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While many believe that monitoring money is sufficient to gauge monetary policy's effect on the economy, others believe that credit provides additional useful information. This article examines the extent to which money and credit predict aggregate output over the 1959-87 period. The evidence indicates that although both money and credit aid in predicting output, in many cases the link between credit and output is stronger than the link between money and output. This result suggests that it may be worthwhile to pay particular attention to credit when determining the stance of monetary policy.

Higher loan losses and excessive operating expenses have often been cited as the cause of lower profitability at black-owned banks in comparison to other banks operating in the same major metropolitan areas. This article examines black-owned banks relative to nonminority-owned banks operating in the same specific neighborhoods and shows that loan losses and operating expenses are no higher at black-owned banks. The analysis thus suggests that previously reported differences were the result of locational effects and unrelated to minority ownership. Black-owned banks continued to report slightly lower return on assets, but the cause is not poor underwriting or an inability to control expenses.

Forecasts of the New Mexico economy derived from a time series model suggest that state personal income may rise more than 3.5 percent in 1989 and nonfarm employment is likely to expand more than 2.5 percent. The two growth rates represent an acceleration of the state's economy compared with 1988. Although these aggregate measures increase, housing construction and mining activity are likely to drop in 1989. The model also facilitates an understanding of the structure of the New Mexico economy, even though it uses a time series approach, rather than a structural one.

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The Credit-Output Link vs. the Money-Output Link: New Evidence

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The way monetary policy affects the economy has long been a source of debate among economists. Many believe that policy operates mainly through the monetary aggregates. Others believe that the volume of credit or the level of interest rates are the variables that impact the economy. While it is true that money and credit are highly correlated, there is still the question of which provides more information about the ultimate goals of policy.

Until recently, the main focus of monetary policy has, in fact, been on the link between a monetary aggregate and output. There has not been a consensus explanation for this relationship, however. The justification most often accepted for the money-output link has been that the existence of either informational imperfections or nominal rigidities allow changes in nominal money balances to have a short-run impact on real output and a long-run impact on prices. With the economy in the 1980s experiencing a breakdown in the money-output relationship, research has turned to the credit market for an alternative explanation of this correlation.[1]

Recent studies of credit market behavior argue that shocks to the credit market affect real output. Such shocks occur as a result of either monetary policy or other credit market occurrences. Since money and credit move together, the credit-output link shows up as a correlation between money and output.

Economists focusing on the money-output relationship recognize that policy may operate through the credit market. They believe, however, that monitoring the money-output relationship is sufficient to account for the credit-market channel. In contrast, economists advocating that the credit-output relationship be monitored believe this relationship provides additional information that should be followed along with the money-output link.

This article examines the extent to which monetary policy can be characterized as operating through the monetary or credit aggregates, or both. The main contribution of this article is its employment of recently developed statistical

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procedures in testing the credit-output and money-output relationships. These procedures allow for a more accurate specification of the empirical work than was previously possible.

The results indicate that monetary policy, as measured by the monetary base, plays a significant role in predicting credit. Credit, in turn, is significant in predicting output. The base is also significant in predicting demand deposits, the measure of money used in this study, and demand deposits are, in turn, significant in predicting output. In many cases, however, the link between credit and output is stronger than the link between demand deposits and output.[2]

This article also examines the importance of the credit-output link for the formation of monetary policy. Finding a link between credit and output suggests that the Federal Reserve should at least explore the possibility of paying more attention to credit than it has in the past.[3]

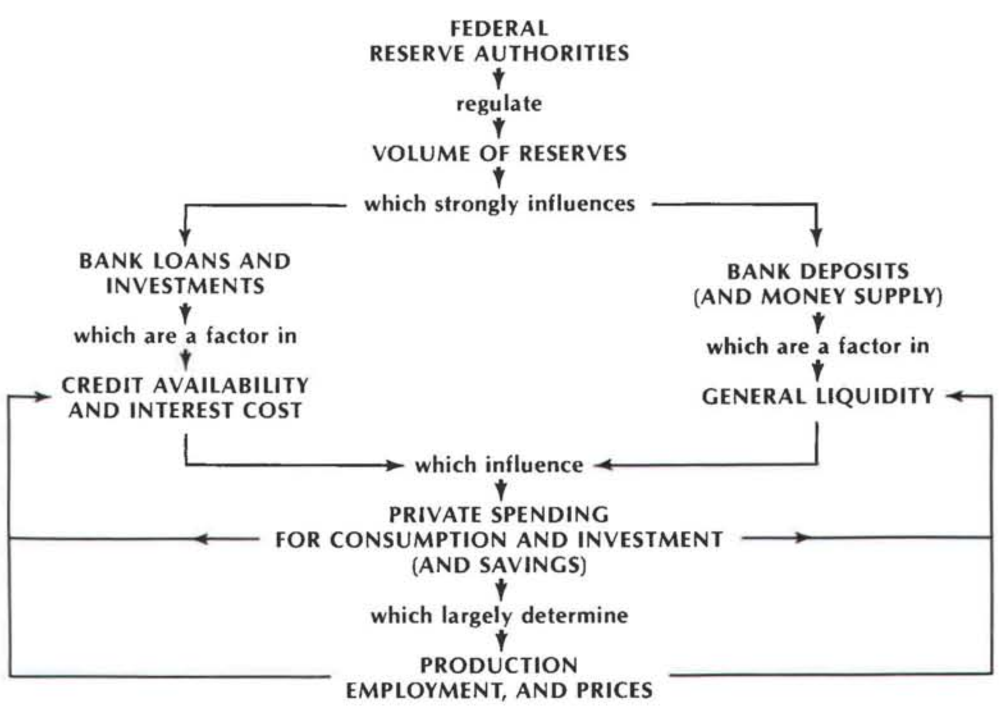
The first section of this article discusses the possible channels through which monetary policy influences the economy, and then recent empirical work that has examined these links is reviewed. Next, the empirical tests are presented and explained, followed by an analysis of the results. The fifth section discusses an extension of the analysis to include an interest rate variable, while the sixth section discusses the policy implications of the study. Some concluding remarks are offered in the final section.

The channels of monetary policy

Figure 1 details how money and credit serve as channels of monetary policy. An increase in bank reserves results in an increase in both bank loans and bank deposits. The right-hand side of the diagram represents the channel whereby a change in reserves influences general liquidity in the economy. General liquidity, in turn, affects consumption and investment. The left-hand side depicts the influence that policy has on credit availability and on interest rates, which ultimately affect output.

Support for the credit-output link as a possible policy channel is strengthened if bank credit and other forms of credit are viewed as imperfect substitutes, or if banks ration credit.[4] Imperfect substitution implies that restrictions on the availability of bank credit cannot be easily offset by an increased issuance of private bonds. Borrowers are either unwilling or unable to substitute bonds for loans. Conse-

Figure 1



quently, changes in monetary policy have a stronger effect on output than otherwise would be the case.

The result is similar if banks engage in nonprice discrimination of their loan applicants. A borrower that has been turned down for a bank loan often has difficulty securing credit elsewhere. In this situation, interest rates do not fully reflect the extent to which credit is curtailed.

Because movements in credit and movements in money are closely related, it is difficult to distinguish empirically between a credit channel for monetary policy and a money channel. In the banking system, since assets must equal liabilities, an increase in loans on the asset side must be offset by an increase in deposits on the liability side (see Box A).

It could be the case, however, that the liability increase occurs in a component of a broad monetary aggregate. In such a case, the more commonly watched measures of money and credit would be less than perfectly correlated. In general, imperfect timing of deposit and loan movements would lower the correlation between these two variables. When this occurs, one of these aggregates may be a more accurate indicator of economic activity than the other.[5]

Previous empirical work

The empirical support for the credit-output link has been mixed, despite the recent attention paid to the link between credit and economic activity. King found only weak empirical support for the idea that credit, as measured by bank loans, led economic activity.[6] Specifically, King found the link between bank loans and output weaker than the link between demand deposits and output. This result also proved robust to an examination of the percentage of output variation attributable to loans and demand deposits.

Box A

Banking System

Assets	Liabilities
Reserves	
Securities	
Loans	Deposits
	Net Worth

Using the same empirical methods employed by King and broader measures of money and credit, Bernanke found money to be a more powerful predictor of output than was credit.[7] Bernanke also estimated a structural vector autoregression model and found that credit and money explained an equal percentage of the variation in output.

The King and Bernanke articles constitute the most recent evidence on the money-output and credit-output links. Since the time of the publication of their work, however, two primary concerns have been raised over the specification of empirical models. One deals with the issue of obtaining stationary time series. The other deals with the appropriate lag-length specification of the variables.

Although it is well recognized that the variables used in empirical work must be stationary—i.e., display a constant mean over time—most of the recent research has merely made assumptions about what constitutes a stationary series. These assumptions vary across studies and, not surprisingly, affect the outcome of analyses. It has also become recognized, however, that what constitutes a stationary series can be statistically determined, thus avoiding potentially incorrect specifications and inferences. Hence, the credit-output and money-output relationships are reevaluated here in light of this newer technique.

It has also recently been pointed up that empirical findings are highly sensitive to lag-length specification. For example, Thornton and Batten recently noted that setting the lag-length of the variables in an equation arbitrarily at four produces one result, while setting them at eight produces the opposite result.[8] To resolve this problem, more formal statistical tests have been developed to guarantee that empirical work is specified appropriately. Such a procedure is also incorporated into the empirical work of this study.

The credit vs. deposit-output relationship: test procedure

This section discusses the use of Granger-causality tests to examine the relationship between bank credit and output and between bank deposits and output. These tests are often used to examine causality, where one variable is said to "Granger-cause" another if past values of the first variable help predict the second. Despite the name, these tests indicate only whether one variable predicts another; they do not indicate whether one variable determines another.

The test for causality is based on the following equations:

$$(1) \qquad y_t = \alpha_0 + \sum_{i=1}^{m} \alpha_i y_{t-1} + u_t$$

$$(2) \qquad y_t = \beta_0 + \sum_{i=1}^{m} \beta_i y_{t-i} + \sum_{j=0}^{n} \gamma_j x_{t-j} + v_t$$

where

u_t, v_t = independent, randomly distibuted error terms

and

α's, β's, γ's = parameters.

The variable x is said to cause y if equation 2 is a significantly better predictor of y than equation 1. The specific test for causality is a test of the hypothesis that $\gamma_1 = \gamma_2 = \ldots\ldots = \gamma_n = 0$.

Following earlier studies, a predictive relationship between the policy variables (the x variable) and *both* nominal and real gross national product (the y variable) is examined. Real output is used to consider the extent to which nominal policy variables have real effects in the short run. Nominal output is also used because the breakdown of a policy variable's effect on real economic activity and on prices is often difficult to determine. Moreover, the high correlation of money with nominal output has been well documented.[9]

The independent, or x variables used in this study are two measures of credit—commercial plus industrial loans and a broader aggregate, total bank loans—and, consistent with the work of King, demand deposits are used as the measure of money.[10] Thus, altogether, six bivariate regressions are estimated, where

y = gross national product (GNP), nominal or real.
x = total loans made by commercial banks (TL), commercial and industrial loans made by commercial banks (CI), or demand deposits (DD).

Trivariate tests of the form

$$(3) \qquad y_t = \beta_0 + \sum_{i=1}^{m} \beta_i y_{t-1} + \sum_{j=0}^{n} \gamma_j x_{1t-j} + \sum_{k=0}^{s} \delta_k x_{2t-k} + v_t$$

are also estimated where

x_1 = total loans
x_2 = demand deposits.

In this case, the question asked is, does each of the policy variables have predictive content for output once the other policy variable has been accounted for.[11]

The data used for estimation consist of quarterly observations over the period 1959:1 through 1987:4. The time period is also split at 1979:3 and the equations are estimated over the subperiod 1959:1-1979:3. In addition, equation 2 is estimated over the period 1979:4-1987:4.[12] This breakdown allows the results to be compared with King's results. His work only utilized data through 1979:3. Moreover, this breakdown also allows for the fact that the Federal Reserve changed its operating procedure in October 1979.[13]

As indicated earlier, two steps must be taken before the equation is estimated. First, the series used must be made stationary. Otherwise, if the series changed over time, it would be difficult to specify the proper dynamics. To guarantee stationarity, the autocorrelation functions of each of the series were examined. For each series, it was determined that either its growth rate or the change in its growth rate was a stationary process.

Next, the appropriate lag lengths, m, n and s, were chosen. Until recently, most researchers have imposed the same lag length on all the variables in their models. But their resulting parameter estimates may have suffered from bias or inefficiency, depending on whether the lag lengths chosen were too short or too long. To avoid this problem and the resulting incorrect inferences, Akaike's Final Prediction Error (FPE) was used to determine the appropriate lag lengths (see Box B). The lag lengths chosen by this method are reported in the following section.

The credit vs. deposit-output relationship: empirical results

This section reports the results of estimating equation 2, the bivariate specification, and equation 3, the trivariate test. Consider first the empirical results for the bivariate tests. Table 1 contains marginal significance levels for the test that the policy variable does not significantly aid in predicting GNP after controlling for a constant and lagged values of GNP. A number smaller than 0.05 implies rejection of the hypothesis that GNP is not Granger-caused by the variable at the 5-percent significance level.

Over the 1959:1-1987:4 period, both credit and demand deposits Granger-cause nominal output at the 5-percent level, while credit is also significant at the 1-percent level. All three variables have a predictive effect on real output at the 1-percent level. This conclusion differs significantly from the results reported by King in that he found the relationship between demand deposits and output to be far stronger

Box B

Akaike's Final Prediction Error

Akaike's Final Prediction Error (FPE) trades off bias from selecting lag lengths that are too short against a loss in efficiency caused by selecting lag lengths that are too long. The FPE formula is

$$\frac{SSR}{T} \quad \frac{T+i+1}{T-i-1}$$

where *SSR* is the residual sum of squares of the regression, *T* is the number of observations, and *i* is the number of included lagged variables.

