On the Predictive Power of Interest Rates and Interest Rate Spreads

Ben S. Bernanke

Professor of Economics and Public Affairs, Princeton University. This paper was written while the author was on leave at the Department of Economics, Massachusetts Institute of Technology, and the Federal Reserve Bank of Boston. *James Clark provided research assistance. Timothy Cook, Stephen McNees, and James Wilcox provided useful comments.*

Economists have long understood that financial market variables contain considerable information about the future of the economy. Stock prices, in particular, have always been a popular leading indicator. Recently, though, a number of researchers have pointed out that interest rates and interest rate spreads—that is, differences between interest rates on alternative financial assets—can be effective predictors of the economy.

Probably the most striking results along these lines have been obtained by Stock and Watson (1989), who examined the information contained in a wide variety of economic variables in an attempt to construct a new index of leading indicators. Stock and Watson found that two interest rate spreads—the difference between the six-month commercial paper rate and the six-month Treasury bill rate, and the difference between the ten-year and one-year Treasury bond rates—outperformed nearly every other variable as forecasters of the business cycle. The two Stock and Watson variables are not the only candidates that have been advanced, however: A number of alternative interest rates and spreads have been suggested by various authors, as will be discussed further below.

The finding that interest rates and spreads contain a great deal of information is interesting, but it raises a number of questions. Possibly the most important of these is the question of *why* interest rates and spreads predict the course of the economy so well. This article will try to make some progress on this issue.

To do this, a necessary first step is to determine which interest rate variable (or variables) is the most informative about the future course of the economy. Section I of this article runs a "horse race" between a number of suggested predictors, testing the ability of the alternative interest rate variables to predict nine different monthly measures of real macroeconomic activity as well as the inflation rate. While many interest rate variables have been excellent predictors of the economy during the period considered, the best single variable is found to be the spread between the commercial paper rate and the Treasury bill rate—one of the two Stock and Watson variables.[1] An additional finding is that, unfortunately, the predictive power of this variable (as well as of the other interest rate variables) appears to have weakened in the last decade; this poses a potential problem for the use of this variable in the new index of leading indicators proposed by Stock and Watson.

Given the superiority of the commercial paper–Treasury bill spread documented in Section I, in Section II the focus is narrowed to inquire why this particular spread has historically been so informative about the economy. Two principal hypotheses are considered: The first is that the commercial paper–Treasury bill spread is informative because, as the difference between a risky return and a safe return on assets of the same maturity, it is a measure of perceived default risk. Suppose that, for whatever reason, investors expect the economy to turn down in the near future; because this will increase the riskiness of privately issued debt, the current spread between private and safe public debt will be bid up. The commercial paper–Treasury bill spread forecasts the future, according to this explanation, because it embodies whatever information the market may have about the likelihood of a recession.

The second hypothesis discussed here is that the commercial paper–Treasury bill spread predicts the economy because it measures the stance of monetary policy, which in turn is an important determinant of future economic activity. Two variants of the monetary policy hypothesis are considered, both of which require the assumption that commercial paper and Treasury bills are imperfect substitutes in the portfolios of investors. The general idea underlying both variants is that monetary policy affects the spread between commercial paper and Treasury bills by changing the composition of assets available in the economy; because of imperfect substitutability, interest rate spreads must adjust in order to make investors willing to hold the new mix of assets. A more detailed discussion of this hypothesis is deferred until Section II below.

The best single predictor among interest rate variables has been found to be the spread between the commercial paper rate and the Treasury bill rate.

It seems clear that the commercial paper–Treasury bill spread must reflect default risk to some degree (the first hypothesis), so much of Section II is devoted to asking whether the spread also measures the stance of monetary policy (the second hypothesis). Using several alternative measures of monetary policy, this study finds evidence that it does. Indeed, to a degree that perhaps is surprising, the commercial paper–Treasury bill spread seems more closely related to conventional indicators of monetary policy (such as the federal funds rate) than to alternative measures of default risk.

The paper's tentative conclusion—tentative, because of the surprisingly weak association of the spread with other measures of default risk—is that the spread between commercial paper and Treasury bill rates has historically been a good predictor because it combines information about both monetary and nonmonetary factors affecting the economy, and because it does this more accurately than alternative interest rate-based measures. However, because this spread has become over time a less perfect indicator of monetary policy, it may be a less useful predictor of economic fluctuations in the future.

I. A Comparison of the Predictive Power of Alternative Interest Rates and Spreads

This section will review some recent literature on the predictive power of interest rates and spreads. It will then compare the forecasting power of a number of the variables that have been suggested by various authors.

Much of the recent attention to the predictive power of interest rates can be traced back to a provocative 1980 paper by Christopher A. Sims. At the time, Sims was interested in interpreting his own earlier finding (1972) that the growth rate of the money stock helped forecast output; in particular, he wanted to know if this earlier finding could be taken as evidence that monetary policy can be used to affect the real economy. In the 1980 paper Sims showed, in a vector autoregression (VAR) system including postwar data on industrial production, wholesale prices, and the M1 money stock, that M1 was an important predictor of production; indeed, in this VAR, disturbances to M1 were found to explain 37 percent of the forecast variance of industrial production at a horizon of 48 months. This predictive power for money was in line with the earlier results of Sims and others. However, in his paper Sims also showed that, when the commercial paper rate was added to the VAR, nearly all of money's predictive power for output was "absorbed" by the interest rate: In the expanded VAR, the commercial paper rate explained 30 percent of the forecast variance of industrial production at the 48-month horizon, while money accounted for only 4 percent. Similar results were later obtained, but for the Treasury bill rate rather than the commercial paper rate, by Litterman and Weiss (1985).

