Liabilities - Demand Deposits - Time and Savings Deposits - Net Fed Funds Purchased

The effect of imposing these constraints on the model is to maintain the basic accounting relationships and assure that a projected balance sheet will actually balance. For example, given the constraints presented above, the left and right sides of the balance sheet will always be equal and the totals for specific categories of assets will always equal the sum of their components.

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This framework represents a departure from a number of bank planning models which rely on "Fed funds purchased" as the balancing items to maintain accounting relationships. In this model "Other Assets" serves as the balancing item. This approach is preferable since all but the largest banks are frequently constrained in the volume of Fed funds they can borrow. In addition, from a policy perspective, Fed funds constitute an important component in any analysis of bank liquidity positions. Therefore, relegating the item to residual status can lead to faulty analysis.

The orientation used in estimating the equations was to rely on exogenous macroeconomic variables and avoid, wherever possible, reliance on endogenous banking variables. Nevertheless, deposit growth was considered to be a key constraint on asset growth and was therefore included in most of the asset equations. The rationale for this approach is that the model is to be used to forecast the condition of the banking industry under various economic conditions. Consequently, it was designed to be used in conjunction with a large econometric model of the U.S. economy.

Empirical Estimation

Equations were estimated using ordinary least squares regression techniques for each of the items marked with an asterick in Table 1.[2] The data encompassed an aggregation of the Reports of Condition filed by each insured commercial bank in the United States with its primary federal regulator. All the equations, except those for securities were estimated using semiannual data from 1955 to 1978. However, since only annual data was published prior to 1968 extrapolated values were used for the mid-year observations. The stability of the equation was verified on actual semiannual data for 1968 to 1978. The equations' pre-

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2/ Those equations which incorporate deposits as an endogenous variable were solved using two-stage least squares as a separate recursive block within the model. However, the coefficients and coefficient of correlation were not significantly different than those estimated using single equation OLS.

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dictive abilities were tested on a holdout period from the second half of 1978 through 1979.

The banking data used in this study were obtained from the Reports of Condition filed quarterly by every insured commercial bank. The semiannual aggregations of these data are published semiannually by the Federal Deposit Insurance Corporation in Assets and Liabilities of Commercial and Mutual Savings Banks. The macroeconomic data were obtained from the data bases maintained by Data Resources, Inc. and are based on published sources.

While the thrust of the research is concerned with forecasting future "stocks" (balance sheet items) it was decided that less econometric problems would be encountered and more accurate forecasts achieved by using a stock adjustment approach. As a result, all of the equations were estimated using first differenced dependent variables. A balance sheet item was then projected by adding the forecasted dependent variable to the previous period stock item, as follows:

$$\hat{X}_t = X_{t-1} + \Delta\hat{X}_t$$

This approach proved to yield superior results with both smaller residuals on the historical data as well as superior forecasts of the hold-out sample than did running regressions on stock data.

Securities

In forecasting commercial bank holdings of securities it was found that the best results were obtained by first estimating total securities and then estimating the allocation of the securities portfolio between U.S. government securities and those issued by state and local governments.

Commercial bank holdings of securities change in response to changes in loan demand, availability of funds to invest, and, with respect to holdings of

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state and local securities, the tax rate. The availability of funds and the relative price of securities (yield differentials), as reflected in the tax rate, are obvious determinants of changes in holdings of securities. With respect to loan demand, the hypothesis is that banks allocate their available funds among various alternative assets with a preference for loans. Consequently, when loan demand is weak, banks will prefer to "invest" available funds in securities. A number of aggregate demand variables were tested and the unemployment rate proved to serve as the best proxy for economic conditions. In addition, a number of interest rate spreads as well as rates proved to be significant but did not enhance the adjusted R^2. The best equation for changes in commercial bank holdings of securities:[3]

$$(6)\ \Delta TOTSEC = \underset{(-5.63)}{-89.98} + \underset{(7.27)}{5.4\ RU} + \underset{(4.95)}{1.61\ RTCGF} + \underset{(3.1)}{0.11\ \Delta TOTDEP}$$

$$\bar{R}^2 = .76 \qquad D - W = 2.20$$

where:

ΔTOTSEC is the change in the investment account holdings of all insured commercial banks.

RU is the unemployment rate for all civilian workers.

RTCGF is the effective Federal corporate income tax rate.