This statistic was first suggested by Hsiao and then used by McMillin and Fackler and by Chowdhury, Fackler, and McMillin. See Cheng Hsiao "Autoregressive Modelling and Money Income Causality Detection," *Journal of Monetary Economics* 7 (January 1981): 85-106. W. Douglas McMillin and James S. Fackler, "Monetary vs. Credit Aggregates: An Evaluation of Monetary Policy Targets," *Southern Economic Journal* 50 (January 1984): 711-723. Abdur R. Chowdhury, James S. Fackler and W. Douglas McMillin, "Monetary Policy, Fiscal Policy, and Investment Spending: An Empirical Analysis," *Southern Economic Journal* 52 (January 1986): 794-806.

than the credit-output link. Specifically, over the 1950:1-1979:3 period, the marginal significance levels for nominal GNP reported by King were 0.002 for demand deposits, 0.302 for total loans, and 0.743 for commercial and industrial loans.

The results for the two subperiods are reported in Table 2. Over the 1959:1-1979:3 period, demand deposits dominated loans in predicting nominal economic activity. Nevertheless, loans were much more significant in this study (0.074 and 0.076) than in the work reported by King. All the variables were significant in predicting real economic activity. For the more recent subperiod, only total loans significantly predicted nominal GNP. The hypothesis of no causality was not rejected for the other variables, and none of the variables significantly predicted real GNP.

The fact that demand deposits were not significant in predicting either nominal or real GNP over the more recent time period is not surprising since it is well known that the correlation between demand deposits and economic activity has declined.[14] In addition, the introduction of NOW accounts has reduced the demand deposits held by households, further changing the link between demand deposits and GNP. A similar breakdown in the relationship between credit and output has not been documented, however, although the estimates do suggest that the relationship between loans and real economic activity also weakened somewhat in the 1980s.[15]

The money-output and credit-output relationships were further analyzed by examining the trivariate tests of these variables. These results are reported in Table 3. For the period 1959:1 through 1987:4, total loans significantly aided in predicting both nominal and real GNP, after the predictive content of demand deposits was incorporated. Demand deposits were also significant in predicting output once loans were accounted for, although the significance levels of the demand deposit tests were somewhat lower than the loan tests (0.047 and 0.038, as compared with 0.001 and 0.000).

For the subperiod 1959:1 through 1979:3, total loans did not aid in predicting nominal GNP once deposits were accounted for. This was consistent with the bivariate result over this period. Total loans were significant in predicting real GNP after deposits were included, while demand deposits did not improve the prediction of real output once loans were included.

Table 1
BIVARIATE TESTS OF PREDICTIVE CONTENT FOR GNP
1959:1-1987:4

	NGNP			RGNP		
	Marg. Sig. Level	Lag-Length	BG	Marg. Sig. Level	Lag-Length	BG
TL	.001	0*	.032	.000	1*	.900
CI	.007	0*	.066	.000	0*	.866
DD	.030	1	.149	.014	1	.900

NOTE: NGNP = nominal GNP, RGNP = real GNP. One lagged value of NGNP and two lagged values of RGNP were included as dependent variables. The logarithmic values of NGNP, RGNP, and DD were stationary in their first differences (their growth rates), while TL and CI were stationary in second differences of their logarithmic values.

BG = Breush-Godfrey statistic. This statistic detects the presence of serial correlation. Because of the presence of lagged dependent variables the Durbin-Watson statistic is invalid. The marginal significance level for the BG test is reported, indicating that none of the equations contain serially-correlated residuals.

*Indicates that the contemporary value of the independent variable was included in the regression. Given the time interval of the data, inclusion of the contemporaneous value of the independent variable does not rule out a temporal ordering.

Table 2
BIVARIATE TESTS OF PREDICTIVE CONTENT FOR GNP: SUBPERIOD RESULTS

	NGNP			RGNP		
	Marg. Sig. Level	Lag-Length	BG	Marg. Sig. Level	Lag-Length	BG
1959:1-1979:3[1]						
TL	.074	0*	.276	.003	0*	.537
CI	.076	0*	.284	.008	0*	.861
DD	.003	2*	.973	.010	7*	.856
1979:4-1987:4[2]						
TL	.010	1*	.099	.122	7	.208
CI	.270	1	.196	.226	1	.463
DD	.354	0*	.548	.127	1*	.307

NOTE: 1. One lagged value of NGNP and two lagged values of RGNP were included as dependent variables. NGNP, RGNP and DD were stationary in the first difference of their logarithmic values. TL and CL were stationary in the second difference of their logarithmic values.

2. One lagged value of NGNP and eight lagged values of RGNP were included as dependent variables. All the variables were stationary in the first difference of their logarithmic values.

*Indicates that the contemporary value of the independent variable was included in the regression.

Table 3
TRIVARIATE TESTS OF PREDICTIVE CONTENT FOR GNP

	NGNP			RGNP		
	Marg. Sig. Level	Lag-Length	BG	Marg. Sig. Level	Lag-Length	BG
1959:1-1987:4						
TL	.001	0*		.000	1*	
			.039			.765
DD	.047	1		.038	1	
1959:1-1979:3						
TL	.294	0*		.017	0*	
			.908			.504
DD	.007	2*		.104	0*	

NOTE: The stationary properties of the variables are discussed in Tables 1 and 2 for each of the time periods. The number of lagged dependent variables included is the same as the number in the bivariate tests.

*Indicates that the contemporary value of the independent variable was included in the regression.

Table 4
SUMMARY
EXTENT TO WHICH THE POLICY VARIABLES PREDICT OUTPUT AT THE 5-PERCENT LEVEL

	Nominal GNP			Real GNP		
	Total Loans	C & I Loans	Demand Deposits	Total Loans	C & I Loans	Demand Deposits
Bivariate Tests						
1959:1-1987:4	Yes*	Yes	Yes	Yes*	Yes*	Yes
1959:1-1979:3	No	No	Yes*	Yes*	Yes	Yes
1979:4-1987:4	Yes*	No	No	No	No	No
Trivariate Tests						
1959:1-1987:4	Yes*		Yes	Yes*		Yes
1959:1-1979:3	No		Yes*	Yes*		No

*Indicates the variable with the higher significance level.

In sum, as reported in Table 4, for the tests on nominal output, both credit and demand deposits led economic activity over the 1959:1-1987:4 period, with credit having a slightly higher significance level in both the bivariate and the trivariate tests. Demand deposits had a higher significance level in predicting nominal output over the earlier subperiod, while the bivariate tests over the latter subperiod indicated that loans had a substantially higher significance level.

The bivariate tests also indicate that both credit and money have a strong predictive link with real output, although these relationships do not hold up over the most recent decade. And the trivariate tests indicate that loans are more significant than deposits in predicting real output.

In the light of the newly developed statistical procedures, the tests here indicate that credit *does* have a predictive relationship with output. Moreover, during certain time periods, credit provides more information on output movements than does the demand deposit component of M1. It is therefore reasonable for the Federal Reserve to consider giving more weight to the credit-output link than in the past, if an aggregate strategy again becomes important to the policy process.

Interest rate extension

Many believe that monetary policy operates through interest rates and, in fact, most models of output movements include an interest rate variable. Therefore, this section discusses the results obtained from such an extension of the trivariate equation. Because Federal Reserve policy generally affects short-term interest rates to a larger extent than long-term rates, a short- term interest rate, the three-month Treasury bill rate, was used in this further analysis. These results are reported in Table 5.

With the inclusion of the interest rate variable, one important earlier conclusion is reversed. Over the 1959:1-1987:4 period, demand deposits are no longer significant in predicting either nominal or real GNP. Total loans remain highly significant, however. The interest rate variable is not significant over the 1959:1-1979:3 subperiod, indicating that interest rates provide no additional predictive content for output. Therefore, including an interest rate variable does not change the trivariate test results previously reported for this subperiod.

The fact that demand deposits are no longer significant in predicting output over the 1959:1-1987:4 period, once the interest rate variable is included, supports the notion that the money-output relationship deteriorated in the 1980s.[16] And since the volume of credit provided predictive content for output beyond that of the interest rate variable, the results also suggest that further research on credit rationing be pursued. Finally, similar to the conclusion drawn in the previous section, these results suggest that there may be times when a credit aggregate provides more information about movements in output than does a monetary aggregate.

Relationship to monetary policy instruments

Despite the fact that credit has a predictive effect on output, it has not yet been shown that the Federal Reserve can affect credit through a policy instrument. To check this,

Table 5
TESTS OF PREDICTIVE CONTENT FOR GNP WITH INTEREST RATE INCLUDED
1959:1-1987:4

	NGNP			RGNP		
	Marg. Sig. Level	Lag-Length	BG	Marg. Sig. Level	Lag-Length	BG
TL	.004	0*		.001	0*	
			.166			.149
DD	.185	1		.280	1	

NOTE: The stationary properties of the variables are discussed in Table 1. The number of lagged dependent variables included is the same as the number in the bivariate tests. The interest rate was stationary in the first difference of its level. One lag of the interest rate along with the contemporary value was used in the nominal GNP regression. Five lags along with the contemporary value were used in the real GNP regression.

*Indicates that the contemporary value of the independent variable was included in the regression.

Table 6
BIVARIATE TESTS OF PREDICTIVE CONTENT OF THE MONETARY BASE
1959:1-1987:4

	Marg. Sig. Level of MBASE	Variable Lag-Length	MBASE Lag-Length	BG
TL	.000	4	8*	.298
RTBs	.152	7	8*	.147
RTB	.094	3	8	.518
DD	.000	6	2*	.444

NOTE: RTBs = three-month Treasury bill rate. RTB = one-year Treasury bill rate. MBASE = monetary base. TL and MBASE were stationary in second difference of their logarithmic values. DD was stationary in the first difference of its logarithmic value. RTBs and RTB were stationary in the first difference of their levels.

*Indicates that the contemporary value of the independent variable was included in the regression.

causality tests were examined for the monetary base-loan relationship and for the monetary base-demand deposit relationship. A test was also conducted for the base-interest rate relationship to consider, as the credit-rationing hypothesis would argue, if the link between the base and credit is stronger than the link between the base and interest rates.

The marginal significance levels for these tests are reported in Table 6. As the table shows, the monetary base does predict loans. The base is also highly significant in predicting demand deposits. The base does not significantly predict either the three-month Treasury bill rate or the one-year Treasury bill rate. Therefore, these tests suggest that monetary policy may operate through both the credit and the money aggregates. Moreover, the base-loan relationship appears to be stronger than the relationship between the base and interest rates.

Policy implications

With a link established between a Federal Reserve policy instrument and bank credit and between credit and output, it is useful to examine the implications of these results for the recent effectiveness of monetary policy and for the conduct of policy.

In a recent article in this *Review*, Robinson argues that expansionary monetary policy has not resulted in lower long-term nominal interest rates in the 1980s.[17] Instead, as a result of an increase in inflationary expectations, expansionary policy led almost immediately to higher interest rates. If interest rates were the only channel of policy, one would conclude that the effectiveness of monetary policy has declined in recent years. But policy also operated through the volume of credit during this period, the Federal Reserve could still have affected the real economy in the short run. This is what the work presented here suggests.

Another implication of the analysis presented here concerns how monetary policy should be conducted. The results suggest that the Federal Reserve should consider targeting credit along with money, or at least consider treating credit as a more valuable indicator than it has in the past. This strategy has recently received support from a number of economists.[18]

The idea behind watching both money and credit is that important information is lost when one of these variables is ignored. In fact, the empirical work discussed here indicates that in most instances a credit aggregate provides information on output movements, beyond the information offered by demand deposits. Thus, ignoring credit may lead to policy being less accurate than it would be otherwise.

Admittedly, a distinction exists between monitoring a variable and targeting it for policy purposes. Monitoring involves watching an aggregate to obtain information on the ultimate goals of policy. Targeting involves, in addition, keeping the variable within prescribed levels of growth in order to meet the ultimate policy objectives. Although the existence of a relationship between the monetary base and credit suggests that credit might be used as a target variable, further empirical work should be conducted to verify these results. It would be particularly important to verify the results presented here using a broader monetary aggregate, since the size of demand deposits as a percentage of total deposits has declined in recent years. The work here could also be extended to include a broader credit measure as well. At this point, it is most realistic for credit to be considered a variable that may provide information about future output movements.

Conclusion

This article has explored the relationships between credit and output and between demand deposits and output over the 1959-87 period. Whereas previous empirical work found demand deposits to be a stronger predictor of output than credit, the work presented here shows that the credit-output relationship is often as strong as the deposit-output relationship and in some cases is stronger. Moreover, in some instances, credit and interest rates—rather than credit and deposits—have the strongest predictive relationship with output.

It was also determined that the monetary base plays a significant role in predicting both demand deposits and credit. This determination makes it reasonable that a credit aggregate might be given more weight as a target variable for monetary policy. Or less stringently, credit could be given a greater emphasis as an information variable that aids in predicting future output movements.

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1. See Benjamin M. Friedman, "Using a Credit Aggregate Target to Implement Monetary Policy in the Financial Environment of the Future," *Monetary Policy Issues in the 1980s*, Federal Reserve Bank of Kansas City, 1982, 223-247. Alan S. Blinder and Joseph E. Stiglitz, "Money, Credit Constraints, and Economic Activity," *American Economic Review, Papers and Proceedings* 73 (May 1983): 297-302. Ben Bernanke and Mark Gertler, "Banking in General Equilibrium," National Bureau of Economic Research Working Paper 1647, June 1985. For a survey of recent work see Mark Gertler, "Financial Structure and Aggregate Economic Activity: An Overview," National Bureau of Economic Research Working Paper 2559, April 1988.