Both the levels and the spreads between interest rates can be extremely informative for forecasting the economy.

From the finding that money did not predict output when interest rates were also in the forecasting equations, both Sims and Litterman and Weiss concluded that monetary policy does not in fact affect real output. This interpretation was disputed by McCallum (1983), who pointed out that in practice interest rates might be a better indicator of monetary policy than money growth rates; hence the predictive power of interest rates was not necessarily evidence against the effectiveness of monetary policy. A paper by Bernanke and Blinder (1989) concurred with McCallum's view, pointing out that the federal funds rate—the interest rate most closely associated with monetary policy—was in fact unusually informative about the future of the real economy. Some evidence is presented here that bears on the debate about monetary policy in Section II; for the time being, it is enough to note that the literature following Sims' contribution demonstrated the forecasting power of several alternative interest rates.

The research that followed Sims suggested that it was the level of interest rates that was important for forecasting the economy. However, a number of papers written during the 1980s showed that spreads between different interest rates could also be extremely informative. For example, in a study of financial crises during the Great Depression, Bernanke (1983) showed that the spread between the rates on Baa-rated corporate bonds and Treasury bonds was a leading indicator of output during the interwar period. Estrella and Hardouvelis (1989) demonstrated the forecasting power of the difference between short-term and long-term Treasury rates; the "tilt" of the term structure, as this spread is sometimes referred to, is in fact a popular forecasting variable in financial circles, as Estrella and Hardouvelis mentioned. In their paper cited above, Bernanke and Blinder suggested that the spread between the federal funds rate and the long-term government bond rate—which they interpreted as an indicator of monetary policy—would be a useful predictor; similar conclusions were drawn by Laurent (1988; 1989). The high information content of the spread between the commercial paper rate and the T-bill rate was first documented in an important paper by Friedman and Kuttner (1989). Finally, as discussed in the introduction, Stock and Watson's comparison of a wide variety of potential leading indicators gave high marks to the commercial paper–Treasury bill spread and the spread between short-term and long-term Treasury rates (the tilt of the term structure).

Table 1
Interest Rates and Spreads Used in This Study

Mnemonic	Definition
RAAA	Long-term corporate bond rate, Aaa credit rating
RBAA	Long-term corporate bond rate, Baa credit rating
RCP6MO	Commercial paper rate, highest quality, 6 months' maturity
RFF	Federal funds rate, overnight
RT3MO	Treasury bill rate, 3 months
RT6MO	Treasury bill rate, 6 months
RT1	Treasury bill rate, 1 year
RT10	Treasury bond rate, 10 years
SHORT	RCP6MO − RT6MO
LONG	RBAA − RT10
TILT	RT1 − RT10
FUNDS	RFF − RT10
DEFAULT	RBAA − RAAA

Table 2
The Information Content of Interest Rates

Predicted Variable	Interest Rates			
	RFF	RT3MO	RCP6MO	RT10
Industrial Production	.0000	.0000	.0000	.0021
	.0236	.0204	.0008	.0169
	.1227	.1084	.0163	.0828
Unemployment Rate	.0000	.0001	.0000	.0001
	.0089	.0220	.0043	.0113
	.0133	.2232	.1446	.1197
Capacity Utilization	.0000	.0000	.0000	.0001
	.0224	.0217	.0005	.0145
	.1012	.0921	.0085	.1080
Employment	.0000	.0000	.0000	.0079
	.0379	.0419	.0057	.0547
	.4147	.2843	.1497	.2240
Housing Starts	.0000	.0000	.0000	.0000
	.0000	.0001	.0000	.0006
	.0000	.0001	.0000	.0001
Retail Sales	.0001	.0157	.0017	.0795
	.0396	.7010	.3566	.6718
	.0019	.1383	.0464	.3168
Personal Income	.0005	.0109	.0007	.2211
	.0192	.1275	.0183	.2880
	.0107	.1439	.0148	.2173
Durables Orders	.0000	.0005	.0000	.0059
	.0038	.0720	.0189	.0329
	.0031	.0942	.0286	.0269
Consumption	.0000	.0000	.0000	.0001
	.0046	.0621	.0183	.1012
	.0000	.0000	.0000	.0003
Inflation	.0000	.0000	.0000	.0003
	.0000	.0000	.0000	.0001
	.0001	.0002	.0004	.0021

Note: For definitions of interest rate variables, see Table 1. Entries give the probability that the interest rate variable can be excluded from a prediction equation for the macro variable, for each of three specifications of the prediction equation. Data are monthly, 1961–89.

Comparisons of Univariate Forecasting Power

Given the variety of interest rate-based predictors that have been suggested, it is important to try to determine more precisely which of the candidate variables contain the most information. A preliminary examination of eight proposed forecasting variables, taken one at a time (that is, in univariate fashion), is reported in Tables 2 and 3. (Definitions of the alternative interest rates and spreads used in this paper are given in Table 1.) Four interest rates and four interest rate spreads are considered. The four interest rates include the federal funds rate (RFF), the three-month Treasury bill rate (RT3MO), and the six-month commercial paper rate (RCP6MO), all of which have been used in previous studies of the forecasting power of interest rates. The ten-year Treasury bond rate (RT10) is also brought in at this stage, both because Stock and Watson include the first difference of this variable in their experimental index of leading indicators and in order to have a representative long-term rate. The four interest rate spreads examined are 1) the commercial paper–Trea-