ΔTOTDEP is the change in total deposits at all insured commercial banks.

In estimating the breakdown of the securities portfolio between U.S. government securities and those issued by state and local governments various attempts were made to directly estimate changes in the specific holdings. None of these proved successful. As a result, an equation was developed to project the share of the portfolio held as U.S. government securities and derive the municipal securities holdings

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3/ In this equation, and all the others that follow, the values in parentheses are t-statistics.

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as a residual. The key determinants of the relative share of securities by type is the difference in tax treatment as reflected in the tax rate, the time of year, and previous preferences. The time of year is particularly important since many banks will increase their holdings of U.S. government securities at the end of the year in order to "dress up" their balance sheets prior to publication. All of these variables were included in the estimated equation as specified below.

$$(7)\quad US\%TOTSEC = \underset{(1.8)}{0.15} - \underset{(-2.5)}{0.02}\, S1 + \underset{(6.4)}{.90}\, US\%TOTSEC_{-1} - \underset{(-1.4)}{0.18}\, RTCGF$$

$$\bar{R}^2 = .72 \qquad D - W = 1.54$$

US%TOTSEC is the investment account holdings of U.S. government securities as a percentage of total securites at all insured commercial banks.

S1 is a seasonal dummy that equals 1 for mid-year observations and zero otherwise.

RTCGF is the effective federal corporate income tax rate.

To obtain estimates of holdings of U.S. government securities the estimated value of US%TOTSEC obtained from equation (7) was multiplied by TOTSEC which was derived from equation (6). Holdings of municipal securities were then obtained by subtracting holdings of U.S. securities from total holdings as shown in equation (1).

Loans

Commercial bank holdings of loans has been the subject of previous studies. Many of these studies have focused on business loans since the relationship to aggregate economic activity is most apparent. {For examples of recent studies

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see Hicks (1980), and Harris (1976).} Consumer installment credit has also received some attention in the literature {see Marcis and Sullivan (1975)}. Most of the earlier studies have correctly related commercial bank holdings of loans to three basic factors: demand for credit as determined by aggregate economic activity, availability of alternative sources of funds, and the supply of loanable funds in the banking system. This relationship can be expressed as follows:

(8) Loans = f(AgDem, Earnings, TOTDEP)

where AgDem is a measure of aggregate demand. The approriate measure of aggregate demand which is related to the various types of loans will differ with each equation. While earnings to the borrowing group may represent an alternative source of funds to finance expenditures, the growth in earnings also is synonymous with increased returns from investment. As such, one would expect borrowings to grow with an increase in earnings. Moreover, borrowers' ability to handle additional debt is directly related to earnings. Consequently, on balance one should find a positive correlation between borrowings and earnings. Changes in total deposits (TOTDEP) reflect the availability of increased funds to support additional lending and thereby constitute the most significant supply consideration.

Commercial and Industrial Loans. Using the basic functional relationship presented in equation (8), an equation was estimated for the change in C&I loans at commercial banks. These changes were related to changes in deposits, investment expenditures, corporate profits, and the condition of the economy as reflected by the unemployment rate. The inclusion of various components of nonfinancial corporate investment, as well as the total, permitted the estimation of the various interactive effects of investment on loan volume.

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$$(9)\quad \Delta C\&ILOANS = \underset{(3.1)}{3.57} + \underset{(2.7)}{0.42}\,\Delta TOTDEP + \underset{(3.2)}{0.96}\,\Delta ICNR - \underset{(-8.9)}{0.38}\,NFCGI$$

$$+ \underset{(4.5)}{0.14}\,IPDENR + \underset{(6.1)}{1.8}\,NFCRESCH + \underset{(5.7)}{0.35}\,RE - \underset{(-3.0)}{0.72}\,RU$$

$\bar{R}^2 = .88$ $\qquad$ D - W = 1.94

$\Delta C\&ILOANS$ is the change in commercial and industrial loans outstanding at all insured commercial banks.

$\Delta TOTDEP$ is the change in total deposits at all insured commercial banks.

$\Delta ICNR$ is the change in gross investment in private nonresidential structures.

NFCGI is nonfinancial corporate gross investment.

IPDENR is nonresidential investment in producers' durable equipment.

NFCRESCH is nonfinancial corporate residential construction expenditure.

RE is undistributed corporate profits.

RU is the unemployment rate for all civilian workers.