2. This article does not examine the notion that the existence of a deposit-output or credit-output relationship is the result of increased economic activity leading deposit or credit creation. A predictive relationship from deposits or credit to output does not rule out the real business cycle hypothesis that these relationships are a result of expected *future* output leading deposit or credit creation.

3. The Federal Reserve regularly looks at bank credit and maintains a monitoring range for nonfinancial debt. Less importance is attached to movements in the credit aggregates as compared to the money aggregates in the policy process, however.

4. Ben S. Bernanke and Alan S. Blinder, "Credit, Money, and Aggregate Demand," *American Economic Review, Papers and Proceedings* 78 (May 1988): 435-439.

5. In fact, the correlation between total bank loans and demand deposits over the period 1959:1-1987:4 is 0.91. The growth rates of these two aggregates have a much lower correlation.

6. Stephen R. King, "Monetary Transmission: Through Bank Loans, or Bank Liabilities?" Journal of Money, Credit, and Banking 18 (August 1986): 290-303.

7. Ben S. Bernanke, "Alternative Explanations of the Money-Income Correlation," *Carnegie-Rochester Conference Series on Public Policy* 25 (Autumn 1986): 49-99.

8. Daniel L. Thornton and Dallas S. Batten, "Lag-Length Selection and Tests of Granger Causality Between Money and Income," *Journal of Money, Credit, and Banking* 17 (May 1985): 164-178.

9. Milton Friedman and Anna J. Schwartz, *A Monetary History of the United States: 1867-1960* (Princeton University Press 1963).

10. Demand deposits are used in the analysis since the purpose of this article is to redo earlier empirical work, in light of new statistical techniques. Admittedly, M1 or M2 are the variables most often thought of as money and, hence, most often examined for their link with output. Future work will extend the present analysis to include these broader aggregates.

11. Since total loans and C&I loans produced similar results in the bivariate tests, only total loans were used in the trivariate tests.

12. There are not enough degrees of freedom to conduct the trivariate tests with two independent variables over the more recent period.

13. Ideally, tests over the 1979-82 and 1983-87 periods would be conducted separately due to another change in operating procedures in late 1982. These sample periods are not long enough however, to ensure statistical accuracy.

14. "The Recent Behavior of Demand Deposits," *Federal Reserve Bulletin* 74 (April 1988): 195-208.

15. One explanation for the weaker significance of C&I loans in the 1980s is that loan commitment agreements used by U.S. businesses have become increasingly important. Use of loan commitments limits the extent to which policy can operate through the credit market. See George Sofianos, Paul Wachtel, and Arie Melnik, "Loan Commitments and Monetary Policy," National Bureau of Economic Research Working Paper 2232, May 1987.

16. This result is consistent with that reported in Christopher A. Sims, "Comparison of Interwar and Postwar Business Cycles: Monetarism Reconsidered," *American Economic Review, Papers and Proceedings* 70 (May 1980): 250-257. Sims found that once a short-term interest rate was included in the model, money explained only a very small percentage of the variation in real output. This conclusion was based on empirical work that used monthly data over the period 1948-78. In the work presented here the same result did not hold up over the 1959-79 period. Sims' model was different, however, in that it did not include a credit variable.

17. Kenneth J. Robinson, "The Effect of Monetary Policy on Long-Term Interest Rates: Further Evidence from an Efficient-Markets Approach," *Economic Review* Federal Reserve Bank of Dallas, (March 1988): 10-16.

18. See the references in footnote 1.

Appendix

Data Appendix

Data are quarterly, seasonally adjusted, for the period 1959:1-1987:4. The exception was data for the interest rates, which were available beginning only in 1960:1. All variables are in the first or second difference of their logarithmic values, with the exception of the interest rates, which were specified in level-differenced form.

Total Loans (TL) are total loans issued by commercial banks. Commercial and Industrial Loans (CI) are a component of total loans (approximately one-third of total loans as of December 1987). Both series are quarterly averages of monthly data. Data for 1959:1-1970:4 are from *Banking and Monetary Statistics (BMS)* (BMS) Table 1.4. Data for 1971:1-1972:4 are from the *Annual Statistical Digest* (ASD) Table 15. Data for 1973:1-1987:4 can be obtained from the ASD, the *Federal Reserve Bulletin*, or the Citibase Data Bank. Demand deposits (DD), the monetary base (MBase), and the Treasury bill rates (RTBs and RTB) are quarterly averages of monthly data from the Federal Reserve data bank. Real and Nominal Gross National Product (NGNP and RGNP) are from the National Income and Product Accounts.

The Performance of Black-Owned Banks in Their Primary Market Areas

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Previous research has consistently shown black-owned banks to be less profitable than nonminority-owned banks. It has not been determined, however, that poor management is the cause of the lower profitability. It could be that any bank serving the same immediate neighborhood—the same primary market—would also be less profitable. Black-owned banks have been compared with nonminority-owned banks in the same standard metropolitan statistical area (SMSA). But an SMSA is too broad an area for researchers to be certain that black-owned banks and the nonminority-owned banks serve similar primary markets. This article compares the performance of black-owned banks to nonminority-owned banks operating in close proximity. Any remaining differences should not be due to the banks serving different primary markets.

This article shows that many of the cited differences between black-owned and nonminority-owned banks disappear when black-owned banks are compared with nonminority-owned banks in the same primary market areas. Loan losses and operating expenses, two of the most often cited reasons for the poor performance of black-owned banks, are no higher at black-owned banks than at nonminority-owned banks in the same primary market area. Black-owned banks do have a slightly lower return on assets, but this difference does not necessarily mean their long-run viability is threatened.

Importance of the primary market area

Previous studies of black-owned banks have usually cited two reasons for these banks being less profitable than nonminority-owned banks.[1] One is high loan losses reduce profitability. Separate studies by Brimmer and Boorman suggested that problems with loan quality may reflect a lack of high-quality borrowers in the markets served by minority-owned banks.

The second reason is high noninterest expenses reduce net income. These higher expenses were often associated with a more volatile deposit base made up of many small deposit accounts. A statistical study of deposit outflows at black banks showed that private deposits were significantly more volatile at these banks than at nonminority banks.[2] Servicing more volatile deposits requires more labor, the largest noninterest expense of most banks. Occupancy expenses were also higher at black banks. To the extent that every worker requires workspace, the two issues may be related.

Despite all the previous research on black banks, no one has determined whether differences in characteristics and performance result from their operating in a specific primary market or from their majority ownership by blacks. This issue has been recognized in the literature. Brimmer suggested that it was their operating in the urban ghetto that made black banks different from other banks. As he stated in his study:

> Black banks trying to do business in urban ghettos appear to operate at a substantial disadvantage (even when compared with other banks of the same size) in terms of both operating costs and efficiency. . . .This experience, of course, is intimately related to the inherent risk of doing business in the urban ghetto: the high unemployment rates, low family incomes, the high failure rates among small businesses (compounded by high crime rates) make the ghetto an extremely risky place for small banks to lend money.[3]

There are two problems with Brimmer's analysis. First, he implicitly assumed that the black banks were operating in urban ghettos. No evidence was provided to support this assertion. Second, Brimmer's analysis could not separate the effects of black ownership from the effect of operating in the urban ghetto because he compared the aggregate financial statement of black-owned banks with the aggregate financial statement of all Federal Reserve member banks. He recognized that he was comparing banks that operated both in and out of the urban ghetto. In fact, he assumed that the problems of black-owned banks would also be encountered by nonminority-owned banks operating in the ghetto.

Boorman set the standard for later research by using a sample of minority-owned banks and nonminority-owned banks operating in the same Standard Metropolitan Statistical Area (SMSA). Following established precedent, he defined the relevant market as an SMSA. The SMSA had been the standard market definition used in structure-conduct-performance studies of competition in banking.

Boorman's and later researchers' use of the SMSA was a substantial improvement over Brimmer's use of national data. But an SMSA is too broad an area for the assumption that economic conditions are uniform across the whole area. Rents, and to some extent wages, are expected to differ between neighborhoods in an SMSA. The need for a better sample was raised by Black, who stated:

> It has been argued elsewhere that the poor performance of minority banks is in part due to the low economic condition in the banks' primary market areas. Such statements have, however, hitherto gone unsubstantiated despite having been accepted without much disagreement. Ideally, what should be done is to match banks according to size, charter source, age, SMSA, and economic characteristics of the primary market area. Such a matching scheme has not yet been done and must await a careful delineation of the primary service area as well as economic data of the primary service area.[4]

Black was the first to use the term primary market area, but he did not define it. Black's use of the term suggests that he was discussing the economic characteristics of the population living or working in the neighborhood served by the black-owned bank. Among such characteristics would be the unemployment rate, per capita income, average education, and banking habits. These characteristics were important, especially during the era of regulated interest rates on deposits, because locational convenience has been one of the most important factors cited by bank customers choosing a bank. Consequently, the characteristics of a bank's customer base is determined to a great extent by characteristics of the neighborhood population.[5] In addition to Black's concerns about the characteristics of the population, other locational factors, such as rents and wages, also affect a bank's portfolio and its performance.

Research for this article was designed to answer, to what extent differences in the financial structure and performance of black banks are the result of operating in a specific primary market area. To answer that question, the financial differences between mature black banks and mature nonminority banks were examined for three progressively smaller market definitions. The largest market was the SMSA. The second market was the zip-code cluster, defined as the zip-code region where a black bank operated and all adjacent zip-code regions.[6] The third and smallest market area was the zip-code region where the black-owned bank operated.[7] These two smaller regions were designed to specify an approximation of a primary market area. It was assumed that economic characteristics would be more uniform in the zip-code cluster, and certainly in the zip-code region, than in an entire SMSA.

This approach is not the one Black proposed. He suggested combining all similar primary market areas in an SMSA, but that is almost impossible. There is no generally accepted definition of a primary market area. And there are no finely disaggregated economic data to define one. The zip-code cluster and the zip-code region should approximate a primary market area. Economic characteristics might not be perfectly uniform across these areas, but by comparing black and nonminority banks operating in close proximity, this approach is a substantial improvement over the previous approach based on SMSAs.

The data and statistical tests

The sample of banks consisted of black-owned and nonminority-owned banks that were at least four years old on December 31, 1980. Mature banks were compared to eliminate any distortions that might be associated with the startup of minority-owned banks. Examination of mature banks would indicate that any differences were of a long-term nature. This approach also allowed a nearly direct comparison with the results of the study of mature black banks by Kwast and Black. The sample was restricted to banks with total assets no more than $125 million. This restriction eliminated any distortions arising from economies of scale or scope that might be associated with larger banks. As a result of these restrictions, there were 33 black-owned banks and 1070 nonminority-owned banks in the sample.

The financial data were obtained from the Report of Condition and the Report of Income and Dividends published by the Federal Reserve System. Annual balance sheet data were constructed by weighting quarterly observations.[8] Year-end income statements were used to eliminate seasonal variation. The bank zip codes were obtained from the Federal Reserve Board's Summary of Deposits database.

Zip codes reported in the Summary of Deposits database represent the geographical location of the banks and not their mailing addresses, which could be a postal box. Some black-owned banks mistakenly reported the zip code of their postal box. The zip codes of these black banks were corrected. It could not be determined, however, if the zip codes of the nonminority banks were correct. Consequently, some nonminority-owned banks may have been erroneously dropped from the zip-code cluster and zip-code region samples.

The average black bank is difficult to describe. Black banks were first chartered at the turn of the century. Nine black-owned banks chartered between 1904 and the 1950s were still in operation in 1983. Eight of these banks were in the South and one was in the District of Columbia. These banks provided an established base of black banks with several decades of banking experience. The average size of these banks in 1983 was $40.6 million in assets.

No new black-owned banks were established during the 1950s. Beginning in the 1960s, however, and peaking in the 1970s, a wave of black-owned bank charters were granted. Nine additional black-owned banks were chartered in the 1960s, doubling the number of existing black-owned banks. In the 1970s, 23 new black-owned banks were established. Another eight black-owned banks were chartered between 1980 and 1983. The black-owned banks in existence in 1983 ranged in asset size $4.2 million to $104.1 million and averaged $31.8 million.

Whether the differences in various financial ratios were significant between black and nonminority banks was determined by a *t* test. The ratios were calculated for individual banks and the unweighted mean and variance was calculated for each ratio for the black and nonminority banks. The variances of the two sample groups were tested for significant differences. If the variances were not significantly different, a simple difference-of-means test was conducted by using a *t* statistic. If the variances were significantly different, based on the results of an *F* test, the *t* statistic and the number of degree of freedom were calculated differently to adjust for the violation of the basic assumption that variances were equal.[9] Tables in the text report the difference between the ratios for black-owned banks and the nonminority-owned banks.

Reducing the size of the primary market area reduces the number of banks in the sample and reduces the power of the statistical tests. The null hypothesis in this study is that black banks are not different from nonminority banks. Two types of possible errors might result. A null hypothesis that is true could be rejected as false, and a null hypothesis that is false could be accepted as true. The first error—rejecting a true null hypothesis—is known as a Type I error. The statistical tests are constructed to permit only a 5 percent chance of this error. The probability of the second error—accepting a false null hypothesis, known as a Type II error—is a function of the number of observations and the probability of a Type I error. The number of observations decline as smaller areas are used to define a market, and these declines indicate that the probability of a Type II error is greater for the smaller market areas.