Table 3
The Information Content of Interest Rate Spreads

Predicted Variable	Interest Rate Spreads			
	SHORT	LONG	TILT	FUNDS
Industrial Production	.0000	.0000	.0000	.0000
	.0001	.0000	.0707	.3004
	.0014	.0012	.4144	.6166
Unemployment Rate	.0000	.0032	.0053	.0002
	.0003	.0008	.4488	.1443
	.0121	.0314	.6963	.0262
Capacity Utilization	.0000	.0000	.0001	.0001
	.0000	.0000	.0738	.1197
	.0003	.0032	.1378	.1063
Employment	.0000	.0000	.0001	.0002
	.0015	.0003	.3691	.5683
	.3816	.0511	.9062	.9818
Housing Starts	.0002	.0006	.0000	.0000
	.0261	.0300	.0000	.0004
	.0104	.0087	.0000	.0001
Retail Sales	.0012	.0199	.0000	.0000
	.2607	.3630	.2502	.0087
	.2026	.7911	.0087	.0002
Personal Income	.0000	.1117	.0015	.0001
	.0000	.0075	.0400	.0082
	.0000	.0461	.0964	.0138
Durables Orders	.0000	.0007	.0001	.0000
	.0060	.0018	.2673	.0467
	.0545	.0173	.3345	.0442
Consumption	.0000	.0348	.0000	.0000
	.0006	.1664	.0207	.0017
	.0002	.4888	.0000	.0000
Inflation	.1814	.0006	.0002	.0001
	.1305	.0006	.0000	.0000
	.2123	.0040	.0011	.0004

Note: For definitions of interest rate variables, see Table 1. For explanation of the table, see notes to Table 2 and text.

sury bill spread (at six months' maturity), called SHORT because Stock and Watson refer to it as the short-term public-private spread; 2) the spread between the long-term corporate bond rate (Baa rating) and the ten-year government bond rate, or LONG; 3) the difference between the one-year Treasury bill rate and the ten-year Treasury bond rate, called TILT because it measures the tilt of the term structure; and 4) the spread between the federal funds rate and the ten-year Treasury bond rate, referred to here as FUNDS.

The study examined the ability of each of the eight forecasting variables to predict ten macroeconomic variables (nine indicators of real activity, plus the CPI inflation rate); the chosen macro variables are listed down the left-hand side of Tables 2 and 3. The ten macroeconomic variables are essentially the same as those used by Bernanke and Blinder (1989), with the addition of nonagricultural employment and personal consumption expenditures; all of these variables are closely watched measures of the economy that also meet the criterion of being available on a monthly basis. The predictive power of the interest rate variables was tested for a number of different economic series, instead of just (say) industrial production, as a check on the robustness of the relationships found.[2]

The univariate forecasting power of the individual interest rates and spreads was evaluated as follows: For each macro variable and each interest rate variable (rate or spread), three in-sample, one-month-ahead prediction equations were estimated, using monthly data for 1961–89.[3] In the first of the three prediction equations, the macro variable being forecasted was regressed on a constant, a trend, six lags of itself, and six lags of the interest rate variable. The second prediction equation augmented the first equation by adding six lags of CPI inflation and six lags of real M2 growth to the right-hand side of the equation.[4] The third equation augmented the first equation by adding six lags of the growth rate of the index of leading indicators to the right-hand side.[5]

Given these estimated forecasting equations, each containing the interest rate variable and other predictors, the study then tested the hypothesis that all lags of the interest rate variable could be excluded from the equation (that is, that the interest rate variable had no marginal predictive power). The results are given in Table 2 (for interest rates) and Table 3 (for interest rate spreads). For each macro variable and each interest rate variable, the tables give three numbers; these correspond to the probability that the interest rate variable can be excluded from the first, second, or third prediction equation, respectively. Low values imply strong marginal predictive power; thus, a value of .0001 means that there is only one chance in 10,000 that the interest rate variable does not belong in that particular prediction equation.

The two tables show that interest rates and spreads clearly contain information about the future of the economy that is not included even in the index of leading indicators. For example, the federal funds rate (RFF in Table 2) predicts each of the macro variables at the .0001 level of significance when only lags of the forecasted variable are included; it predicts all of the macro variables at the .05 level or better when inflation and real money growth are added; and it predicts seven of the ten variables at close to the .01 level or better even in the presence of the index of leading indicators.

Interest rates and spreads clearly contain information about the future of the economy that is not included even in the index of leading indicators.

Which interest rate variables are the best predictors of the economy? Direct comparisons are undertaken in the next section. However, as a simple and informal way of quantifying the impressions given by the univariate results in Tables 2 and 3, "points" were assigned to each interest rate variable as follows: 5 points for each entry in Table 2 or 3 that is less than .001; 4 points for entries between .001 and .01; 3 points for entries between .01 and .05; 2 points for entries between .05 and .10; and 1 point for entries between .10 and .20. The scores arrived at in this way are as follows:

Federal funds rate (RFF)	118 points
3-month T-bill rate (RT3MO)	95 points
Commercial paper rate (RCP6MO)	119 points
10-year T-bond rate (RT10)	85 points
SHORT spread (RCP6MO − RT6MO)	109 points
LONG spread (RBAA − RT10)	105 points
TILT spread (RT1 − RT10)	89 points
FUNDS spread (RFF − RT10)	107 points

On a univariate basis, and by this informal scoring measure, the federal funds rate and the commercial paper rate do better than the Treasury bill rate and the long-term bond rate. Of the spreads, the TILT variable seems weaker than the others, which are more or less equal.

Multivariate Comparisons

All the interest rate variables considered here appear to have significant forecasting power. Is this because all interest rates capture basically the same information about the future? Or does each interest rate or spread have separate information about the evolution of the economy? To try to answer these questions, and to make more direct comparisons between the different interest rate variables, a multivariate analysis is necessary.