Real Estate Loans. Factors that influence other types of lending also affect real estate lending by commercial banks. However, real estate lending, as compared with commercial and industrial lending, is not a primary activity for many banks. Specifically, while banks frequently finance construction activity they have avoided long-term mortgage lending. Banks have preferred bonds, with the added liquidity provided by the market, to mortgage loans. To capture the substitutability between these long-term assets a relative price variable was included in the equation. The first differenced equation for real estate loans is:

$$(10)\quad \Delta RELOANS = \underset{(-1.2)}{-1.66} - \underset{(-1.9)}{0.36}\,S1 + \underset{(19.8)}{0.22}\,ICR - \underset{(-4.1)}{0.61}\,RMTG + \underset{(3.9)}{1.22}\,(RMTG - RMUN)$$

$$- \underset{(-4.4)}{0.37}\,RU$$

$\bar{R}^2 = .97$ $\qquad$ D - W = 1.42

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ΔRELOANS is the change in real estate loans outstanding at all insured commercial banks.

S1 is a seasonal dummy which equals one for the first half year.

ICR is investment in residential structures.

RMTG is the effective conventional mortgage rate on new homes.

(RMTG - RMUN) is the spread between the mortgage rate and the yield on municipal bonds.

RU is the unemployment rate for civilian workers.

The results of this equation are also consistent with economic theory. Net increases in real estate loans are positively correlated with purchases of residences and the existence of a positive spread between bond and mortgage rates. Moreover, a decline in the unemployment rate is consistent with increased mortgage lending since more households are able to purchase homes thereby increasing the demand for mortgage credit.

Consumer Credit. The approach used in estimating commercial bank consumer loan activity follows from that outlined in equation (8). However, because of their intermediate maturity and full amortization, a six period polynomial lag of the outstanding balance of consumer loans was added to the equation utilizing the technique developed by Almon (1965). The equation is presented below with the coefficient for each of the lags shown.

$$\begin{aligned}(11)\ \Delta CONSLOANS = & \underset{(-1.7)}{-0.56} + \underset{(5.1)}{0.27}\,\Delta CDMV\&P + \underset{(4.2)}{0.06}\,\Delta TOTDEP + \underset{(2.4)}{1.02}\,S1 \\ & + \underset{(11.31)}{0.47}\,CONSLOANS_{-1} - \underset{(-8.0)}{0.21}\,CONSLOANS_{-2} - \underset{(11.2)}{0.35}\,CONSLOANS_{-3} \\ & - \underset{(10.6)}{0.18}\,CONSLOANS_{-4} + \underset{(3.7)}{0.08}\,CONSLOANS_{-5} + \underset{(7.8)}{0.21}\,CONSLOANS_{-6}\end{aligned}$$

$\bar{R}^2 = .92$ D - W = 2.44

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ΔCONSLOANS is the change in consumer loans outstanding at all insured commercial banks.

ΔCDMV&P is the change in personal consumption expenditures on motor vehicles and parts.

ΔTOTDEP is the change in total deposits at all insured commercial banks.

S1 is a seasonal dummy which equals one for the first half a year.

CONSLOANS is the level of outstanding consumer loans at all insured commercial banks.

A possible explanation for the pattern on the signs associated with the lagged variable is that it is capturing interest rate cycles and bank responses to them. A number of consumer expenditure variables were tested and none worked as well as expenditures for automobiles. Inclusion of additional expenditure variables added multicolinearity without a resultant significant gain in the R^2.

Total Loans. To complete the estimation of the loan section of the balance sheet equation (8) was estimated to get a value for total loans and then, as shown in equation (2), used to get a residual called "other loans". The best estimate of the functional relationship specified in equation (8) turned out to be the following equation.

$$(12)\ \Delta TOTLOANS = \underset{(2.1)}{4.16} + \underset{(1.6)}{2.43}\ S1 + \underset{(4.9)}{0.25}\ \Delta TOTDEP + \underset{(9.3)}{0.72}\ ICR - \underset{(-7.3)}{0.42}\ NFCGI$$

$$+ \underset{(2.6)}{0.26}\ RE - \underset{(-5.9)}{2.3}\ RU + \underset{(4.6)}{0.14}\ \Delta GNP72$$

$\bar{R}^2 = .93$ D - W = 1.62

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ΔTOTLOANS is the change in total loans outstanding at all insured commercial banks.