The decline in the number of observations in the smaller market areas comes from two separate effects. First, there are fewer nonminority banks in the smaller areas. The number of nonminority banks in the sample declined from 1070 for the SMSA market to 55 for the zip-code cluster market and to 16 for the zip-code region market. Second, there are fewer black banks in the sample. The requirement was that a black bank could be included in the sample if at least one nonminority-owned bank operated in the same area. In several instances, there were no nonminority banks in the same area as the black bank. As a result, the number of black banks declined from 33 in the SMSA market to 19 in the zip-code cluster market and 11 in the zip-code region market. Since four years of annual data were used, the number of observations was four times the number of banks.[10]

Empirical results

The empirical results are presented in three subsections that address the three main issues other research has raised about black bank performance. First, ratios concerning the quality of loan portfolios are examined, since black banks are often said to have difficulty lending to high-quality borrowers. Second, operating expense ratios at black banks are compared with the same ratios at nonminority banks to determine the validity of previous charges that black banks have higher expenses. And third, overall performance is examined. Each of these subsections presents the financial ratios for both the SMSA market, the definition used in other minority bank research, and the primary market area defined by zip-code region.

Loan quality. The empirical results of examining financial ratios that measure loan quality support the expected hypothesis that differences that existed in the SMSA market may disappear when the comparison is based on the primary market area. The differences in financial ratios for the SMSA market, reported in Table 1, are similar to the differences reported in other studies of black-owned banks. Compared with nonminority banks in the same SMSA, black banks had a significantly lower loan-to-asset ratio, a significantly higher rate of net loan losses, and a significantly lower risk-adjusted return on loans. These significant differences have been cited as evidence that black-owned banks have difficulty making profitable loans to high-quality borrowers.

The differences between black and nonminority banks change drastically as the size of the market area being analyzed is reduced to the zip-code region. As the market becomes smaller and more closely approximates a primary market area, the differences in the loan-to-asset ratio and the rate of net loan losses become insignificant. These changes imply that it is not more difficult for black banks to make profitable loans to high-quality borrowers than it is for nonminority banks in the same primary market area.

Two factors could account for the smaller difference in the loan-to-asset ratios as the market area becomes smaller. One is that nonminority banks in the same primary market area as black banks may also have difficulty attracting high-quality borrowers. The other is that the lower loan-to-asset ratio may reflect a need for liquidity resulting from a volatile deposit base. The deposits base could be volatile because of the Government Minority Bank Deposit Program (see box). In either case, the difference becoming insignificant as the size of market area is reduced indicates, for this measure at least, that the black banks may be more similar to nonminority banks in the same primary market area than previous studies indicated.

In contrast to the financial ratios mentioned above, the gross yield on the loan portfolios of black banks is significantly lower than the gross yield on loan portfolios of nonminority banks in the same zip-code region. The gross yield is the ratio of interest and fees on loans divided by total loans. The yield on loans adjusted for net loan losses, how-

Table 1
DIFFERENCES IN FINANCIAL RATIOS MEASURING LOAN QUALITY AND RETURNS OF BLACK-OWNED BANKS RELATIVE TO NONMINORITY-OWNED BANKS

	SMSA	Zip-code cluster	Zip-code region
	Difference from nonminority-owned banks (Percent)		
Loan/total assets	−8.1*	−6.1*	−4.6
Net loan losses/gross loans	.3*	.2	0.0
Loan loss provision/total operating expenses	.6	.9*	1.0
Interest and fees on loans/gross loans	−.1	−.3	−.6*
Interest and fees on loans − net loan losses/gross loans	−.4*	−.6*	−.7

* Significant at the 5-percent level.
SOURCE OF PRIMARY DATA: Statistics were derived from data taken from the Consolidated Reports of Condition and Income.

Government Minority Bank Deposit Program

Factors unrelated to location or primary market area could cause differences between black-owned and nonminority-owned banks. One of the most visible of these factors is the government program to increase deposits at minority-owned banks. In October 1970, the U.S. Treasury announced the Minority Bank Deposit Program to increase government deposits at minority banks by $100 million. The effects of this program began to be reflected in the balance sheets of minority-owned banks in 1971. Boorman reported that government deposits rose to 10 percent of total deposits at minority-owned banks that year while these deposits represented only 2 percent of total deposits at nonminority-owned banks.

The Government Minority Bank Deposit Program distorts the financial statements of black-owned banks in several ways. First, federal, state, and local government deposits are a significantly larger proportion of total liabilities at minority-owned banks. Second, being short-term and volatile, these deposits are not appropriate for funding long-term illiquid assets. In addition, U.S. government deposits of more than $100,000 must be backed by Treasury or agencies securities. As a result, minority-owned banks hold much more of their total assets in highly liquid forms. Third, private deposits make up less of total deposits at these banks. Therefore, the interest paid on private deposits is a smaller proportion of total expenses. And fourth, the lower interest expense of private deposits tends to be offset by the higher interest expense on government deposits, recorded under other operating expenses. Banks have paid interest on government demand deposits held more than one day since 1978. The interest rate is 25 basis points less than the federal funds rate.

Since the government program was designed to place funds in minority-owned banks, differences in financial ratios should be expected, regardless of the definition of a market area. Data reported in Table A support these expectations. With only one exception, the differences in all the financial ratios were as predicted and they were significant in every test of the primary market area. These results agree with the results of the Kwast and Black study. Therefore, some of the differences between black-owned and nonminority-owned banks result from the government deposit program and are not related to the market definition.

Table A

EFFECT OF GOVERNMENT DEPOSIT PROGRAMS ON DIFFERENCES IN FINANCIAL RATIOS OF BLACK-OWNED BANKS RELATIVE TO NONMINORITY-OWNED BANKS

	SMSA	Zip-code cluster	Zip-code region
	Difference from nonminority-owned banks (Percent)		
U.S. government deposits/total liabilities	9.4*	8.5*	9.2*
State and local government deposits/total liabilities	5.0*	7.3*	7.4*
Time and savings deposits/total liabilities	−17.2*	−15.0*	−12.4*
Other operating expenses/total operating expenses	8.6*	6.4*	4.8*
Interest on deposits/total operating expenses	−16.3*	−13.4*	−8.4*
U.S. government securities/total assets	6.5*	3.4*	3.5
Federal funds sold/total assets	4.5*	5.4*	4.8*

* Significant at the 5-percent level.

SOURCE OF PRIMARY DATA: Statistics were derived from data taken from the Consolidated Reports of Condition and Income.

ever, is not significantly different for the two groups of banks.

From these conflicting results, it is not clear that black banks earn a lower risk-adjusted return on their loan portfolios than nonminority banks. The lower gross yield at black banks could be the result of a less risky loan portfolio. However, the rate of loan losses (net loan losses divided by total loans) is not significantly different at black banks—which suggests that the credit risk is not significantly different at black banks.

Credit risk is not the only type of risk. Black banks could hold loan portfolios that result in less exposure to interest rate risk than the portfolios of nonminority banks. In that case, the gross yield would be expected to be lower at black banks and there would be no expected difference in the rates of loan losses. The data is not sufficient, however, to determine if, after adjusting for risk, black banks earned the same return on their loan portfolios as nonminority banks or a lower return. A lower return would be a sign of a poorly managed portfolio.

Some of the difference in loan yield could be due to a difference in the composition of loan portfolios. Table 2 reports the distribution of loans by type. There is a significant difference when the comparison is based on zip-code regions. The difference is that black banks hold fewer consumer loans than nonminority banks. Consumer loans typically earn a higher interest rate because they have a higher rate of loan loss. The lower gross yield on the loan portfolio at black banks, then, could result partly from their holding proportionally fewer consumer loans.

Operating expenses. The empirical results indicate that operating expenses are not significantly higher at black banks than at nonminority banks in the same zip-code region. Financial ratios concerning operating expenses are reported in Table 3. The ratio of total operating expenses to total assets is not significantly different for black banks and nonminority banks in any market area. As in other comparisons of black banks with nonminority-owned banks in the same SMSA, their salary and employee benefits are significantly higher relative to total assets or total expenses. The differences in labor-cost ratios become insignificant, however, when black banks are compared with nonminority banks in the same primary market area. These results suggest that wages are affected by location within an SMSA.

Significant differences in occupancy expenses also disappear when comparisons are based on the primary market area. As a proportion of total operating expenses, occupancy expenses are significantly higher at black banks than at nonminority banks in the same SMSA or zip-code cluster. The difference in this occupancy expense ratio becomes insignificant, however, when black banks are compared with nonminority banks in the same zip-code region. This result suggests that land values and rents may vary substantially across SMSAs and zip-code clusters.

One of the arguments given in previous research for the higher operating expenses at black banks was the higher volatility of their deposits bases. The literature suggests that black banks use services charges to discourage excessive volatility. This study cannot answer whether deposits at black banks are more volatile than deposits at nonminority

Table 2
DIFFERENCES IN LOAN PORTFOLIO COMPOSITION OF BLACK-OWNED BANKS RELATIVE TO NONMINORITY-OWNED BANKS

	SMSA	Zip-code cluster	Zip-code region
	Difference from nonminority-owned banks (Percent)		
Composition			
Real estate	−.6	2.3	2.0
Commercial and industrial	3.0*	−.6	3.9
Consumer	−2.0	−2.6	−7.5*
Other	−.4	.9	1.5

SOURCE OF PRIMARY DATA: Statistics were derived from data taken from the Consolidated Reports of Condition and Income.

Table 3
DIFFERENCES IN OPERATING EXPENSE RATIOS OF BLACK-OWNED BANKS RELATIVE TO NONMINORITY-OWNED BANKS

	SMSA	Zip-code cluster	Zip-code region
	Difference from nonminority-owned banks (Percent)		
Total operating expense/total assets	.2	−.3	−2.3
Salary and employee benefits/total assets	.6*	.2	−1.0
Salary and employee benefits/total operating expenses	5.3*	4.5*	2.1
Occupancy expenses/total operating expenses	1.4*	1.1*	−.1
Service charges on deposits/total operating income	1.0*	2.2*	2.7*
Service charges on deposits/total private deposits	.3*	.6*	.7*

* Significant at the 5-percent level.
SOURCE OF PRIMARY DATA: Statistics were derived from data taken from the Consolidated Reports of Condition and Income.

banks in the same primary market area. The empirical results do support the hypothesis, however, that black banks use higher service charges on deposits either to discourage volatility in deposits or to compensate for the higher costs. Service charges on deposits, whether as a share of total operating income or as a return on private deposits, were significantly higher at black banks than at nonminority banks, regardless of the market tested. This result is similar to that of most previous research.

The results on service charges and expenses contrast sharply with the results of the Kwast and Black study of mature black-owned banks. Kwast and Black found that black banks had higher operating expenses as a result of a volatile deposit base and did not offset these higher expenses with higher service charges. Actually, their results showed service charges were slightly higher but they did not test the difference for statistical significance. Results of this study show, however, that when black-owned banks are compared with competitors in the same primary market area, their expenses are not different. Furthermore, relative to deposits, service charges are significantly higher at black banks than at nonminority banks operating in the same SMSA or primary market area.

Performance. Previous discussion of the empirical results has detailed differences in key issues pertaining to black banks when the analysis is based on primary market areas as opposed to larger market definitions, such as an SMSA. This discussion takes up overall measures of performance, comparing black banks with nonminority banks in the same primary market area. Financial figures and ratios in Table 4 show that, on average, black banks are significantly smaller than their competitors and significantly less capitalized.

Previous studies have cited significantly higher operating costs as one of the reasons for lower overall performance at black banks. In contrast, this research shows that operating expenses are not significantly higher at black banks than at nonminority banks in any of the market areas tested. Nor is total operating income relative to total assets significantly different in any of the markets.

The most common measure of total performance in previous studies was the return on assets. The results of using SMSAs as markets were the same in this study. Before taxes and after taxes, the returns on total assets were significantly lower at black banks than at their nonminority competitors. Performance based on the before-tax return on assets was significantly lower even when the market area was reduced to the primary market area.[11] Based on this measure of performance, there appears to be a difference in black bank performance and the difference appears not to be the result of operating in a different primary market.

The after-tax return on capital was not significantly different, however, when based on a primary market area approximated by a zip-code region. This result should not be seen as contradicting the previous one. The difference in the two ratios is the result of the tax structure. If the tax structure is progressive enough, the real differences in before-tax performance could be eliminated on an after-tax basis.

Table 4
DIFFERENCES IN FINANCIAL DATA MEASURING SIZE, CAPITALIZATION, AND PERFORMANCE OF BLACK-OWNED BANKS RELATIVE TO NONMINORITY-OWNED BANKS

	SMSA	Zip-code cluster	Zip-code region
	Difference from nonminority-owned banks		
Data	(Millions of dollars)		
Total assets	−26.0*	−46.3*	−50.2*
Total capital	−2.3*	−4.3*	−4.4*
Ratios	(Percent)		
Capital/total assets	−.3	−1.0*	−2.1*
Total operating income/total assets	−.1	−.7	−3.1
Returns			
Return on assets, before taxes	−.4*	−.4*	−.8*
Return on assets, after taxes	−.2*	−.2	−.2

* Significant at the 5-percent level.
SOURCE OF PRIMARY DATA: Statistics were derived from data taken from the Consolidated Reports of Condition and Income.

The lower performance of the black banks is surprising, especially in the primary market area approximated by the zip-code region. Contrary to previous studies, this study shows that the differences in labor and occupancy expenses were not significant between black and nonminority banks in the same primary market area. Nor were net loan losses significantly different. The relative improvement in expense control does not appear to be enough to eliminate differences in total performance.