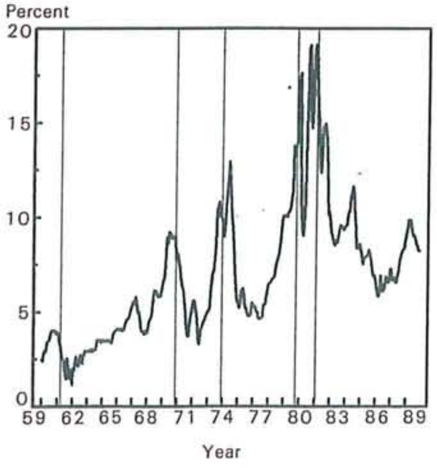
In the previous section, the federal funds rate and the commercial paper rate appeared to be better predictors than the Treasury bill rate and the long-term Treasury bond rate. Since this has also been indicated by previous research, the two Treasury rates were dropped from the comparison.[6] This leaves six interest rate variables to be compared—two interest rates and four interest rate spreads.[7] The historical behavior of these variables is shown in Figures 1 to 6; vertical lines in those figures indicate the dates of business cycle peaks.

To see which of these variables are the best predictors, and to try to determine the "dimensionality" of the information in interest rates, in-sample forecast equations were estimated for each of the macro variables. Each forecast equation contained a constant, a trend, six monthly lags of the forecasted variable, and six lags each of one to four interest rate variables. A forecasting equation containing k different interest rate variables on the right-hand side (along with the constant, trend, and lagged values of the dependent variable) will be referred to here as a model of size k.

All possible models of size k were estimated for each macro variable and for k = 1,2,3,4. With six interest variables, this meant that for each forecasted variable six models of size one were estimated, fifteen models of size two, twenty models of size three, and fifteen models of size four. The best-fitting (highest R^2) models for each forecasted variable and for each

Figure 1

Federal Funds Rate



Note: Vertical lines indicate business cycle peaks.

Figure 2

Six-Month Commercial Paper Rate

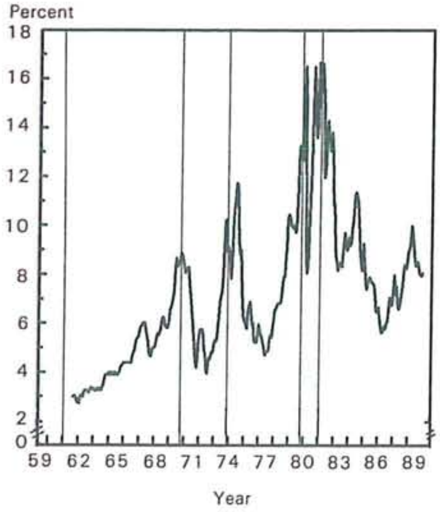


Figure 3

Commercial Paper Rate minus Treasury Bill Rate (SHORT)

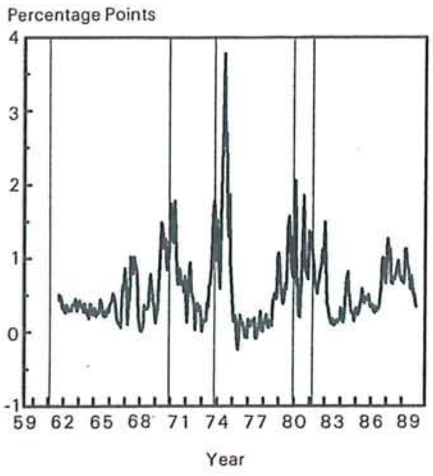


Figure 4

Baa Corporate Bond Rate minus 10-Year Treasury Bond Rate (LONG)

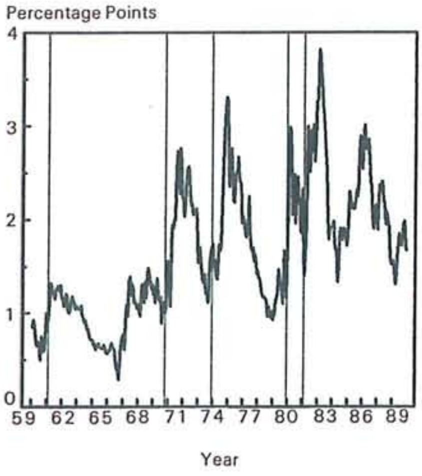


Figure 5

One-Year Treasury Bill Rate minus 10-Year Treasury Bond Rate (TILT)

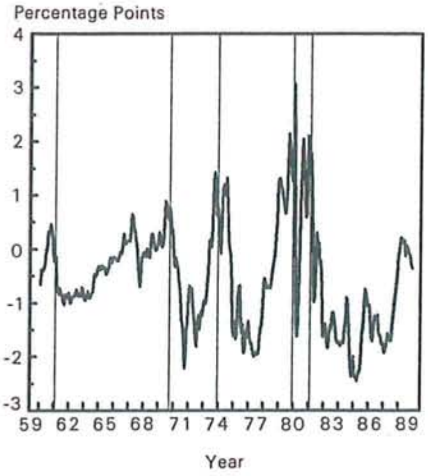
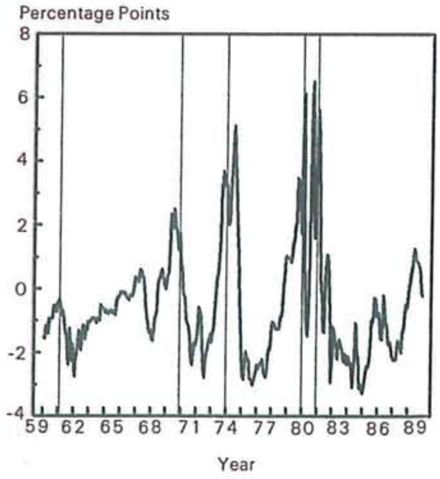