S1 is a seasonal dummy, equals one for fist half of year.

ΔTOTDEP is the change in total deposits at all insured commercial banks.

ICR is the gross investment in residential structures.

NFCGI is nonfinancial gross investment.

RE is undistributed corporate profits.

RU is the unemployment rate for all civilian workers.

ΔGNP72 is the change in real gross national product (1972 $).

Substituting the projected values from equations (9) - (12) into equation (2) yields an estimated value for "other loans". This forecasted "residual" serves to maintain the basic accounting constraint that the sum of the loan categories must equal the forecasted value for total loans.

Deposits

Deposit variability has received a great deal of attention in the literature, with many of the studies attempting to empirically analyze the subject {see Morrison and Selden (1965) and Struble and Wilkerson (1967)}. Melnik (1979) developed a Box and Jenkins model to analyze variability of demand deposits. In addition, Hodgeman (1961) and Murphey (1969), among others, have studied the relationship between deposit variability and lending decisions. This study attempts to identify those macroeconomic variables that can successfully predict changes in demand deposits for all insured commercial banks. Because of varying market conditions, many of the market variables found significant by Feige (1964 and 1974) and others in studies of the varibility of time and demand deposits prove insignificant when all banks are aggregated as was done in this study. However, the income and relative price effects found by Feige did prove to be significant.

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Much of the work on time deposits has been similar to that on demand deposits and has been oriented toward research on monetary aggregates. Other work has focused on bank behavior and performance in response to deposit shifts {Hodgeman (1961)}. A detailed study by Gramely and Chase (1965) analyzed the role of time deposits in monetary economics. They specifically analyzed the cyclical behavior of time and demand deposits as it related to the monetary aggregates.

Demand Deposits

As one would expect, changes in the public's holding of demand deposits is a function of changes in the rate of interest on substitute instruments and changes in the income of households. In addition, changes in Regulation Q, with respect to the types of instruments and rates available on substitutes, played a key role in explaining changes in demand deposits. Due to the existence of autocorrelation, a first-order rho adjustment was used. The resultant equation is:

$$(13)\quad \Delta DEMDEP = \underset{(4.2)}{13.09} - \underset{(-7.5)}{26.15\ S1} - \underset{(-2.8)}{49.76\ \Delta RMSB} - \underset{(-2.6)}{6.39\ DREGQ}$$

$$+ \underset{(4.9)}{0.88\ \Delta YDPERM72} - \underset{(-3.2)}{0.46\ RHO}$$

$\bar{R}^2 = .83$ $\qquad$ D - W = 2.08

ΔDEMDEP is the change in total demand deposits at all insured commercial banks.

S1 is a seasonal dummy which equals one for first half of year.

ΔRMSB is the change in the average rate of interest paid on mutual savings banks' deposits.

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DREGQ is a dummy signifying the implementations and adjustments to Regulation Q. Assigned a value of one whenever Regulation Q was changed.

ΔYDPERM72 is the change in real permanent disposable income expressed in 1972 dollars.

RHO is the adjustment for first-order autocorrelation.

Since the rates paid on time and savings deposits at depository institutions tend to move together only one was included. Of the various interest rates on substitute deposits tested, the change in the rate on mutual savings bank deposits yielded the best results. A possible explanation for this finding is that these institutions are the dominant thrift competitors of commercial banks in the populous north-eastern states. The measure of income (or wealth) that best explains changes in demand deposits is real permanent disposable income. This finding is consistent with Friedman's permanent income hypothesis.

Time Deposits

The impact of changes in income on changes in holdings of time deposits is similar to that of demand deposits. The major difference is the existence of a greater number of close substitutes available to a time depositor. Hence, an equation to predict variations in time deposits must capture the relative price differentials between the various instruments. In addition, the introduction of large negotiable certificates of deposit has affected the growth in time and savings deposits at commercial banks. Since changes in CDs at large banks is a variable projected by many macro models it is included as an exogenous variable. The first differenced equation for time and savings deposits, adjusted for first-order autocorrelation is:

$$(14)\ \Delta T\&SDEP = \underset{(-21.1)}{-21.69} + \underset{(7.2)}{6.47}\,(\Delta RSDCD - \Delta RG10CM) + \underset{(5.2)}{3.53}\,(RSDCD - RG3)$$

$$+ \underset{(20.1)}{0.05}\,YDPERM72 + \underset{(13.2)}{0.76}\,\Delta LCD - \underset{(-3.5)}{1.58}\,\Delta RCP - \underset{(-2.5)}{0.47}\,RHO$$

$\bar{R}^2 = .95$ D - W = 1.97

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ΔT&SDEP is the change in time and savings deposits at all insured commercial banks.