One possible explanation could be the Government Minority Bank Deposit Program. If black banks invest their government deposits in federal funds sold, their net return on these funds is only a quarter of one percent. Investment of these deposits offer a profit at the margin, but the average yield on the investment is likely to be less than the average yield on the bank's other assets. As a result, the government deposit program may increase the minority-owned bank's profits while lowering its average return on assets.

Conclusions

These results offer a new perspective on the difference in performance of black-owned banks and nonminority-owned banks. Previous research suggests that the main differences in these banks are the higher loan losses and higher labor and occupancy expenses of black-owned banks. When the "market" was defined as an SMSA, the results were consistent with those in other research, specifically that loan losses and some expenses were higher at black-owned banks than at nonminority-owned banks. Compared with nonminority-owned banks in the same primary market area, however, these differences disappear. There were no significant differences in loan losses or in labor or occupancy expenses.

Empirical results support the hypothesis that some of the differences between black-owned and nonminority-owned banks reported in previous research were likely based on locational differences within an SMSA. This result is intuitively appealing. Rental rates in the central city are different from the average rental rate for an entire SMSA. Similarly, workers may demand a wage premium for working in the central city to compensate for the cost of commuting. These differences in factor costs appear to be due to locational effects. It does not appear that they can be attributed in any way to inefficient management at black-owned banks, as previous research has suggested.

Similarly, the higher loan losses at black-owned banks reported in previous studies may be more closely related to the immediate market areas the banks serve than to any fundamental difference in the management of black-owned banks. The differences in loan losses disappear when the comparisons are between black-owned and nonminority-owned banks in the same zip-code region. One explanation is that demographic characteristics of the primary market area have an important effect on the rate of loan losses. Consequently, any comparison of banks in different primary market areas—such as black-owned banks with nonminority-owned banks operating elsewhere in the SMSA—would not be valid.

The importance of these locational differences extend beyond the literature on minority-owned banks. Any peer-group comparison of bank performance could be improved by comparing banks with competitor banks in the same primary market area.[12] This study supports the hypothesis that locational factors can be significant.

As expected, some factors were independent of locational effects. The effects of the government deposit program were independent of the specific market definition tested. The magnitude of the benefit of this program—or even if there is any benefit to minority-owned banks—is an issue for further research.[13]

Adjusted for locational differences, there is still a significant difference in the performance of black-owned and nonminority-owned banks. Before taxes, the return on assets is lower at black-owned banks—and in every market size tested. The precise cause of this difference is not clear. Black-owned banks seem able to control their costs as well as other banks. The Government Minority Bank Deposit Program might depress the return on assets.

Future research should be directed at improving the power of the statistical tests. The probability of erroneously accepting the null hypothesis that there are no differences between black-owned and nonminority-owned banks increases as the size of the market area is reduced. Future research might try to balance the probability of accepting a false null hypothesis against the probability of rejecting a true null hypothesis.

Compared with other banks serving the same primary market, black-owned banks have a slightly lower return on assets. They could be less profitable than other banks, in the nation or even in the same SMSA. These black-owned banks appear, however, to be serving a niche in the market that may not be well served by the mainstream banking industry. In many instances, given other restrictions in the samples, there were no other banks in the same zip-code cluster or region as the black-owned banks. Consequently, while the performance of black-owned banks may not compare favorably with the performance of banks nationwide, they may still be highly viable in the long run. Their ability to generate profits by serving their niche in the market suggests that they will continue in operation.

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1. See Andrew F. Brimmer, "The Black Banks: An Assessment of Performance and Prospects," *The Journal of Finance*, 26, no. 2 (May 1971), 379-405; John T. Boorman, "The Prospects for Minority-Owned Commercial Banks: A Comparative Performance Analysis," *Journal of Bank Research*, 4, no. 4 (Winter 1974), 263-79; and Myron L. Kwast and Harold Black, "An Analysis of the Behavior of Mature Black-Owned Commercial Banks," *Journal of Economics and Business*, 35, no.1 (1983), 41-54. For the sake of exposition black-owned banks and nonminority-owned banks are referred to here as black banks and nonminority banks, respectively.

2. Timothy Bates and William Bradford. "An Analysis of the Portfolio Behavior of Black-Owned Commercial Banks," *The Journal of Finance*, 35, no. 3 (June 1980), 753-68.

3. See Brimmer, "The Black Banks: An Assessment of Performance and Prospects."

4. Harold Black, "An Analysis of Minority Banks," Research Paper no. 77-6, Division of Economic Research and Analysis, Office of the Comptroller of the Currency (Washington, D.C., 1977).

5. In describing how customers choose banks, a study by A. J. Woods Research Corp. showed that physical location serves primarily as a screening device. If a bank is not convenient, it will not even be considered. See "Key Factors Revealed in Selecting a Bank," *Mid-Continent Banker*, 78, no. 8 (August 1982), 32.

6. Major geographical barriers were considered in the design of the zip-code clusters. If a major river, for example, separated an adjacent zip-code region from the zip-code region containing the black-owned bank, that zip-code region was not included in the cluster.

7. Construction of the sample was based on the location of the head office of the bank. Consequently, there is a complication in the nonminority-owned bank sample. In states that permit branch banking, the nonminority sample is underreported to the extent that branches of banks with head offices outside the market provide services in the same market served by the black-owned bank. The problem cannot be corrected, but it may not be large. As the asset size is restricted to less than $125 million, large banks with extensive branch networks are eliminated anyway.

8. The weights used in creating annual observations were developed by Peter Lloyd-Davies in, "Measuring Rates of Return," Research Paper in Banking and Financial Economics, Financial Studies Section, Division of Research and Statistics, Board of Governors of the Federal Reserve System (Washington D.C., 1977).

9. The t statistic adjusted for different variances is

$$t = (x_1 - x_2) / \sqrt{(s_1^2/n_1 + s_2^2/n_2)} .$$

where

$\bar{x}_i$ = sample mean for group i
s_i^2 = sample variance for group i
n_i = number of observations in group i

The number of degrees of freedom is

$$df = \frac{(s_1^2/n_1 + s_2^2/n_2)^2}{\{[(s_1^2/n_1)^2/(n_1 - 1)] + [(s_2^2/n_2)^2/(n_2 - 1)]\}} .$$

10. With a pooled sample of cross-section, use of time-series data assumes that the means and variances of the financial ratios do not change over time. It would be better if a single year's data could be used so that this assumption would be unnecessary. But there are too few observations not to use pooled data. As stated above, there were only 11 black-owned banks and 16 nonminority-owned banks in the zip-code region sample.

11. This result is an example of fewer observations in smaller market areas reducing the power of the statistical tests. The difference in the after-tax return on assets to black-owned banks and nonminority-owned banks is almost constant at −0.2 in every market area. This difference is statistically significant, however, only for the SMSA market. The likely reason for it not being statistically significant for the two smaller market areas is that the power of the test is diminished for the smaller markets, making it more likely that the false null hypothesis is accepted.

12. Peer-group samples that isolated the locational effects of primary market would be more difficult to construct for larger banks operating in regional or national markets.

13. The actual gain to the minority-owned banks has never been estimated. It is not clear that the gain is even positive. Kwast and Black reported that "there is some evidence that the U.S. Treasury demand note program may have disproportionately increased the expenses of the black banks." See Kwast and Black, "An Analysis of the Behavior of Mature Black-owned Commercial Banks."

The New Mexico Economy: Outlook for 1989

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This article presents forecasts of the New Mexico economy for 1989. The forecasts are the product of a multivariate time series model that was constructed according to statistically based decision rules. As is generally true of time series models, this one is a set of pure forecasting equations, and it was not constructed on the basis of any preconceived theories about structural relations in the New Mexico economy. Variables in the equations are purely predictive, and independent variables should not be construed as "driving," or causing, changes in the dependent variables. Nevertheless, the process used to build this model not only results in forecasts but also provides much information about New Mexico's economy. Because world and national events affect the New Mexico economy, the model contains a series of equations that forecast movements in indicators of such events. Forecasts from these equations are then used as inputs to the predictive equations for the New Mexico economy.

The model forecasts moderate growth for the New Mexico economy for 1989, and the expansion occurs slightly faster than the rate so far in 1988. Despite this modest forecasted acceleration in overall New Mexico growth, the upturn is not shared by all sectors of the economy. While nonagricultural employment, personal income, durable and nondurable goods manufacturing employment, and sales tax revenue all increase in 1989, the value of the state's nonfuel mineral production drifts downward. Oil and gas drilling activity falls, and mining employment slips. Housing permits also decline.

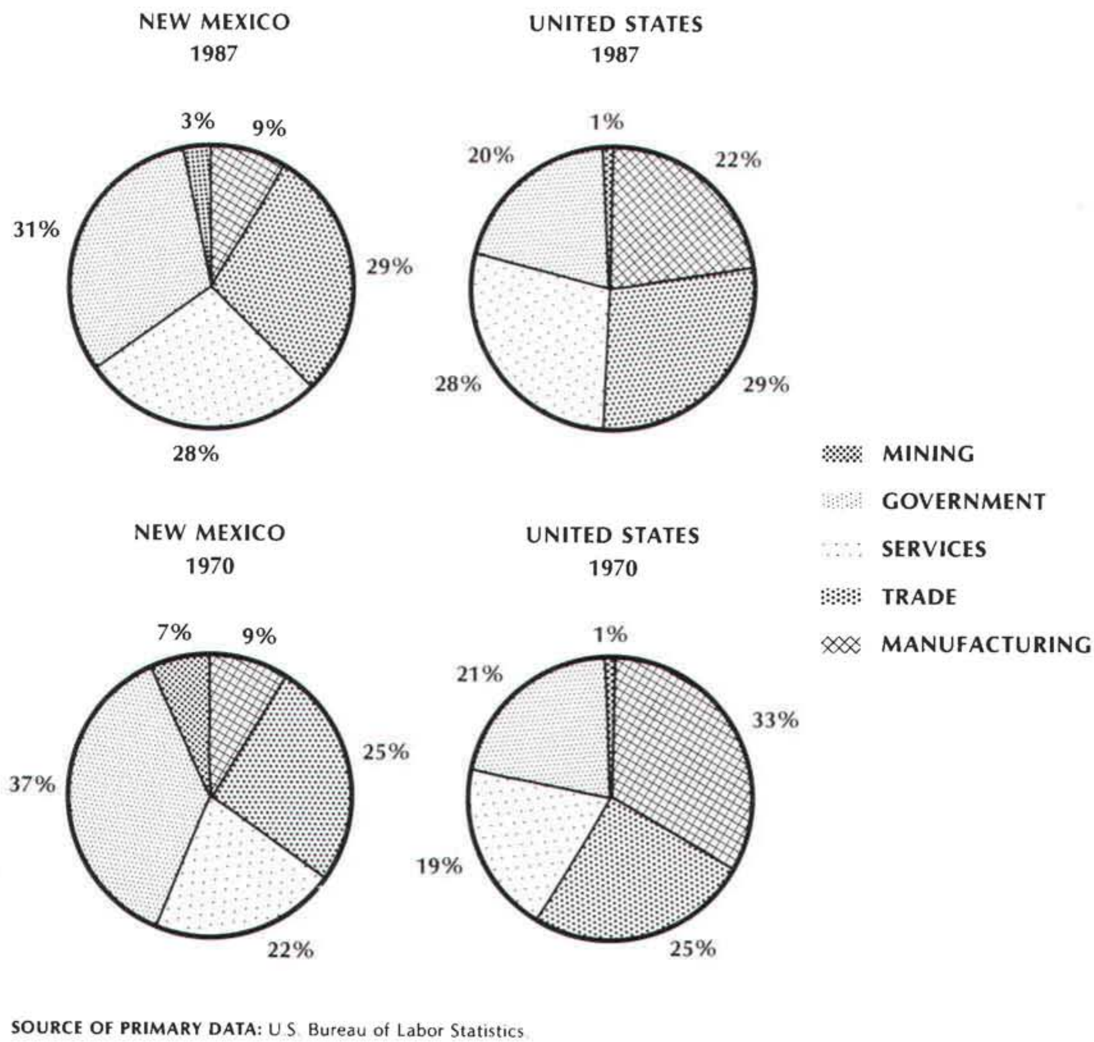
To provide a background for interpreting the New Mexico economy and the forecasts, this article begins with an outline of special characteristics of the state's economy and an overview of its recent fluctuations. These sections are followed by an analysis of the information derived through the process of constructing the model, then by a discussion of the model and its forecasts. The procedure used to construct the model, similar to one applied earlier to the Texas economy, is discussed in the accompanying box.[1]

The structure of the New Mexico economy

The composition of the New Mexico economy is substantially different from that of the U.S. economy as a whole. One measure of difference between a state's industrial structure and the nation's shows New Mexico as ranking 15th among the 50 states in its degree of deviance from the U.S. economic structure.[2] Mining and the Federal Government absorb much larger shares of employment in New Mexico than in the nation.[3 4] Conversely, manufacturing plays a comparatively small role in New Mexico. Agricultural employment absorbs about the same share of the state's work force as the nation's, but agricultural income accounts for a substantially smaller portion of total personal income in New Mexico than nationally. Despite the importance of tourism to the state, personal income from services (including hotel and related services) accounts for about the same share of personal income as in the United States.

Chart 1 compares employment shares, by economic sector, in New Mexico with those of the nation for 1987 and 1970. In 1987, mining absorbs three times as large a percentage of the work force in the state as in the nation although, even in New Mexico, this share is only 3 percent. Government's share of the work force in New Mexico is more than 50 percent above the national average as a result of the many federal installations in the state. The trade and service employment shares for New Mexico are at the national averages in 1987. While the combined share of government and mining employment in the state is 13 per-

Chart 1
Employment Shares, by Industry
(Calculated from Annual Averages)



SOURCE OF PRIMARY DATA: U.S. Bureau of Labor Statistics.

centage points higher than in the nation, the New Mexico share of manufacturing employment is 13 percentage points below the comparable U.S. average.