Figure 6

Federal Funds Rate minus 10-Year Treasury Bond Rate (FUNDS)



model size are listed in Table 4. The best overall fits (regardless of model size) are indicated by superscripts in the table: Superscript r indicates the model that fit best by the adjusted R^2 criterion, superscript a the model that is best by the Akaike information criterion, and superscript s the model that is best by the Schwarz criterion.[8]

Putting aside for a moment the question of which model size produces the overall best equations, consider first how the alternative interest rate variables compare in this head-to-head forecasting competition. Obviously, the answer depends on which macro variable is considered; but, generally, the SHORT variable—the spread between the commercial paper rate and the Treasury bill rate—appears to be the best predictor. When only one interest rate variable is allowed (that is, in the models of size one), SHORT gives the best fit in six of the ten cases; it also appears in seven of the best size two models.

To see the size of SHORT's advantage as a predictor, as before the results of Table 4 were summarized using an informal point system, with 5 points awarded to each interest rate or spread variable for each time it appears in the best size-one model; 3 points for each appearance in the best size-two model; 2 points for each time in the best size-three model; and 1 point for each appearance in the best size-four model. The point totals this time are:

Federal funds rate (RFF)	27 points
Commercial paper rate (RCP6MO)	35 points
SHORT spread (RCP6MO − RT6MO)	69 points
LONG spread (RBAA − RT10)	38 points
TILT spread (RT1 − RT10)	4 points
FUNDS spread (RFF − RT10)	37 points

These totals point to SHORT as the best overall of the six interest rate predictors; this is in line with the previous findings of Friedman and Kuttner (1989) and of Stock and Watson (1989). At the other end of the scale, TILT (the difference between the one-year T-bill rate and the ten-year Treasury bond rate) appears to add little when the other variables are included.[9] The other four interest rates and spreads embody intermediate amounts of independent information. Of these four, perhaps the most interesting is LONG, the spread between the Baa corporate bond rate and the long-term bond rate. LONG is not the best variable in any of the size-one models, but it appears in four of the size-two models, eight of the size-three models, and all ten of the size-four models.

Table 4
Best-Fitting Prediction Equations

Predicted Variable	Model Size (number of explanatory variables) 1	2	3	4
Industrial Production	SHORT[s]	SHORT LONG	RCP6MO[a] SHORT LONG	RCP6MO[r] SHORT LONG FUNDS
Unemployment Rate	SHORT[s]	SHORT LONG	RCP6MO LONG FUNDS	RCP6MO[ar] SHORT LONG FUNDS
Capacity Utilization	SHORT[s]	RCP6MO SHORT	RCP6MO[a] SHORT LONG	RCP6MO[r] SHORT LONG FUNDS
Employment	SHORT[s]	RCP6MO SHORT	RCP6MO[ar] SHORT LONG	RFF SHORT LONG TILT
Housing Starts	RCP6MO[s]	RCP6MO FUNDS	RFF[a] LONG FUNDS	RFF[r] SHORT LONG FUNDS
Retail Sales	FUNDS[sa]	LONG FUNDS	RFF[r] LONG FUNDS	RFF RCP6MO LONG FUNDS
Personal Income	SHORT[sa]	RCP6MO SHORT	RCP6MO[r] SHORT TILT	RCP6MO SHORT LONG TILT
Durables Orders	SHORT[s]	RFF SHORT	RFF[a] SHORT LONG	RFF[r] SHORT LONG FUNDS
Consumption	FUNDS[s]	RFF SHORT	RFF LONG FUNDS	RFF[ar] SHORT LONG FUNDS
Inflation	RFF[s]	LONG FUNDS	RFF[a] RCP6MO FUNDS	RFF[r] RCP6MO LONG FUNDS

Note: For each macro variable, the table lists the interest rate variables included in the best prediction equation of the specified size. Data are monthly and cover 1961–89. All equations include a constant, a trend, and six monthly lags of the predicted variable. For definitions of interest rate variables, see Table 1.
[s] Best model by Schwarz criterion.
[a] Best model by Akaike criterion.
[r] Best model by adjusted R^2 criterion.

Since the correlation of LONG with the other interest rate variables is low, it appears that this variable, while not containing the most "essential" information that is present in interest rates, does contain useful additional information.

The comparison just drawn among forecasting variables ignored the issue of the optimal size of the forecasting models (which is closely related to the issue of the "dimensionality" of the information in interest rates). Unfortunately, the conclusions on this count are somewhat ambiguous. Of the three criteria used to compare models of different sizes, the one that puts the stiffest penalty on extra parameters (the Schwarz criterion) always indicated that the model of size one was best, while the criterion with the smallest penalty on extra parameters (adjusted R^2) chose models of size three or (usually) size four. (See Table 4.) The Akaike criterion, which gives an intermediate penalty for increased model size, indicated in two cases that the best model was of size one but in the other eight cases that the best size was either three or four.

In many cases the models chosen by the stringent criteria are nested in the larger models chosen by the alternative criteria. When a larger model nests a smaller one, the hypothesis that the smaller model is to be preferred can be directly tested by testing the hypothesis that the additional forecasting variables can be excluded. These tests usually found that the larger model was statistically preferred at conventional significance levels. The fact that larger models are typically preferred is weak evidence for the view that interest rate variables contain several different types of independent information, which cannot be completely captured by using a single interest rate or spread in a forecasting equation.

