

Using Interest Rates and Money Supply Measures to Forecast the Dow Jones Industrial Average

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INTRODUCTION

This article discusses forecasting the Dow Jones Industrial Average using interest rates and money supply measures, which influence the value of stocks. Correlations among interest rates are examined first, then correlations among money supply measures. (Correlations describe the strength of association among items studied.) Finally, six rates and measures are used to forecast the Dow Jones. The statistical analyses and the graphs in this article were made using the RESEARCH software program.

INTEREST RATES

Interest rates measure the cost of money. The stock market, like bond and commodity markets, is sensitive to interest rate changes. Examining the relationship between interest rate changes and the stock market can be informative. Choosing which interest rates to study depends on available data and your investment interests. Deciding on the number of rates to include in a forecasting model, on the other hand, depends on whether the rates are correlated.

Studies of the federal funds, prime rate, discount rate, 26-week T-Bills, and Donoghue's 7-day money market average from 1972 to 1984 indicated that these interest rates are highly correlated. Correlations between the T-Bill and the federal funds rates are particularly high: they vary from .80 to .95 between 1972 and 1984. (Perfect correlation is 1.00.)

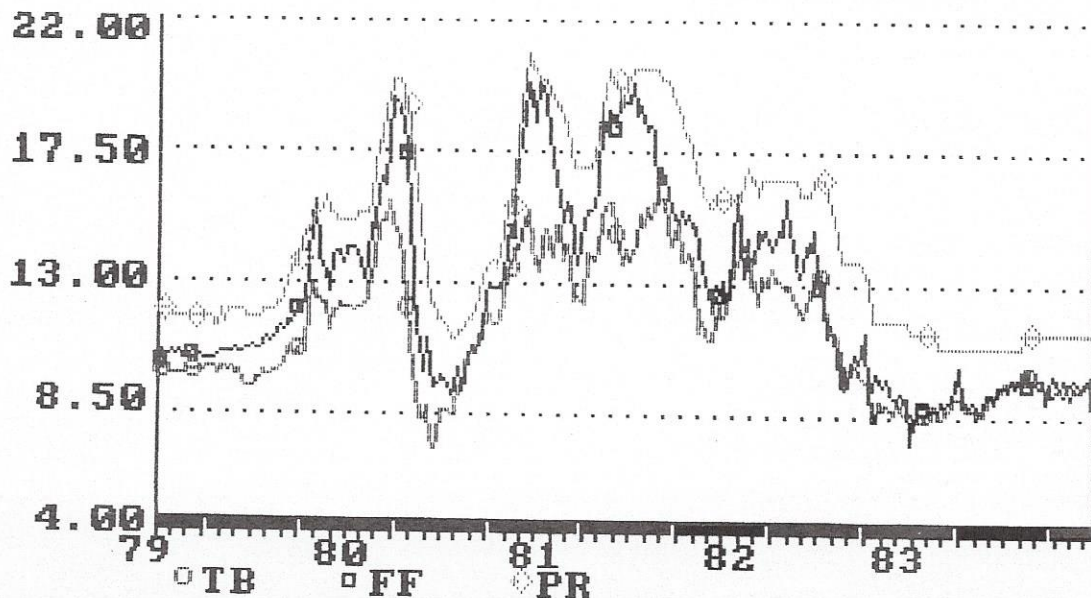
This relationship exists regardless of whether the Dow is going up, down, or sideways. For example, during 1/7/77 to 4/7/78, the Dow went down and the correlation between the 26-week T-Bill and the federal funds was .977. During 4/14/78 to 4/4/80, the Dow went sideways. The correlation between the 26-week T-Bill and the federal funds was .978. The correlation of these rates is seen in the graph titled "Federal Funds, Prime and T-Bill Rates" showing weekly data from 1979 to 1984. The three curves are close, with the T-Bill having the lowest values during the period and the prime rate the highest.

These rates vary together because of actions of the central bank. Numerous Federal Reserve procedures affect interest rates: changes in reserve requirements, Federal Reserve Open Market transactions, discount window borrowing procedures, interest rate limits on time and savings deposits at federally insured institutions, and the setting of target growth rates for interest rates, reserves, and monetary aggregates.

MONEY SUPPLY MEASURES

Money supply also influences stock market values. The Monetary Base, M1, M2, and M3, are all measures of money supply and are highly correlated among themselves. In our study, the period from 1972 to 1984 was divided into 13 segments and correlations among M1, M2, and M3 were all found to be greater than .90 in each time period. These are expected results because these measures are not independent of one another: M1

Federal Funds, Prime and T-Bill Rates
From 01/05/1979 To 12/30/1983



is included in M2, and M2 is included in M3. Studies of their quarterly and yearly rates of change also show their similarity.