Despite New Mexico's unusual aspects, the state was more similar to the nation in 1987 than in 1970, as can also be seen in Chart 1. A comparison of New Mexico and U.S. employment shares for 1970 shows that government and mining absorbed more of the New Mexico work force then than recently. At the same time, New Mexico's service employment share was larger than the national average, but the state and national shares for this sector have since converged.

Also, while manufacturing's share of the U.S. work force declined markedly between 1970 and 1987, this sector's share has remained unchanged in New Mexico. One reason for the convergence of shares is the relatively rapid expansion of electronics manufacturing activity in New Mexico. A recent motivation for this expansion has been high labor and living costs in northern California's Silicon Valley. These factors led to a spatial restructuring of the semiconductor industry and a geographical diffusion of high-skilled phases of the production process, including expansion of productive capacity in New Mexico.[5] Between 1970 and 1987, electronics employment grew much more rapidly in New Mexico than nationally. More generally, manufacturing employment during this period changed little in the United States but expanded markedly in New Mexico.

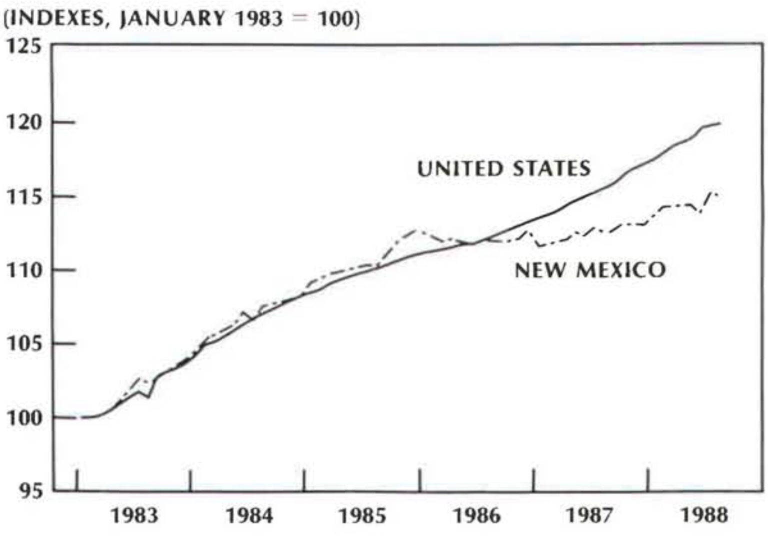
Although there is wide variation in income per capita and in levels of economic activity within the state, New Mexicans generally earn less than the average U.S. citizen. Income per capita for the state is about 76 percent of the national average, placing New Mexico 45th among the 50 states.

Recent fluctuations in the state's economy

New Mexico has recently been growing faster than its neighboring states of Oklahoma and Texas, but its economic expansion has been slower than the nation's. In 1986, when energy prices fell precipitously, the impact made New Mexico one of only four states whose nominal gross state product declined. Conversely, the U.S. economy continued to expand. Since then, the New Mexico economy has grown but at a slower pace than the nation's. In 1987, growth in New Mexico's nominal personal income was about 3.6 percent, compared with a national increase of 5.8 percent.

Employment expansion in the state has also been slower than nationally, as can be seen in Chart 2, which presents indexes of U.S. and New Mexico employment for the period from 1983 to August 1988. Note that the index for New

Chart 2
Nonagricultural Employment



SOURCE OF PRIMARY DATA: U.S. Bureau of Labor Statistics

Mexico employment has remained below the national index since 1986, when an energy industry-related slowdown hit the state. Although employment growth has been strong in manufacturing and mining, slow expansion in the state's important government sector and absolute declines in construction employment have dampened upturns overall.

Factors affecting the state's economy in 1989

A combination of world and national events is likely to shape the performance of the New Mexico economy in 1989. Although these events are not captured in the model structurally since it is a pure forecasting model, they still have structural links to variations in the New Mexico economy. First, the performance of the national economy itself will be a major determinant of growth in New Mexico. Recent research suggests that New Mexico's fluctuations are more closely tied to national economic shocks, and less linked to region-specific shocks, than is the case for most other states.[6]

This relation may raise some questions concerning the forecast. As each successive month creates a new record duration of national peacetime economic expansion, some factors point to slower national growth. For example, rising national capacity utilization rates are approaching points at which further expansion in output may be constrained in the short run. These constraints may restrain further U.S. growth. By affecting the demand from other regions for New Mexico's products, slower national growth would restrain the state's pace of expansion. The New Mexico forecast produced by the model is consistent with a moderate expansion of about 2.5 percent in U.S. real personal income.

Perhaps equally important for New Mexico's economic performance in 1989 will be the behavior of the foreign exchange value of the dollar. Previous research has demonstrated that the dollar's value in foreign exchange markets can have significant regional effects.[7] Because of its industrial structure, New Mexico is likely to benefit least among the three Eleventh District states and less than the nation from a decline in the dollar. Conversely, New Mexico's industrial composition makes it less susceptible than the nation or other District states to dampening effects of the appreciation of the dollar. The model we present forecasts modest depreciations in the dollar in 1989, with some resulting modest increases in demand for New Mexico's products.

Oil and gas extraction accounts for a large share of New Mexico's mining output. Employment in oil and gas extraction accounts for almost 60 percent of New Mexico's mining employment. Thus, oil prices will have an important impact on the state's mining sector. Although mining is a small sector in relation to the state's overall economy, this impact can have a significant effect on the state's growth.

Much of the government contribution to the New Mexico economy derives from federal defense spending and from the associated multiplier effects such spending has on other sectors of the state's economy. Federal defense spending appears as a forecasting variable in the model specified here. Although per capita defense spending in New Mexico is only slightly above the national average, the state ranks first in per capita federal procurement contracts for military and nondefense goods and services. Much of this spending involves research and development activities in the state. Attempts to reduce the federal budget deficit, however, have called to question the ability of national defense spending to continue to increase in real terms. The stimulus to the New Mexico economy from military spending is likely to diminish in the near future.

Economic cycles and the New Mexico economy

Part of the process of isolating the characteristics of New Mexico's economic indicators is an examination of their cyclical behavior, defined here simply as the persistence of high or low growth rates. That is, a cycle involves a protracted period of high growth rates that is followed by a protracted period of low or negative growth rates. If high or low (or negative) growth rates occur as a purely random walk, so that they do not normally persist over an extended period of time, there is no cycle. In order to consider the possible ability of past movements of a variable to forecast its own future movements, the cyclicality of each variable is examined. Table 1 allows a statistical examination of cyclical tendencies of growth rates for the nine New Mexico economic indicators that we forecast. Some indicators display cyclical behavior, while others do not.

The table displays autocorrelations, which measure the relation of growth in a variable to its past growth for lags of one, two, three, and four quarters.[8] For the correlation between movement of a variable in one period and its movement in a past period to be significant at the 0.05 level or better, the value of the autocorrelation has to be 0.2560 or greater, owing to the degrees of freedom allowed by our number of observations. With regard to the first variable, nonagricultural employment, a good deal of cyclicality appears. A movement in New Mexico nonfarm employment is significantly linked to movements one, two, and three quarters back and is also fairly closely related to movement four quarters back. These statistical relations signify that persistent deviations from average growth rates are a common occurrence for nonfarm employment.

Table 1
AUTOCORRELATIONS OF CURRENT GROWTH RATES WITH PAST GROWTH RATES OF NINE NEW MEXICO ECONOMIC INDICATORS

	Lag (Quarters)			
Indicator	1	2	3	4
Nonagricultural employment	.5965	.3839	.3465	.2259
Personal income	.1467	.2435	.2213	.1903
Durable goods manufacturing employment	.2504	-.0659	-.0576	-.2635
Nondurable goods manufacturing employment	.2550	.0480	.1882	.1331
Mining employment	.7141	.4871	.3135	.0700
Value of nonfuel mineral production	.7277	.3564	.0275	-.1942
Sales tax revenue	-.1613	-.0981	-.0899	.0822
Total housing permits	-.1173	.0514	-.1460	.0237
Rotary rig count	.3604	-.0798	-.1070	-.1224

Cyclicality is also particularly prevalent for New Mexico mining employment, where three lags are significant, and for New Mexico value of nonfuel mineral production, where two lags are significant. Some significant autocorrelation also appears for nondurable manufacturing employment, for durable manufacturing employment, and for the rotary rig count. Thus, six out of the nine variables exhibit at least some evidence of persistent deviation from their average growth rates. Nevertheless, only three variables demonstrate autocorrelations of two or more consecutive lags. Even where some cyclicality is present, much of it does not last very long.

The structure of the model

A time series model-building procedure (see the box) was used to construct forecasting equations for each of the 9 New Mexico variables and for 18 U.S. variables used in the various stages of assembly of the New Mexico equations. Variables are defined in Appendix A, and all equations are described in Appendix B. It should be emphasized that because this is a time series model, its equations are purely predictive and do not represent attempts to "explain" the New Mexico economy but, rather, attempts to forecast it.

Nevertheless, despite the pure time series forecasting approach used in the construction of this model, the equations are generally formed of variables that seem intuitively reasonable. Although there may be exceptions, a number of the equations in the model would raise little controversy if they were presented as structural, or theoretically based, equations. For example, the personal income equation is formed from two lags of New Mexico personal income plus one lag of New Mexico nonagricultural wage and salary employment. Because wages and salaries make up the bulk of personal income in New Mexico, the inclusion of this variable should not be surprising. In addition, the importance to personal income of fluctuations in the state's energy sector is reflected in the inclusion of the New Mexico rig count as a predictive variable. Finally, the impact of national expansion is captured through the inclusion of two lags of a broad monetary aggregate, real M3. Again, although these are pure forecasting equations constructed according to a series of statistical decision rules, it is conventional to think of U.S. economic growth as being positively related to expansion in various measures of the money stock. The forecast of personal income is based on predictions of moderate growth in nonfarm employment, a reduction of about three rigs in the New Mexico rig count, and an increase of slightly more than 3 percent in the real money stock (M3).

Likewise, the equation that predicts movements in the rig count contains variables that may reflect supply and demand factors for energy. For example, the New Mexico rig count equation includes two lags of oil prices, together with one lag of New Mexico mining employment and one two-quarter lag of U.S. retail sales—a variable that may be considered an indicator of U.S. aggregate economic activity.

The New Mexico nonfarm employment forecasting equation displays characteristics that may seem inconsis-

The Model-Building Procedure

The procedure for constructing a multivariate time series forecasting model of the type applied to New Mexico in this study is discussed elsewhere in detail.[1] The approach is summarized here to emphasize some points about the information the model reveals and about the processes used to generate it.

This is a pure forecasting model, so its construction involves no theoretical conjectures about the New Mexico economy. Instead, a system of statistical decision rules is used to build equations that predict the growth rates of 9 seasonally adjusted New Mexico variables and of the 18 U.S. variables used in the New Mexico forecasting equations. The same decision rules are applied to build the national forecasting equations that are used to produce the predicted U.S. variables used in the New Mexico forecasts. Forecasted U.S. variables are used to predict fluctuations in the New Mexico economic indicators, but New Mexico variables are not used in the equations that forecast the U.S. variables.

In following these decision rules, we perform a series of nested tests. To perform a nested test, we construct a forecasting equation and then build a second equation by adding one more variable to the first equation. We next test to see how much more accurately the second equation forecasts than the first one did. If the second equation improves forecast accuracy to a degree that is significant at the 0.20 level or better, we include the variable that was added to the second equation as a candidate variable for the ultimate forecasting equation.

In the first stage of this model-building procedure, we begin by examining the ability of a variable to forecast itself.[2] Then, we add other variables and test to see if any of them improve forecast accuracy. For example, to examine the ability of variables to predict employment in New Mexico's durable goods manufacturing industry, we initially test the ability of past values of New Mexico durable manufacturing employment to predict their own future values. In this test, quarterly values for New Mexico durable manufacturing employment are regressed on a one-quarter lag and a two-quarter lag of New Mexico durable manufacturing employment.

We then add other variables, which are also lagged by one and two quarters, to the self-forecasting New Mexico durable manufacturing employment equation. For example, as part of the test, a one-quarter lag and two-quarter lag of the U.S. index of leading economic indicators are added. The addition of this variable results in a forecasting equation with a standard error of estimate 9.5 percent lower than that of an equation containing only two lags of nonfarm employment. This reduction is statistically significant at the 0.0008 level, according to our information-gain test, so the U.S. index of leading economic indicators becomes a candidate for our final regression equation.[3]

So far, however, the U.S. index of leading economic indicators is only a candidate. Even though it forecasts well, it may not forecast well enough to be included in the final predictive equation for New Mexico durable manufacturing employment. But because the index improved the accuracy of the simple model, it is added to the list of variables that will receive a second examination later.

Note that even though the U.S. index of leading economic indicators becomes a candidate for further consideration in a model of durable manufacturing employment, this index will not automatically become a candidate for consideration in a model forecasting some other variable. We test the U.S. index of leading economic indicators (and all other variables under consideration) separately for each variable to be forecasted. A given forecasting variable might become a candidate for entry into every forecasting equation, but that is not likely. This nested-test procedure is used not only to examine national forecasting variables, such as the U.S. index of leading economic indicators, but also to examine regional variables. For example, we test to see if New Mexico durable manufacturing employment can be used to forecast other New Mexico variables. In all cases, our decision rule is that a variable becomes a *candidate* for consideration in the next step if it improves forecast accuracy to a degree that is significant at the 0.20 level or better.