ΔRSDCD is the change in the average of the interest rates paid on consumer time deposits and three month CDs.

ΔRG10CM is the change in the yield on ten year U.S. government bonds - constant maturity.

RG3 is the average market yield on 3 month Treasury bills.

YDPERM72 is real permanent disposable income (1972 $).

ΔLCD is the change in negotiable certificates of deposit in denominations of $100,000 or more at large weekly reporting Federal Reserve member banks.

ΔRCP is the change in the money market rate on prime commercial paper with maturities of 4-6 months.

RHO is the adjustment for first-order autocorrelation.

Net Fed Funds Purchased

Typically, individual banks use the Fed funds market to either borrow excess reserves from other banks to meet reserve obligations or as a source of funds to support lending. During the past decade the latter use of Fed funds market became much more prevalent as large banks turned to liability management as a standard operating practice. Similarly, during periods of high interest rates many small banks have earned very high rates of return selling funds to the larger banks. Budzeika (1976) and others have studied the use of liability management and have empirically studied the variability in short-term borrowings by individual banks. The relationships they found are not fully applicable when one examines the net position of the banking industry in the aggregate.

Consequently, the research done in developing this model indicated that a proxy for loan demand (investment expenditures), past inflation, and certain exogenous events that affected the market explained a significant proportion of

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the changes in the net Fed funds position of the banking industry. The two exogenous events, represented by dummy variables, were: (1) the removal, in 1970, of Regulation Q ceilings on large certificates of deposit which provided banks with a money market liability that is an alternative to Fed funds, and (2) the failure of Franklin National Bank, and the concurrent economic climate, in the second half of 1974, that caused disruptions in the Fed funds market which affected both the availability and terms on funds sold to regional banks. The first differenced equation for net Fed funds purchased, adjusted for first-order autocorrelation is:

$$(15)\ \Delta NETFFPUR = \underset{(-3.3)}{-6.52} - \underset{(-8.0)}{9.51}\ DFNB + \underset{(2.0)}{6.76}\ S1 + \underset{(3.8)}{4.79}\ PGNP_{-3}$$

$$+ \underset{(2.8)}{0.16}\ \Delta(IPDENR + ICNR) - \underset{(-3.4)}{2.62}\ DCD - \underset{(-6.2)}{0.86}\ RHO$$

$\bar{R}^2 = .93$ $\qquad$ $D - W = 1.88$

ΔNETFFPUR is the change in the difference between Fed funds purchased and sold by all insured commercial banks.

DFNB is a dummy variable for representing the financial repercussions surrounding the failure of Franklin National Bank in the fall of 1974.

S1 is a seasonal dummy, one during the first half.

$PGNP_{-3}$ is the GNP price deflator lagged three periods.

ICNR is investment in private nonresidential structures.

IPDENR is nonresidential investment in producers' durable equipment.

DCD is a dummy variable for the removal of Regulation Q ceilings on the rate of interest paid on large CDs in 1970.

RHO is an adjustment of first-order autocorrelation.

Total Liabilities

To maintain the basic accounting relationships, total liabilities is

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estimated econometrically and "other liabilities", a balancing item, is estimated using equation (5). As one would expect, many of the same independent variables that were used to explain the variation in changes in the individual liability categories also explain variations in total liabilities. The following is the first differenced equation for changes in total liabilities, adjusted for first-order autocorrelation.

$$
\begin{aligned}
(16)\ \Delta TOTLIABS = & \underset{(-1.9)}{-14.4} - \underset{(-7.1)}{25.02}\ S1 + \underset{(3.2)}{0.03}\ TOTLIABS_{-1} + \underset{(2.0)}{3.13}\ \Delta NBRES \\
& + \underset{(4.4)}{0.13}\ GNP72 - \underset{(-1.8)}{5.18}\ DREGQ + \underset{(4.9)}{0.98}\ \Delta LCD - \underset{(-4.7)}{5.85}\ RG3@5CM \\
& - \underset{(-2.7)}{14.71}\ RMSB - \underset{(-2.0)}{16.57}\ DFNB - \underset{(-2.0)}{0.42}\ RHO
\end{aligned}
$$

$\bar{R}^2 = .89$ D - W = 1.92

TOTLIABS is total liabilities outstanding at all insured commercial banks.