M1 is used in the graph below because it is reported weekly, while M2 and M3 are reported monthly.

THE INFLUENCE OF INTEREST RATES AND MONEY SUPPLY

The influence of interest rates and money supply on the Dow is suggested in the accompanying graphs showing market changes. The RESEARCH program automatically calculates daily, monthly, quarterly, and yearly rates of change for any series. The example in the chart uses a quarterly rate of change in M1. We compare the Fall 1982 and August 1984 rises in the Dow Jones Industrial Average. The first graph, titled "1982 - THE DOW, FEDERAL FUNDS AND M1" illustrates the 1982 rise in the Dow Jones and the M1 measure of money supply, the federal funds rate (FF) and the Dow Jones Industrial Average (DJ).

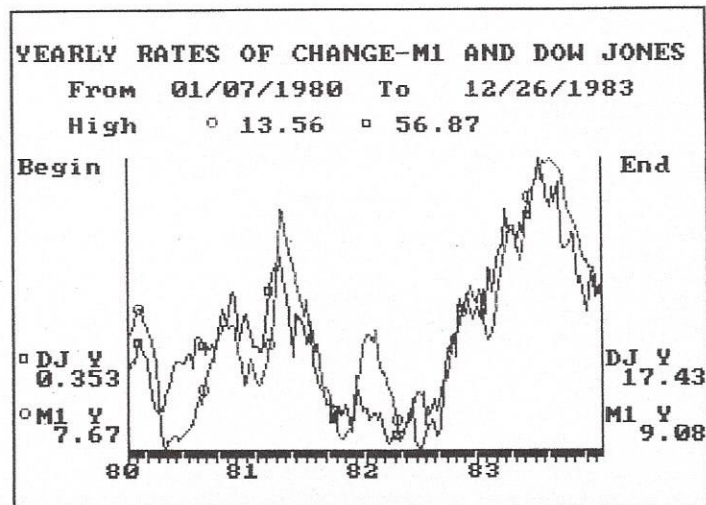
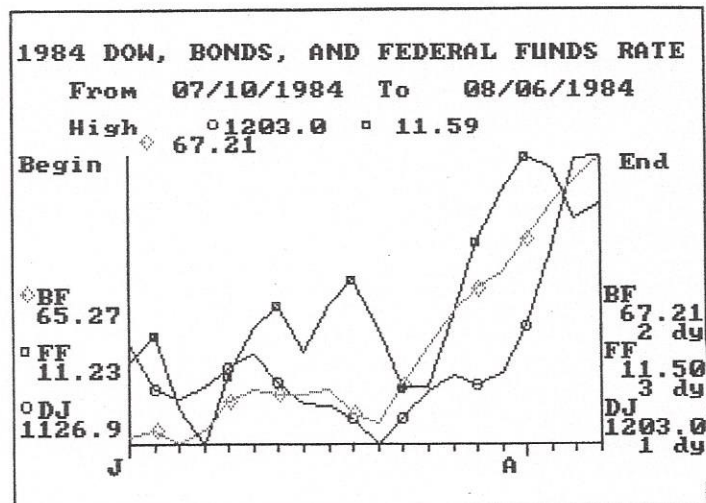
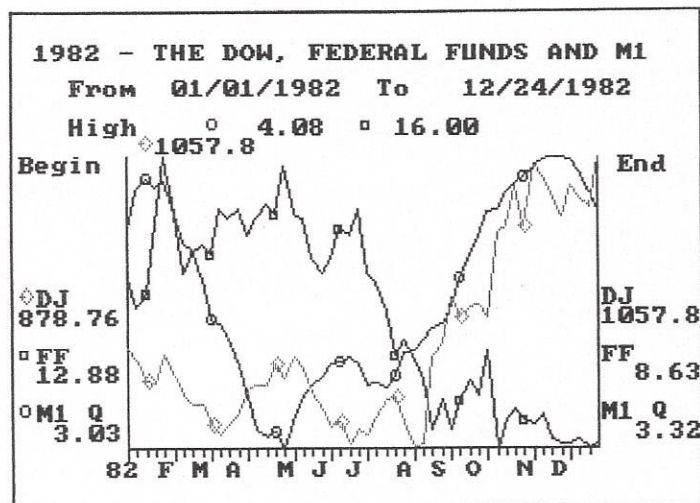
The beginning value of each series is shown on the left of the graph, the high value of each series is shown on the top, and the ending value for each series is shown on the right. This example uses the quarterly rate of change in M1. Notice "M1 Q 3.03" on the left of the graph. This shows the value of the first M1 datapoint. It shows a 3.03 increase in M1 during the quarter ending 1/1/82. "M1 Q 3.32" on the graph's right shows the value of the last M1 datapoint plotted. It shows a 3.32 increase in M1 during the quarter ending 12/24/82.