Once we have examined every variable by this nested test and then selected candidate variables for each of the 27 forecasting equations, we move to step 2. In step 2, each candidate variable is considered in a conventional ordinary-least-squares, stepwise regression procedure. This procedure selects variables that explain the most in-sample variation of the indicator we want to forecast, such as New Mexico durable manufacturing employment.[4] To be included in an equation, a variable must have a t statistic that is significant at the 0.05 level. Once this second step has been finished for each of the variables to be forecasted, we have a model that, in past studies for Ohio and Texas, has been shown to forecast with considerable accuracy.

1. See William C. Gruben and William T. Long III, "Forecasting the Texas Economy: Applications and Evaluation of a Systematic Multivariate Time Series Model," Federal Reserve Bank of Dallas *Economic Review*, January 1988, 11-28; and James G. Hoehn and James J. Balazsy, Jr., "The Ohio Economy: Using Time Series

Characteristics in Forecasting," Federal Reserve Bank of Cleveland Working Paper no. 8508 (Cleveland, December 1985).

2. In an effort to preserve time series stationarity, all data are placed in first differences of logarithmic form. This means that all variables are expressed as growth rates and not as absolute levels. When we construct regression equations, we are regressing the growth rate of a variable on its own past growth rates and/or on past growth rates of other variables.

3. The term "information gain" refers to the percentage reduction in standard error that results from the inclusion of a particular variable in an equation. Consider two equations, equation A and equation B, that are designed to forecast the same independent variable. Suppose that equation B is identical to equation A, except equation B contains two lags of one additional variable. Let SEE_A represent the standard error of estimate of equation A and SEE_B be the standard error of estimate of equation B. The gain in information of equation B over equation A is due to the inclusion of the variable in equation B but not in equation A. The information gain is the percentage difference between the standard error of estimate for equation B and that for equation A. That is,

$$I_{BA} = [(SEE_A - SEE_B)/SEE_A] \times 100.$$

The information-gain variable I and F values correspond to one another in the following form:

$$I = 1 - [(n-k-1+g)/(n-k-1+qF)]^{1/2},$$

where n is the number of observations, k is the number of variables in equation B, and q is the number of added variables in equation B compared with equation A. Thus, the minimum value of I suggesting that a new variable in equation B ought to be included in a forecasting equation corresponds to an F value that is significant at the 0.20 level. The level of significance chosen, it should be noted, is purely arbitrary.

4. The stepwise procedure used in this study contains a decision rule that rejects some candidate variables originally included in the forecasting equation. The rule works as follows. Suppose some variable x_1 adds enough forecasting power to warrant including it in some nearly final predictive equation. If the subsequent inclusion of other predictively powerful variables (say, x_2 through x_n) pushes the t statistic for the coefficient of x_1 below 1.00, then the x_1 is deleted from the equation and $x_2, \ldots, x_n$ remain. The only exception to this rejection rule was that two own lags were used any time they resulted in a mean square error lower than that for only a first own lag or only a second own lag.

tent with economic theory. This equation contains two own lags plus one lag of New Mexico housing permits. The inclusion of housing permits may have some instructive implications, but these implications are related to the process of forecasting and not to any causal relations leading from changes in home-building activity to changes in nonfarm employment. Several recently published papers offer statistical evidence to suggest that investors in nonresidential construction base their building plans on expectations about a region's future growth.[9] If home builders make their decisions similarly, then housing permit data are simply collective expressions of the forecasts individual builders have made. That is, each of many builders chooses how much to build on the basis of some forecast that he or she forms but may or may not divulge to the public. Thus, while growth in New Mexico home building cannot be seen as causing significant expansion in nonfarm jobs, it may reasonably be seen to offer some predictive information about such expansion.

Forecasting the New Mexico economy

Table 2 presents the model's 1988 and 1989 forecasts of nine economic indicators for New Mexico. The model forecasts moderate growth overall. Nonfarm employment, personal income, durable and nondurable manufacturing employment, and sales tax revenue all increase. Housing and mining indicators decline. Mining employment, the value of nonfuel mineral production, and the rig count all fall. Housing permits also drop.

The forecasts of growth for the broadest economic indicators—personal income, nonfarm employment, and sales tax revenue—show acceleration from the rates of expansion in 1987 and 1988.

The model forecasts a 3.8-percent increase in real personal income in New Mexico in 1989, compared with a 3.0-percent increase in 1988. New Mexico's real personal income fell in the second half of 1986 and again in the first quarter of 1987. Since then, not only has personal income grown, but its rate of expansion has accelerated steadily. So far in 1988, average real personal income in the state is estimated to have grown at a somewhat faster rate than nationally.

The model also forecasts acceleration in growth in New Mexico nonfarm employment, with the rate increasing from 1.9 percent in 1988 to 2.8 percent in 1989. Although the projected expansion represents an acceleration in growth

Table 2
FORECASTS OF GROWTH RATES OF NINE NEW MEXICO ECONOMIC INDICATORS

Indicator	Forecasted rates (Percent) 1988	1989
Nonagricultural employment	1.87	2.78
Personal income	2.98	3.77
Durable goods manufacturing employment	2.02	2.51
Nondurable goods manufacturing employment	.82	.59
Mining employment	-7.35	-2.96
Value of nonfuel mineral production	-7.45	-8.37
Sales tax revenue	3.56	4.57
Total housing permits	-13.75	-3.52
Rotary rig count	-4.70	-8.82

over the rates of 1986 and 1987, it is below the rate of growth for 1985.

Our forecast shows very slow growth in nondurable manufacturing employment in 1989 (up 0.59 percent) versus moderate growth for jobs in durable manufacturing (up 2.5 percent). These forecasts probably reflect two features of the state's economy. The first is the effects of the fall in the value of the dollar, which research has shown, for the decline since 1985, to benefit durable goods industries more than nondurable goods industries.[10] The likelihood that the effects of the dollar's fall will persist makes this positive impact on New Mexico manufacturing probable. The current stage of the business cycle also supports the differential performance of the two manufacturing components in New Mexico. Normally, durable goods production grows more in an upswing and falls more in a downswing than nondurable goods production. With investment spending contributing heavily at the present stage of the national expansion, durables are showing greater strength than nondurables.

The accelerated growth forecasted for personal income and for nonfarm employment is consistent with a forecasted acceleration in sales taxes. Sales tax revenue is estimated to have increased 3.9 percent in 1987 and to have risen 3.6 percent in 1988. The model forecasts a 4.6-percent increase in 1989.

Despite aggregate growth, however, housing permits fall 3.5 percent in 1989. Furthermore, declining energy prices contribute to reducing the rig count by 8.8 percent (or about three rigs), while mining employment falls 3.0 percent and the value of nonfuel mineral production goes down 8.4 percent.

In sum, the present forecast suggests that manufacturing and non-goods-producing industries will foster overall growth in the New Mexico economy in 1989. Despite these areas of strength, weakness in the mining sector and a slowdown in home building may retard this overall growth.

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1. See William C. Gruben and William T. Long III, "Forecasting the Texas Economy: Applications and Evaluation of a Systematic Multivariate Time Series Model," Federal Reserve Bank of Dallas *Economic Review*, January 1988, 11-28.

2. Carolyn Sherwood-Call, "Exploring the Relationships Between National and Regional Economic Fluctuations," Federal Reserve Bank of San Francisco *Economic Review*, Summer 1988, 15-25.

3. It should be noted that oil and gas extraction plays a less important role in New Mexico's mining sector than in the nearby states of Oklahoma and Texas but its role is dominant anyway. New Mexico's mining sector is broad-based and includes the production of clay, copper, gold, gypsum, mica, molybdenum, perlite, potash, pumice, salt, silver, uranium, and zinc. New Mexico is the principal producer of potash mined in the United States. In 1987, New Mexico ranked second among all states in the production of copper. Nevertheless, the annual value of oil and gas production in New Mexico is more than three times as large as the value of nonfuel mineral production in the state.

4. In addition to absorbing disproportionately large shares of New Mexico's work force, mining and the Federal Government pay salaries that, on average, are markedly above those in the state's private sector overall. In 1986 the average annual wage for workers in New Mexico's private

sector who were covered by unemployment insurance was $16,551. The average mining employee earned $28,787. The average federal employee earned $23,880. Nevertheless, mining workers and federal employees in New Mexico earned less than the national average for their respective employment sectors.

5. See Gordon L. Clark, Meric S. Gertler, and John E. M. Whiteman, *Regional Dynamics: Studies in Adjustment Theory* (Boston: Allen & Unwin, 1986), 12-13. Their discussion of these points is based on work by A. L. Saxenian, "The Urban Contradictions of Silicon Valley: Regional Growth and the Restructuring of the Semiconductor Industry," in *Sunbelt/Snowbelt: Urban Development and Regional Restructuring*, ed. L. Sawers and W. Tabb (Oxford: Oxford University Press, 1984).

6. See Sherwood-Call, "Exploring the Relationships Between National and Regional Economic Fluctuations." Sherwood-Call uses variance decomposition to examine the relative impact of national versus state-specific shocks in explaining deviations in expected patterns of change in each state's personal income. For the average state, national shocks explain about 44 percent of these deviations. For New Mexico, national shocks explain about 49 percent. Among the 50 states, New Mexico ranks 23d, or slightly above the median, in the relative role that national (versus state-specific) shocks play in explaining the deviations.

7. See W. Michael Cox and John K. Hill, "Effects of the Lower Dollar on U.S. Manufacturing: Industry and State Comparisons," Federal Reserve Bank of Dallas *Economic Review*, March 1988, 1-9; and "Effects of the Lower Dollar on the Economies of the Eleventh District States," in Federal Reserve Bank of Dallas, *1987 Annual Report* (Dallas, 1988), 4-9. The latter report shows that New Mexico's overall rate of response to recent dollar declines has been about 18 percent less than the national response.

8. All variables in this model are formed as first differences of logarithms. (First differences of logarithms are simply growth rates. Thus, when we examine statistical relations between various aspects of the data, we are actually examining statistical relationships between growth rates.)

9. See William C. Gruben, Joann E. Martens, and Ronald H. Schmidt, "Interstate Shifts in Nonresidential Construction," Federal Reserve Bank of Dallas *Economic Review*, July 1988, 26-37; and Ronald H. Schmidt and William C. Gruben, "Regional Shifts in Nonresidential Construction" (Paper delivered at the Twenty-second Annual Pacific Northwest Regional Economic Conference, Boise, Idaho, 28 April 1988).

10. Cox and Hill, "Effects of the Lower Dollar on U.S. Manufacturing."

Appendix A

Definitions of Variables in Forecasting Model Equations

(Quarterly data. Monetary values expressed in 1982 dollars)

State variables		
NMDUR	=	New Mexico durable goods manufacturing employment.
NMMINING	=	New Mexico mining employment.
NMMINV	=	New Mexico value of nonfuel mineral production.
NMNAG	=	New Mexico nonagricultural employment.
NMNONDUR	=	New Mexico nondurable goods manufacturing employment.
NMPRMTOT	=	New Mexico total housing permits.
NMPY	=	New Mexico personal income.
NMRIG	=	Hughes rotary rig count for New Mexico.
SALESTX	=	New Mexico sales tax revenue.
National variables		
CLAIMSSA	=	U.S. initial claims for unemployment insurance.
COMMOD	=	commodity price index—all commodities.
EEPRPD	=	refiners' cost of crude petroleum.
GNP82	=	U.S. gross national product.
INDUST	=	commodity price index—raw industrial materials.
JCOIN	=	U.S. index of coincident economic indicators.
JLEAD	=	U.S. index of leading economic indicators.
M1BM	=	M1 (narrowly defined monetary aggregate).
M2M	=	M2 (more broadly defined monetary aggregate).
M3M	=	M3 (most broadly defined monetary aggregate).
RMFEDFUN	=	interest rate on federal funds.
TWVD	=	trade-weighted value of U.S. dollar.
USDEF	=	U.S. total defense expenditures.
USIP	=	U.S. index of industrial production.
USNAG	=	U.S. nonagricultural employment.
USPY	=	U.S. personal income.
USRET	=	U.S. retail sales.
USTOT	=	U.S. total employment.

Appendix B

Features of Forecasting Model Equations

State variables

DEPENDENT VARIABLE: *NMDUR*

R^2 = .3745; $\bar{R}^2$ = .3427; SSR = .1885E-1; SEE = .1787E-1; DW = 1.6894.

Variable	Lag	Coefficient	Standard error	*t* statistic
Constant	0	-0.1117E-2	0.4195E-2	-0.2664
NMRIG	1	0.4193E-1	0.1416E-1	2.9613
JLEAD	1	0.3088	0.1109	2.7840
M3M	1	0.8257	0.3560	2.3194

DEPENDENT VARIABLE: *NMMINING*

R^2 = .6243; $\bar{R}^2$ = .6052; SSR = .3631E-1; SEE = .2481E-1; DW = 1.9388.

Variable	Lag	Coefficient	Standard error	*t* statistic
Constant	0	-0.2186E-3	0.3170E-2	-0.6896
NMMINING	1	0.5818	0.1041	5.5891
NMMINV	1	0.1490	0.4581E-1	3.2527
EEPRPD	1	0.6785E-1	0.4121E-1	1.6462

DEPENDENT VARIABLE: *NMMINV*

R^2 = .6869; $\bar{R}^2$ = .6533; SSR = .9554E-1; SEE = .4130E-1; DW = 2.0848.