S1 is a seasonal dummy, one for fist half of year.

ΔNBRES is change in nonborrowed reserves of Federal Reserve member banks.

GNP72 is real gross national product (1972 $).

DREGQ is a dummy variable signifying the implementation and adjustments to Regulation Q.

ΔLCD is the change in negotiable certificates of deposit outstanding.

RG3@5CM is the average market yield on U.S. Government securities with maturities of 3-5 years, constant maturity.

RMSB is the average rate of interest paid on mutual savings banks' deposits.

DFNB is a dummy variable accounting for the failure of Franklin National Bank during the second half of 1974.

RHO is the correction for first-order autocorrelation.

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Capital Accounts

A bank's capital represents the initial investment of shareholders in the bank plus the accumulation of retained earnings over time. Changes in net worth, therefore, can largely be explained by changes in bank earnings. Inasmuch as this model is designed to project balance sheet items rather than income and expenses of banks, it was deemed inappropriate to model income variables. The alternative approach used in this model was to identify any macroeconomic variables that could explain changes in net worth for the banking industry in the aggregate.

Since bank earnings are clearly related to the size of the banking industry as well as the performance of the economy, nominal gross national product was used as an independent variable. This variable served to capture both the effects of inflation as well as real economic activity. The impact of the economic environment (extremely high interest rates, REIT problems, etc.) that occured at the time of the Franklin National Bank failure, in the second half of 1974, led to the introduction of a dummy variable to reflect these occurences. The first differenced equation for net worth is:

$$(17)\quad \Delta NETWRTH = \underset{(-6.0)}{-0.64} + \underset{(2.7)}{0.25}\, S1 - \underset{(-2.1)}{0.70}\, DFNB + \underset{(23.3)}{0.002}\, GNP$$

$$\bar{R}^2 = .92 \qquad D - W = 1.36$$

ΔNETWRTH is the change in net worth at all insured commercial banks.

S1 is a seasonal dummy variable; one for the first half of the year.

DFNB is a dummy for the second half of 1974 when Franklin National failed.

GNP is nominal gross national product.

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Model Results

The purpose in developing the model presented above was to develop the capability to forecast the balance sheet for the banking industry under various economic conditions, rather than test hypotheses. By incorporating a stock adjustment framework to the first difference equations presented above and solving for the definitional relationships presented in equations (1) through (5), one is able to estimate the balance sheet for the industry. The full model and a list of variables are included in the Appendix.

To test the forecasting capabilities of the model, data for the second half of 1978 and for both halves of 1979 were not used in the estimation of the regression results. The model was then used to forecast the balance sheet for the industry during this period, using actual macroeconomic data and the projected values for total deposits. The results of these forecasts and the comparison with the actual historic data are presented in Table 2.

An examination of the results in Table 2 indicates that the model did relatively well in forecasting the major asset categories (total securities, total loans, and total assets). The major weakness of the model is the equation that allocates the securities portfolio between U.S. Government issues and those securities issued by state and local governments. The model performed well in forecasting most of the liability categories. The one equation on the liability side that appears not be forecast as well as the others, inspite of its high $\bar{R}^2$, is the one for net Fed funds purchased. One explanation for this may be the change in interest rates that occured beginning late in 1978 and has continued ever since.

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FDIC BANKING MODEL RESULTS

(Billions of Dollars)