Out-of-Sample Forecasting

While in-sample fit is one criterion for judging prediction equations, the ultimate test of an equation is the ability to forecast out of sample. Experiments along this line suggest that, unfortunately, the strong predictive power of interest rates that has been noted is most apparent for the period before (approximately) 1980; since that time the forecasting power of interest rates has deteriorated significantly.[10]

As a simple illustration of this point, results are shown here for only three key macro variables (industrial production, the unemployment rate, and inflation) and for models including only one interest rate variable. The study attempted to determine whether the use of an interest rate variable could improve out-of-sample forecasting for the key macro variables, *given* the inclusion in the equation of lagged values of the macro variable and of the index of leading indicators. In contrast to the prediction equations in the previous section, which focused on one-month-ahead forecasts, six-month-ahead forecast equations were considered.

For each of the three macro variables, prediction equations were estimated for samples beginning in January 1961 and ending in December of 1971, 1974, 1977, 1980, 1983, or 1986. The dependent variable in each case was the cumulative growth rate of the forecasted macro variable over the previous six months. Each prediction equation included a constant, a trend, and the seventh through twelfth lags of the monthly growth rate of the forecasted variable, of the growth rate of the index of leading indicators, and of one of the candidate interest rate variables. For each forecasted variable and sample period the prediction equation was chosen that fit best in sample. The "winning" interest rate variable in each case is shown in Table 5; just below the name of each interest rate variable is the probability that all lags of that variable could be excluded from the associated prediction equation.

Since 1980 the forecasting power of interest rates has deteriorated significantly.

Using the best prediction equations for each sample period, out-of-sample forecasts were made for each subsequent three-year period. The forecast periods were non-overlapping; so, for example, using the equation estimated through December 1971, forecasts were made of the six-month growth rates beginning in January or July of 1972, 1973, and 1974. The accuracy of these forecasts was compared to what could have been obtained if the interest rate variable had been omitted, and the forecasting equation had been estimated using only lagged values of the forecasted variable and the index of leading indicators. The second entry below each variable

Table 5
Marginal Forecasting Power of Interest Rates and Spreads for Industrial Production, the Unemployment Rate, and Inflation at Six-Month Horizons

	Forecasted Variable		
Period	Industrial Production	Unemployment Rate	Inflation
1972–74	SHORT	RFF	RFF
	(.0011)	(.0003)	(.0000)
	.7704	.8743	.8965
	.5997	.7542	.8538
1975–77	RCP6MO	SHORT	FUNDS
	(.0000)	(.0000)	(.0000)
	.8907	.6582	.5445
	.9532	.7497	.2150
1978–80	SHORT	SHORT	FUNDS
	(.0000)	(.0000)	(.0000)
	.7069	.7692	.6387
	.5372	.5435	.4169
1981–83	SHORT	SHORT	FUNDS
	(.0000)	(.0000)	(.0000)
	1.5456	1.3887	1.9002
	1.7403	1.9950	2.6509
1984–86	SHORT	SHORT	FUNDS
	(.0000)	(.0000)	(.0000)
	.9233	.6605	1.5382
	.6846	.6346	1.8680
1987–89	SHORT	SHORT	TILT
	(.0000)	(.0000)	(.0000)
	1.4480	1.2751	1.2782
	1.6922	1.4578	1.9667

Note: For each variable and forecasting period, the interest rate variable named is the one that fit best using data prior to the forecasting period. (Variable names are defined in Table 1.) The number in parentheses is the probability that all lags of the named interest rate variable could be excluded from the prediction equation. The next two numbers are the ratios of (respectively) the average absolute forecasting errors and the average squared forecasting errors between equations with and without the interest rate variable, as discussed in the text.

name in Table 5 gives the ratio of the average absolute forecasting error obtained when the interest rate variable is included to the average absolute error obtained without the interest rate variable. Similarly, the third entry below each variable name gives the ratio of average squared forecast errors. Entries of less than one indicate that using the interest rate variable improves the out-of-sample forecast, relative to an equation that uses only the lagged forecast variable and the index of leading indicators.

Table 5 shows that once again SHORT is the best interest rate variable for predicting real activity; thus, this finding appears to be independent of the forecast horizon. Although the spread between the Federal funds rate and the long-term bond rate (FUNDS) is best for forecasting the nominal variable (inflation), for the two real variables (industrial production and the unemployment rate), SHORT fits best in ten of twelve cases. Table 5 also shows that, up through 1980, the use of interest rate variables would have consistently improved out-of-sample forecasts.

After 1980, however, the story is different. Although the use of SHORT would have helped to forecast real variables in 1984–86, in 1981–83 and 1987–89 an equation using SHORT would have performed considerably worse. Further, the inflation prediction equation deteriorates in all sub-periods of the 1980s.

The "reason" for the poor performance of SHORT in the 1980s is that, first, this variable, like all interest rate variables, was very volatile in 1979–83 (compare Figure 3); although a severe recession occurred during this time, the real economy did not exhibit volatility proportional to that in interest rates. Second, SHORT rose in the last third of the 1980s, indicating (based on previous experience) that the economy should have gone into a mild recession, but no recession occurred. To understand at a deeper level why the forecasting power of SHORT has weakened, it is necessary to explain why this variable seemed to contain so much information in the first place.

II. Why Does the Commercial Paper–Treasury Bill Spread Predict the Economy?

The first main section of this article showed that, while many interest rates and spreads are informative about the economy, the best single interest rate indicator among those examined is probably the spread between the commercial paper rate and the Treasury bill rate, or SHORT. At this point the focus of the study narrows to consider specifically why this variable seems to contain so much information about the future of the economy. For concreteness the study focuses on SHORT, but much of the discussion to follow would apply to several of the other interest rate indicators as well.