Variable	Lag	Coefficient	Standard error	*t* statistic
Constant	0	-0.7267E-2	0.5818E-2	-1.2489
NMMINV	1	0.9444	0.1075	8.7817
NMMINV	2	-0.3954	0.1119	-3.5316
NMDUR	1	0.5828	0.2402	2.4262
NMMINING	1	0.5065	0.2256	2.2444
NMMINING	2	-0.6885	0.2129	-3.2343
TWVD	1	0.5448E-1	0.2453	0.2221

DEPENDENT VARIABLE: *NMNAG*

R^2 = .4784; $\bar{R}^2$ = .4518; SSR = .1817E-2; SEE = .5550E-2; DW = 2.2562.

Variable	Lag	Coefficient	Standard error	*t* statistic
Constant	0	0.2926E-2	0.1168E-2	2.5042
NMNAG	1	0.4924	0.1200	4.1011
NMNAG	2	0.1436	0.1212	1.1849
NMPRMTOT	1	0.1217E-1	0.3462E-2	3.5174

DEPENDENT VARIABLE: *NMNONDUR*

R^2 = .4372; $\bar{R}^2$ = .4086; SSR = .1138E-1; SEE = .1388E-1; DW = 1.9028.

Variable	Lag	Coefficient	Standard error	*t* statistic
Constant	0	-0.8483E-2	0.3053E-2	-2.7781
NMRIG	2	0.3366E-1	0.1119E-1	3.0085
INDUST	1	0.9233E-1	0.3221E-1	2.8666
M3M	1	1.0610	0.2293	4.6270

DEPENDENT VARIABLE: *NMPRMTOT*

R^2 = .0615; $\bar{R}^2$ = .0462; SSR = 2.4026; SEE = .1984; DW = 2.0970.

Variable	Lag	Coefficient	Standard error	*t* statistic
Constant	0	-0.4237E-2	0.2505E-1	-0.1691
TWVD	1	2.2978	1.1484	2.0008

DEPENDENT VARIABLE: *NMPY*

R^2 = .4098; $\bar{R}^2$ = .3465; SSR = .4075E-2; SEE = .8530E-2; DW = 2.0608.

Variable	Lag	Coefficient	Standard error	*t* statistic
Constant	0	0.5373E-2	0.2183E-2	2.4608
NMPY	1	-0.3551	0.1421	-2.4990
NMPY	2	0.6114E-1	0.1272	0.4804
NMNAG	1	0.8009	0.2310	3.4662
NMRIG	1	0.2108E-1	0.7037E-2	2.9961
M3M	1	0.6571	0.2141	3.0687
M3M	2	-0.4588	0.2106	-2.1775

DEPENDENT VARIABLE: *NMRIG*

R^2 = .4678; $\bar{R}^2$ = .4311; SSR = .8770; SEE = .1229; DW = 1.7484.

Variable	Lag	Coefficient	Standard error	*t* statistic
Constant	0	-0.2514E-1	0.1720E-1	-1.4614
NMMINING	1	1.3366	0.5556	2.4057
EEPRPD	1	0.8770	0.2103	4.1695
EEPRPD	2	-0.7288	0.2062	-3.5337
USRET	2	2.5601	0.9528	2.6868

DEPENDENT VARIABLE: *SALESTX*

R^2 = .2703; $\bar{R}^2$ = .2063; SSR = .2754; SEE = .6952E-1; DW = 2.0826.

Variable	Lag	Coefficient	Standard error	*t* statistic
Constant	0	0.6909E-3	0.1429E-1	0.4834E-1
SALESTX	1	-0.3468	0.1200	-2.8900
SALESTX	2	-0.2324	0.1171	-1.9841
NMNAG	2	4.3714	1.5435	2.8320
TWVD	2	-0.9645	0.4358	-2.2132
USPY	2	-1.8639	1.3100	-1.4228

National variables

DEPENDENT VARIABLE: *CLAIMSSA*

R^2 = .5211; $\bar{R}^2$ = .4791; SSR = .2595; SEE = .6747E-1; DW = 2.1714.

Variable	Lag	Coefficient	Standard error	*t* statistic
Constant	0	0.2836E-1	0.1266E-1	2.2395
CLAIMSSA	1	-0.1473	0.1981	-0.7436
CLAIMSSA	2	-0.4487	0.1860	-2.4113
JLEAD	1	-2.8049	0.6632	-4.2293
JLEAD	2	-3.1121	0.7410	-4.1995
USIP	1	2.8581	0.7611	3.7549

DEPENDENT VARIABLE: *COMMOD*

$R^2 = .2849; \bar{R}^2 = .2102$; SSR = .1403; SEE = .4877E-1; DW = 2.0784.

Variable	Lag	Coefficient	Standard error	*t* statistic
Constant	0	-0.1690E-1	0.1094E-1	-1.5446
COMMOD	1	0.2343	0.1230	1.9038
COMMOD	2	0.2398	0.1229	1.9504
M3M	1	2.1771	0.7978	2.7288

DEPENDENT VARIABLE: *EEPRPD*

$R^2 = .3930; \bar{R}^2 = .3621$; SSR = .3621; SEE = .7834E-1; DW = 1.9019.

Variable	Lag	Coefficient	Standard error	*t* statistic
Constant	0	-0.1330E-2	0.1009E-1	-0.1317
EEPRPD	1	0.5619	0.1194	4.7028
EEPRPD	2	-0.2836	0.1220	-2.3244
COMMOD	2	0.5772	0.1889	3.0554

DEPENDENT VARIABLE: *GNP82*

$R^2 = .4414; \bar{R}^2 = .4130$; SSR = .4120E-2; SEE = .8356E-2; DW = 2.0685.

Variable	Lag	Coefficient	Standard error	*t* statistic
Constant	0	0.4366E-2	0.1310E-2	3.3307
GNP82	1	-0.1849	0.1363	-1.3561
GNP82	2	0.1625	0.1045	1.5553
JLEAD	1	0.3161	0.5528E-1	5.7178

DEPENDENT VARIABLE: *INDUST*

$R^2 = .3521; \bar{R}^2 = .3192$; SSR = .1286; SEE = .4669E-1; DW = 2.0286.

Variable	Lag	Coefficient	Standard error	*t* statistic
Constant	0	0.1663E-1	0.7452E-2	2.2325
INDUST	1	0.3016	0.1222	2.4679
JLEAD	1	0.5965	0.2576	2.3149
USDEF	2	-1.4817	0.5583	-2.6534

DEPENDENT VARIABLE: *JCOIN*

$R^2 = .6428; \bar{R}^2 = .6246$; SSR = .8256E-2; SEE = .1182E-1; DW = 1.9719.

Variable	Lag	Coefficient	Standard error	*t* statistic
Constant	0	-0.5651E-2	0.2782E-2	-2.0309
GNP82	2	0.3149	0.1444	2.1806
JLEAD	1	0.4283	0.7302E-1	5.8655
M3M	1	0.6254	0.2446	2.5566

DEPENDENT VARIABLE: *JLEAD*

R^2 = .6105; $\bar{R}^2$ = .5763; SSR = .1564E-1; SEE = .1656E-1; DW = 1.9295.

Variable	Lag	Coefficient	Standard error	*t* statistic
Constant	0	-0.3274E-2	0.3912E-2	-0.8367
JLEAD	1	0.6494	0.1245	5.2144
JLEAD	2	0.4013	0.1227	3.2703
JCOIN	1	-0.9032	0.2097	-4.3055
M3M	1	0.8272	0.3440	2.4045
RMFEDFUN	1	-0.4815E-1	0.1691E-1	-2.8465

DEPENDENT VARIABLE: *M1BM*

R^2 = .6245; $\bar{R}^2$ = .5916; SSR = .4286E-2; SEE = .8671E-2; DW = 2.0899.

Variable	Lag	Coefficient	Standard error	*t* statistic
Constant	0	0.1087E-2	0.1387E-2	0.7831
M1BM	1	0.2297	0.1069	2.1475
M1BM	2	0.3360	0.1115	3.0129
EEPRPD	1	-0.3255E-1	0.1222E-1	-2.6635
GNP82	2	0.2369	0.1139	2.0802
RMFEDFUN	1	-0.4925E-1	0.8193E-2	-6.0116

DEPENDENT VARIABLE: *M2M*

R^2 = .6733; $\bar{R}^2$ = .6383; SSR = .2361E-2; SEE = .6493E-2; DW = 2.0615.

Variable	Lag	Coefficient	Standard error	*t* statistic
Constant	0	0.4321E-2	0.1095E-2	3.9445
M2M	1	0.4165	0.9992E-1	4.1686
COMMOD	1	-0.3706E-1	0.1824E-1	-2.0311
JLEAD	2	0.2299	0.5138E-1	4.4754
RMFEDFUN	1	-0.2382E-1	0.7290E-2	-3.2676
USIP	1	-0.2177	0.7094E-1	-3.0686
USRET	1	0.1289	0.6396E-1	2.0165

DEPENDENT VARIABLE: *M3M*

R^2 = .7008; $\bar{R}^2$ = .6801; SSR = .1137E-2; SEE = .4427E-2; DW = 1.9983.

Variable	Lag	Coefficient	Standard error	*t* statistic
Constant	0	0.2839E-2	0.9964E-3	2.8491
M3M	1	0.6848	0.8268E-1	8.2825
JLEAD	2	0.1667	0.3370E-1	4.9460
RMFEDFUN	1	-0.1245E-1	0.4291E-2	-2.9014
USIP	1	-0.1277	0.4224E-1	-3.0240

DEPENDENT VARIABLE: *RMFEDFUN*

$R^2 = .5541; \bar{R}^2 = .4974$; SSR = .6497; SEE = .1086; DW = 2.0664.

Variable	Lag	Coefficient	Standard error	*t* statistic
Constant	0	-0.6750E-1	0.2765E-1	-2.4409
RMFEDFUN	1	-0.2192E-4	0.1119	-0.1959E-3
RMFEDFUN	2	-0.2311	0.9925E-1	-2.3288
COMMOD	1	1.1930	0.3099	3.8486
EEPRPD	1	0.4346	0.1615	2.6910
M3M	1	12.0889	2.8532	4.2369
M3M	2	-10.3588	2.9854	-3.4697
USNAG	1	7.1368	2.9577	2.4129

DEPENDENT VARIABLE: *TWVD*

$R^2 = .1411; \bar{R}^2 = .1125$; SSR = .2625E-1; SEE = .2092E-1; DW = 1.9751.

Variable	Lag	Coefficient	Standard error	*t* statistic
Constant	0	-0.1221E-2	0.2641E-2	-0.4624
TWVD	1	0.3882	0.1295	2.9973
TWVD	2	-0.2521E-1	0.1323	-0.1906

DEPENDENT VARIABLE: *USDEF*

$R^2 = .5421; \bar{R}^2 = .5269$; SSR = .3920E-2; SEE = .8083E-2; DW = 1.7797.

Variable	Lag	Coefficient	Standard error	*t* statistic
Constant	0	0.3201E-2	0.1301E-2	2.4595
USDEF	1	0.6781	0.8949E-1	7.5780
USRET	2	-0.1573	0.6231E-1	-2.5242

DEPENDENT VARIABLE: *USIP*

$R^2 = .6036; \bar{R}^2 = .5903$; SSR = .1193E-1; SEE = .1410E-1; DW = 2.1396.

Variable	Lag	Coefficient	Standard error	*t* statistic
Constant	0	0.2416E-3	0.2110E-2	0.1145
GNP82	2	0.3677	0.1657	2.2191
JLEAD	1	0.6310	0.7116E-1	8.8674

DEPENDENT VARIABLE: *USNAG*

$R^2 = .7497; \bar{R}^2 = .7324$; SSR = .6706E-3; SEE = .3400E-2; DW = 2.1315.

Variable	Lag	Coefficient	Standard error	*t* statistic
Constant	0	-0.8362E-5	0.8145E-3	-0.1026E-1
USNAG	1	0.3298	0.1445	2.2816
USNAG	2	0.6112	0.1894	3.2264
JCOIN	2	-0.1246	0.5907E-1	-2.1101
JLEAD	1	0.1621	0.2521E-1	6.4322

DEPENDENT VARIABLE: *USPY*

$R^2 = .3317$; $\bar{R}^2 = .2856$; SSR = .3000E-2; SEE = .7192E-2; DW = 1.8715.

Variable	Lag	Coefficient	Standard error	t statistic
Constant	0	0.3080E-2	0.1716E-2	1.7949
USPY	1	-0.2922E-1	0.1274	-0.2293
USPY	2	-0.2700	0.1585	-1.7030
GNP82	2	0.3087	0.1236	2.4963
M3M	1	0.5285	0.1397	3.7825

DEPENDENT VARIABLE: *USRET*

$R^2 = .2465$; $\bar{R}^2 = .2082$; SSR = .1345E-1; SEE = .1510E-1; DW = 2.0437.

Variable	Lag	Coefficient	Standard error	t statistic
Constant	0	-0.1782E-3	0.2516E-2	-0.7081E-1
USRET	1	-0.2050	0.1284	-1.5965
USRET	2	-0.1041E-1	0.1179	-0.8824E-1
M2M	1	0.8788	0.2047	4.2918

DEPENDENT VARIABLE: *USTOT*

$R^2 = .6104$; $\bar{R}^2 = .5906$; SSR = .8249E-3; SEE = .3739E-2; DW = 2.2218.

Variable	Lag	Coefficient	Standard error	t statistic
Constant	0	0.3103E-2	0.6139E-3	5.0546
JCOIN	1	0.1832	0.2634E-1	6.9575
M2M	1	0.1129	0.4737E-1	2.3849
TWVD	1	-0.8081E-1	0.2182E-1	-3.7025

NOTE: SSR = regression sum of squares.
SEE = standard error of estimate.
DW = Durbin-Watson statistic.