	1978:2			1979:1			1979:2		
	Forcasted	Actual	% Error	Forcasted	Actual	% Error	Forcasted	Actual	% Error
Assets									
U.S. Gov. Securities (eq.)	137.876	132.016	4.4	133.894	131.173	2.1	137.216	137.535	-.2
S & L Securties (residual)	115.814	123.511	-6.2	115.248	126.365	-8.8	111.454	132.568	-15.9
Total Securities (eq.)	253.690	255.527	-.7	249.142	257.538	-3.3	248.670	270.103	-7.9
C & I Loans (eq.)	232.457	223.244	4.1	245.475	240.945	1.9	266.714	257.678	3.5
Real Estate Loans (eq.)	212.872	213.625	-.4	231.668	228.402	1.4	251.788	244.796	2.9
Consumer Loans (eq.)	166.860	167.675	-.5	174.048	178.614	-2.6	177.275	187.790	-5.6
Other Loans (residual)	99.210	103.764	-4.6	100.596	100.802	-.2	103.580	106.058	-2.4
Total Loans (eq.)	711.399	708.308	.4	751.787	748.763	.4	799.357	796.322	.4
Other Assets (residual)	304.790	309.354	-1.5	310.367	311.645	-.4	332.269	339.241	2.1
Total Assets (identity, liabilities & capital)	1269.879	1273.189	-2.6	1311.296	1317.946	-.5	1380.296	1405.666	-1.8
Liabilities									
Demand Deposits (eq.)	399.820	400.285	-.1	392.668	384.304	2.2	407.587	431.553	-5.6
Time and Savings Deposits (eq.)	613.471	616.099	-.4	631.905	627.220	.7	658.393	663.052	-.7
Net Fed Funds Purchased (eq.)	46.046	42.536	8.3	57.792	60.289	-4.1	59.317	51.083	16.1
Other Liabilities (residual)	116.948	120.987	-3.5	130.281	147.677	-13.4	151.275	156.781	-3.6
Total Liabilities (eq.)	1176.282	1179.907	-.3	1212.646	1219.490	-.6	1276.572	1302.469	-2.0
Capital Accounts (Net Worth)(eq.)	93.597	93.282	.3	98.650	98.456	.2	103.724	103.197	.5

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Appendix

List of Variables

C&ILOANS - Commercial and industrial loans outstanding at all insured commercial banks.

CDMV&P - Personal consumption expenditures on motor vehicles and parts.

CONSLOANS - Level of oustanding consumer loans at all insured commercial banks.

DCO - A dummy variable for the removal of Regulation Q ceilings on the rate of interest paid on large CDs in 1970.

DEMDEP - Total demand deposits at all insured commercial banks.

DFNB - A dummy variable for representing the financial repercussions surrounding the failure of Franklin National Bank in the fall of 1974.

DREGQ - A dummy signifying the implementations and adjustments to Regulation Q.

GNP - Nominal gross national product.

GNP72 - Real gross national product (1972 $).

ICNR - Investment in private nonresidential structures.

ICR - Gross investment in residential structures.

IPDENR - Nonresidential investment in producers' durable equipment.

LCD - Negotiable certificates of deposit in denominations of $100,000 or more at large weekly reporting banks.

NBRES - Nonborrowed reserves of Federal Reserve member banks.

NETFFPUR - The difference between Fed funds purchased and sold by all insured commercial banks.

NETWRTH - Net worth at all insured commercial banks.

NFCGI - Nonfinancial gross investment.

NFCRESCH - Nonfinancial corporate residential construction expenditure.

$PGNP_{-3}$ - GNP price deflator lagged three periods.

S&LSEC - Municipal securities at all commercial banks.

RE - Undistributed corporate profits.

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RELOANS - Real estate loans outstanding at all insured commercial banks.

RCP - The money market rate on prime commercial paper with maturities of 4-6 months.

RG3 - The average market yield on 3-month Treasury bills.

RG3@5CM - The average market yield on U.S. government securities with maturities of 3-5 years, constant maturity.

RG10CM - The yield on ten year U.S. government bonds, constant maturity.

RHO - The adjustment for first-order autocorrelation.

RMSB - The average rate of interest paid on mutual savings banks' deposit.

RMTG - The effective conventional mortgage rate on new homes.

(RMTG - RMUN) - The spread between the mortgage rate and the yield on municipal bonds.

RSDCD - The average of the interest rates paid on consumer time deposits and three month CDs.

RTCGF - The effective Federal corporate income tax rate.

RU - The unemployment rate for civilian workers.

S1 - A seasonal dummy which equals one for the first half a year.

T&SDEP - Time and savings deposits at all insured commercial banks.

TOTDEP - Total deposits at all insured commercial banks.

TOTLIABS - Total liabilities outstanding at all insured commercial banks.

TOTLOANS - Total loans outstanding at all insured commercial banks.

TOTSEC - Investment account holdings at all insured commercial banks.

US%TOTSEC - The investment account holdings of U.S. government securities as a percentage of total securities at all insured commercial banks.

YDPERM72 - Real permanent disposable income (1972 $).