This 1982 graph uses weekly data to show changes in money supply, an interest rate, and the stock market during 1982. Note the sharp drop in the cost of money throughout July 1982 and the steady increase in the quarterly rate of change in the money supply beginning in early July. The drop in the cost of money and the increase in the supply of money were followed by a sharp increase in the Dow Jones beginning in early August. Note the simultaneous drop in the federal funds and the steep upward movement in the stock market during early October.

The graph titled "1984 DOW, BONDS, AND FEDERAL FUNDS RATE" shows daily data from July 10 to August 8, 1984. This graph includes two markets and shows the impact of changing interest rates on them. The daily data are smoothed slightly using moving averages. The Dow Jones 20 Bonds Fund Index (BF) is used as a measure of the bond market.

The federal funds rate reaches a temporary high on July 20, 1984 and then drops. The bond market responds the following Monday and rises sharply throughout the week. The stock market follows the next day. The bond market continues its rise even though interest rates increase the next week. The stock market moves up at the end of July when the the federal funds rate decreases.

Often, it is important to study the rate of change in a series — and not the values of the series. The influence of money supply changes is shown in the graph titled "YEARLY RATES OF CHANGE FOR M1 AND DOW." This graph shows the yearly percentage change for M1 and the Dow Jones from 1980 to 1984. The curves are similar, indicating the close connection between changes in money supply and the stock market. Note for example, how the change in the money supply and the Dow decrease in the middle of 1983.

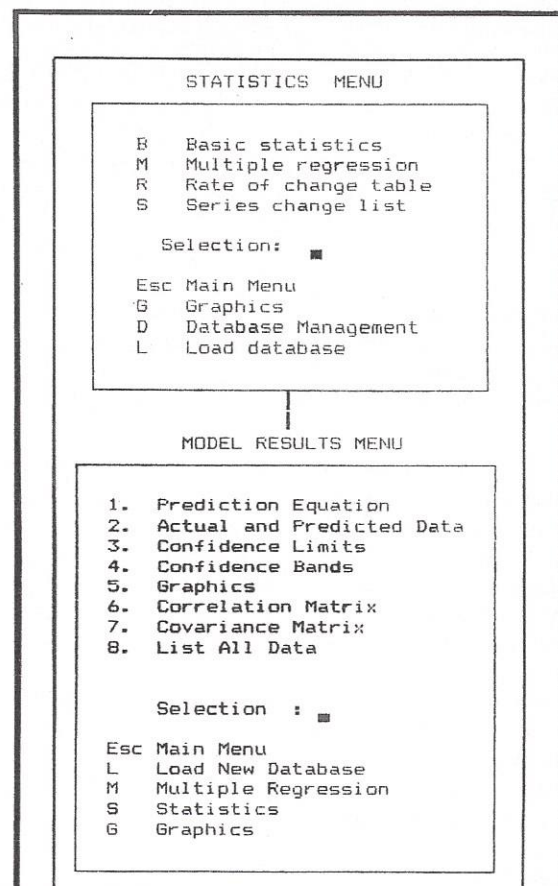


FORECASTING THE DOW JONES

One method of forecasting, the multiple regression technique, is illustrated to show the use of interest rates and money supply measures in forecasting the Dow. Multiple regression is a statistical procedure for studying the impact of a group of series on a single series. The single series is called the dependent series. The series used to predict the dependent series is called the independent series. The rationale for using multiple regression is that having information on how several indicators affect a given series is important for the development of a good forecasting model. As seen in the accompanying chart, interest rates and money supply measures affect the Dow.

The RESEARCH software program does multiple regression forecasting and is used in the following forecast. The table titled "CORRELATION MATRIX" shows the correlations among the Dow Jones, the prime rate, the 26-week T-Bill rate, and M1, M2, and M3. M2 and M3 are reported monthly and are interpolated to a weekly basis.

Note in the table that the three interest rates are moderately and negatively correlated with the Dow for the chosen period. The three measures of money supply are highly and positively correlated with the Dow. The three interest rates are highly correlated among themselves as are the money supply measures. The interest rates and the money supply measures are negatively correlated with each other.