As discussed in the introduction, the simplest explanation of why SHORT forecasts the economy is that it measures the amount of default risk perceived by the market. As such, this spread may be useful because it summarizes available information about the likelihood of a recession.

A difficulty with this explanation is that SHORT would seem to be a poorer measure of general default risk than several other available interest rate spreads. Defaults on prime nonfinancial commercial paper are extremely rare (much too infrequent, it would seem, to plausibly account for the 300-basis-point swings in this spread that have been observed); if obtaining an objective measure of default risk were important, a variable such as the Baa corporate bond–Treasury bond spread ought to do a better job in forecasting than SHORT. Indeed, the correlation of SHORT with other indicators of default risk is remarkably low: For example, the correlation of monthly changes in SHORT with monthly changes in the spread between Baa corporate bonds and Treasury bonds (LONG) is just .09 over the 1961–89 period; when the Aaa rate is used instead of the Baa rate, the correlation is still .09, and when the Baa–Aaa rate differential is used, the correlation in changes with SHORT is less than .04. Van Horne (1979) has shown that the correlation between the commercial paper spread and the long-term corporate bond spread is low even when measured *company by company*.

Although the correlation of SHORT with other default measures is low, its correlation with various measures of monetary policy is higher.

Although the correlation of SHORT with other default measures is low, its correlation with various measures of monetary policy is higher; for example, the correlation of monthly changes in SHORT with monthly changes in the federal funds rate over 1961–89 is .46. While of course not necessarily proof of anything, this correlation does motivate consideration of the possibility that SHORT is a good forecaster because it contains information about monetary policy. This general proposition will be called the monetary policy hypothesis. Two different versions of this hypothesis will be considered; the common element of both, as mentioned in the introduction, is that it is assumed that commercial paper and Treasury bills are imperfect substitutes in investors' portfolios.

The first version of the monetary policy hypothesis might be called the "credit crunch" story, and is due principally to Cook (1981). Cook's argument is that, prior to institutional changes in 1978, monetary policy affected SHORT (and other money market spreads) by inducing disintermediation from the banking system. Because of deposit interest rate ceilings imposed by Regulation Q, during the latter part of the 1960s and in the 1970s monetary tightening and the associated increase in interest rates periodically led to large outflows of deposits from banks. Depositors were motivated to withdraw, of course, in order to obtain higher open-market yields. However, because private money market instruments such as commercial paper could be purchased only in large minimum denominations, during these episodes disintermediated deposits flowed primarily into T-bills. Cook argued that during these credit crunch episodes the large switches from deposits to T-bills in private portfolios lowered the yield on T-bills relative to commercial paper (and other money market instruments). Thus tight money was reflected in an increase in the commercial paper–Treasury bill spread. The increase in this spread during the credit crunches of 1966, 1969, and 1973–74 can easily be seen in Figure 3.[11]

Why didn't the increase in the spread cause banks or other investors not constrained by the minimum denomination restriction to sell off their Treasury bills and buy commercial paper, thus offsetting the switch by depositors? This did happen to some extent. But as Cook (1981) explains in detail, Treasury bills are valuable to banks and other investors for reasons beside their direct yield. For example, T-bills can be used for posting margin, for collateralizing overnight repurchase agreements, and for satisfying bank capital adequacy requirements; commercial paper generally cannot fulfill these functions. Thus, it is reasonable that the demand for Treasury bills will be less than perfectly elastic as the commercial paper–Treasury bill spread widens; that is, Treasury bills and commercial paper are imperfect substitutes.

Given Cook's explanation of why credit crunches caused the spread SHORT to increase, then as long as the monetary actions that caused the credit crunches also tended to induce recessions, SHORT should help predict the economy. A nice feature of this explanation is that it suggests SHORT should no longer be strongly related to monetary policy after the institutional changes (such as the introduction of money market mutual funds and the removal of deposit rate ceilings) that eliminated credit crunches; this is consistent with the finding that SHORT is no longer a good predictor after 1980.

The credit crunch story implies that SHORT will be related to monetary policy only during periods when deposit rate ceilings are binding. An alternative form of the monetary hypothesis, which for lack of a better name will be called the "simple imperfect substitutability" hypothesis, suggests that SHORT will respond to monetary policy whenever the federal funds rate (or some other short-term interest rate) is used as an intermediate target.[12] This story goes as follows: Suppose that, in the process of tightening the stance of monetary policy, the Federal Reserve induces a rise in the federal funds rate. This directly increases the cost of funds to banks. However, banks have several principal alternatives to borrowing federal funds: 1) they can issue CDs or other managed liabilities; 2) they can sell some of their holdings of Treasury securities; or 3) they can cut back on credit to their loan customers (or raise loan interest rates).

If Treasury bills and other assets are imperfect substitutes, then either action (1) or action (3) by banks would tend to increase the open-market commercial paper rate relative to the Treasury bill rate. To sell additional CDs, the banks would have to raise the rate they offer on that instrument; since commercial paper is a very close substitute for CDs in investor portfolios, this would lead the commercial paper rate to rise as well.[13] If banks respond to the higher cost of funds instead by raising the cost of credit to business loan customers, firms that are able to do so will borrow directly from the public by issuing additional commercial paper; this too will raise the commercial paper rate.