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Appendix

Model Equations

Assets

$$TOTASSETS = TOTASSETS_{t-1} + \Delta TOTASSETS_t$$

$$\Delta TOTASSETS = \Delta NETWORTH + \Delta LIABS_t$$

$$TOTSEC = TOTSEC_{t-1} + \Delta TOTSEC_t$$

$$\Delta TOTSEC = -89.98 + 5.4\ RU + 1.61\ RTCGF + 0.11\ \Delta TOTDEP$$

$$US\%TOTSEC = .15 - .0251 + .90\ US\%TOTSEC_{-1} - .18\ RTCGF$$

$$USGOVSEC = US\%TOTSEC * TOTSEC$$

$$S\&LSEC = TOTSEC - USGOVSEC$$

$$TOTLOANS = TOTLOANS_{t-1} + \Delta TOTLOANS_t$$

$$\Delta TOTLOANS = 4.16 + 2.43\ S1 + 0.25\ \Delta TOTDEP + 0.72\ ICR - 0.42\ NFCGI + 0.26\ RE - 2.3\ RU + 0.14\ \Delta GNP72$$

$$C\&ILOANS = C\&ILOANS_{t-1} + \Delta C\&ILOANS_t$$

$$\Delta C\&ILOANS = 3.57 + 0.42\ \Delta TOTDEP + 0.96\ \Delta ICNR - 0.38\ NFCGI + 0.14\ IPDENR + 1.8\ NFCRESCH + 0.35\ RE - 0.72\ RU$$

$$RELOANS = RELOANS_{t-1} + \Delta RELOANS_t$$

$$\Delta RELOANS = -1.66 - 0.36\ S1 + 0.22\ ICR - 0.61\ RMTG + 1.22\ (RMTG - RMUN) - 0.37\ RU$$

$$CONSLOANS = CONSLOANS_{t-1} + \Delta CONSLOANS_t$$

$$\Delta CONSLOANS = -.56 + 0.27\ \Delta CDMV\&P + 0.06\ TOTDEP + 1.02\ S1 + 0.47\ CONSLOANS_{-1} - 0.21\ CONSLOANS_{-2} - 0.35\ CONSLOANS_{-3} - 0.18\ CONSLOANS_{-4} + 0.08\ CONSLOANS_{-5} + 0.21\ CONSLOANS_{-6}$$

$$OTHERLOANS = TOTLOANS - C\&ILOANS - RELOANS - CONSLOANS$$

$$OTHERASSETS = TOTASSETS - TOTSEC - TOTLOANS$$

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LIABILITIES

$$TOTLIABS = TOTLIABS_{t-1} + \Delta TOTLIABS_t$$

$$\Delta TOTLIABS = -14.4 - 25.02\ S1 + 0.03\ TOTLIABS_{-1} + 3.13\ \Delta NBRES + 0.13\ GNP72 - 5.18\ DREGQ + 0.98\ \Delta LCD - 5.85\ RG3@5CM - 14.71\ RMSB - 16.57\ DFNB - .42\ RHO$$

$$DEMDEP = DEMDEP_{t-1} + \Delta DEMDEP_t$$

$$\Delta DEMDEP = 13.09 - 26.15\ S1 - 49.76\ \Delta RMSB - 6.39\ DREGQ + 0.88\ \Delta YDPERM72 - 0.46\ RHO$$

$$T\&SDEP = T\&SDEP_{t-1} + \Delta T\&SDEP_t$$

$$\Delta T\&SDEP = -21.69 - 6.47\ (\Delta RSDCD - \Delta RG10CM) + 3.53\ (RSDCD - RG3) + 0.05\ YDPERM72 + 0.76\ \Delta LCD - 1.58\ \Delta RCP - 0.47\ RHO$$

$$NETFFPUR = NETFFPUR_{t-1} + \Delta NETFFPUR_t$$

$$\Delta NETFFPUR = -6.52 - 9.51\ DFNB + 6.76\ S1 + 4.79\ PGNP_{-3} + 0.16\ \Delta(IPDENR + ICNR) - 2.62\ DCO - 0.86\ RHO$$

$$OTHERLIABS = TOTLIABS - DEMDEP - T\&SDEP - NETFFPUR$$

$$NETWRTH = NETWRTH_{t-1} + \Delta NETWRTH_t$$

$$\Delta NETWRTH = -0.64 + 0.25\ S1 - 0.70\ DFNB + 0.002\ GNP$$

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