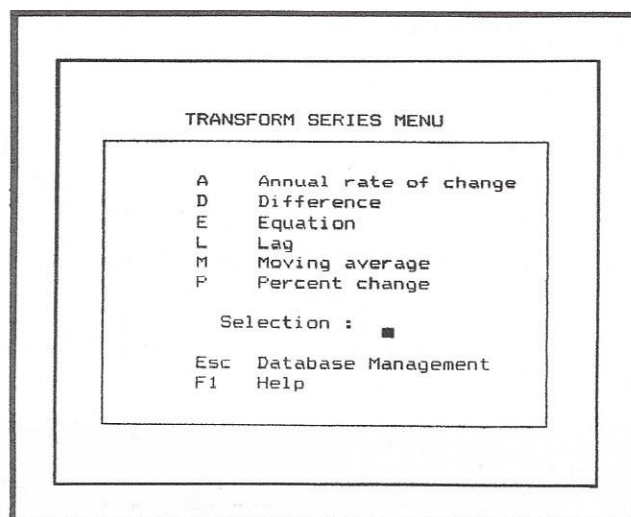


CORRELATION MATRIX
262 Weekly Datapoints From 1/19/79 To 2/1/1984

	Dow Jones	Prime Rate	T-Bill	Federal Funds	M3	M2	M1
Dow Jones	1.000						
Prime Rate	-.480	1.000					
26-week T-Bill	-.419	.929	1.000				
Federal Funds	-.432	.954	.930	1.000			
M3	.750	-.266	-.250	-.340	1.000		
M2	.795	-.316	-.290	-.377	.996	1.000	
M1	.825	-.320	-.281	-.369	.990	.997	1.000

Studies of the correlations between interest rates and money supply measures since 1972 show the correlations are not always negative, although they are with this database. The demand for money should increase when interest rates decline, but the relationship is not simple.

The six rates and money supply measures jointly account for .934 of the variance in the Dow Jones during 1979-1984. The R-squared of the prediction equation is .934, indicating good predictability since an R-squared of 1.00 indicates perfect predictability.



One forecasting possibility in multiple regression is to use the regression equation to forecast values of the dependent series. Actual or predicted values of the independent series can be entered into the equation and used to forecast the dependent series. The Beta weights in the multiple regression can be used to estimate how changes in the each independent series affect the dependent series.

Another possibility for forecasting is to calculate the regression line and extrapolate it into the future. The line is known by various names, including "a least-squares line," and "line of best fit." It is a straight line which is calculated to minimize the number of errors made in predicting values of the dependent series.

The regression line has numerous predictive applications. For example, the regression line can be projected as a trend line and compared to the actual money supply. When the difference between the trend and the actual is plotted on a logarithm scale, the difference measures the size of the shortfall as a percentage of the trend level. The effect of money growth changes on stock market values could be studied using this procedure.

The graph titled "Dow Jones Indus. Avg. 01/19/79 - 02/01/84" shows the plot of the predicted values of the Dow Jones using the regression equation, a plot of the actual Dow Jones values, and the regression line. The plot of predicted values is the light line. The plot of the actual values is the dark line. The regression line is the straight line running from the lower left to the upper right. The plot of the predicted values is close to the plot of the actual values, showing visually the high predictability of the regression equation.

The RESEARCH program contains a forecasting feature. If you press the F key, you receive a message asking how many datapoints ahead you wish to forecast. (You can forecast up to 999 datapoints). After you select the number of datapoints, the regression line is projected and the values of the forecasted dependent series are shown. This procedure can be used with any multiple regression model and a plot of the regression line. The forecasted values represent the future effect of the independent series on the dependent series.

In forecasting regression lines, it is sometimes useful to make long- and short-trend forecasts in order to control for recent turning points. For example, if the market is still going up but its rate of increase is slowing, then a market top may be near. Similarly, if the market is still declining but the rate of decrease is slowing, then a market bottom may be near.

SUMMARY

This article discusses the use of interest rates and money supply measures to predict the Dow Jones Industrial Average. Interest rates and money supply measures are shown to be highly correlated among themselves and with the Dow Jones. Changes in money supply are shown to vary together with changes in the Dow Jones. A multiple regression model containing three interest rates and three money supply measures closely predicted the values of the Dow Jones.

AVAILABLE FROM: Economic Software Inc., P.O. Box 10925, Eugene, OR 97440 (503) 485-6599. (Or call 800 information for toll free line.)
 COST: \$695
 REQUIREMENTS: IBM PC, XT; 196K; DOS 2.0; 2 double-sided drives or 1 double-sided drive and a fixed disk; graphics board required to run graphics portion of program.