If banks sell off Treasury securities (option 2), on the other hand, the tendency for the spread to increase will be arrested; however, following Cook's argument above, banks will not sell off their T-bills in response to a modest increase in the yield differential. Thus, an increased commercial paper–Treasury bill spread will be associated with tight monetary policy, which would help explain why this spread is a useful forecaster. The decline in SHORT's forecasting power after 1980 would in this case be explained by the observations that 1) because of changing Federal Reserve procedures, interest rates in general have been much less reliable indicators of monetary policy since the October 1979 policy shift; and 2) financial innovation, deregulation, and internationalization over the last decade may have increased the substitutability among alternative short-term assets. Another possibility is that monetary policy has simply been relatively less important in recent years.[14] Note that, relative to the credit crunch hypothesis, this alternative view would predict a more gradual reduction in the sensitivity of SHORT to monetary policy after 1978.

Like the credit crunch version of the monetary policy hypothesis, the simple imperfect substitutability version is sensitive to the possibility of investors in the economy, outside of banks, for whom commercial paper and Treasury bills are (nearly) perfect substitutes; if these investors exist, their arbitrage activity will cause the spread between these two assets to reflect only differences in after-tax expected yields. Rather than discuss in the abstract whether such arbitrage is likely to exist, however, some empirical evidence on the relationship of interest rate spreads to Fed policy will be reviewed.

The Response of Interest Rate Spreads to Changes in Monetary Policy

This study will now consider how some key interest rate spreads, including SHORT, respond to changes in monetary policy. As will be shown, the evidence is consistent with the general view that SHORT is if anything more closely related to indicators of monetary policy than to the economywide level of default risk. Precise dates of changes in monetary policy are, of course, not available. Instead, the study will rely on two very different efforts to measure shifts in Federal Reserve policy.

The first of these studies is by Romer and Romer (1989). By reading Federal Reserve records, they identified dates in the postwar era at which monetary policy shifted to a tighter, anti-inflationary mode. Four of these dates (December 1968, April 1974, August 1978, and October 1979) fall within the 1961–89 sample period. Table 6 shows the behavior of the federal funds rate (RFF), the commercial paper–Treasury bill spread (SHORT), the spread between Baa and Aaa corporate bond rates (here called DEFAULT), and the difference between the one-year and ten-year Treasury bond rates (TILT) for the period from two months before until twelve months after each Romer and Romer date. DEFAULT is introduced as a measure of the behavior of perceived default risk in the economy. DEFAULT is probably

Table 6
Behavior of the Federal Funds Rate and Interest Rate Spreads in the Periods around the Romer and Romer Dates[a]

Episode 1 (*December 1968)	RFF	SHORT	DEFAULT	TILT	Episode 2 (*April 1974)	RFF	SHORT	DEFAULT	TILT
1968 O	5.92	.39	.75	−.01	1974 F	8.97	.87	.68	−.08
N	5.81	.33	.82	.05	M	9.35	.59	.61	.55
D*	6.02	.12	.78	.16	A*	10.51	1.47	.62	1.11
1969 J	6.30	.25	.73	.30	M	11.31	2.22	.68	1.20
F	6.64	.32	.64	.22	J	11.93	2.84	.80	1.13
M	6.79	.66	.66	.04	J	12.92	3.78	.76	.99
A	7.41	.91	.65	.09	A	12.01	2.54	.77	1.32
M	8.67	1.20	.73	.10	S	11.34	2.70	.94	.83
J	8.90	1.48	.72	.47	O	10.06	1.62	1.21	.15
J	8.61	1.42	.76	.88	N	9.45	1.29	1.71	−.02
A	9.19	1.14	.89	.85	D	8.53	1.87	1.74	−.12
S	9.15	1.17	.91	.66	1975 J	7.13	.94	1.98	−.67
O	9.00	1.27	.89	.54	F	6.24	.71	2.03	−1.41
N	8.85	.84	.90	.75	M	5.54	.44	1.81	−1.62
D	8.97	.95	.93	.52	A	5.49	.15	1.63	−1.33
Episode 3 (*August 1978)	**RFF**	**SHORT**	**DEFAULT**	**TILT**	**Episode 4 (*October 1979)**	**RFF**	**SHORT**	**DEFAULT**	**TILT**
1978 J	7.60	.40	.84	−.37	1979 A	10.94	.90	1.12	.95
J	7.81	.47	.72	−.25	S	11.43	1.40	1.10	1.51
A*	8.04	.53	.79	−.10	O*	13.77	1.57	1.27	2.14
S	8.45	.45	.73	.22	N	13.18	1.44	1.23	1.74
O	8.96	.48	.70	.50	D	13.78	.96	1.32	1.59
N	9.76	.99	.80	1.20	1980 J	13.82	.82	1.33	1.26
D	10.03	1.07	.78	1.29	F	14.13	.74	1.19	1.51
1979 J	10.07	.85	.88	1.31	M	17.19	1.47	1.49	3.07
F	10.06	.60	.82	1.14	A	17.61	2.05	2.15	1.83
M	10.09	.49	.89	1.13	M	10.98	.64	2.18	−.79
A	10.01	.38	.95	.94	J	9.47	.73	2.13	−1.62
M	10.24	.44	.97	.87	J	9.03	.23	1.58	−1.60
J	10.29	.65	1.09	.66	A	9.61	.20	1.51	−.86
J	10.47	.58	1.09	.69	S	10.87	.47	1.68	.01
A	10.94	.90	1.12	.95	O	12.81	.69	1.92	.74

[a]The dates defining the four episodes were determined by Romer and Romer (1989) to be dates at which monetary policy was tightened in order to fight inflation. Variables names are defined in Table 1.

superior to LONG as a measure of default risk (although the two spreads are highly correlated), since changes in LONG may also be affected by changes in the value of the call option attached to most corporate bonds.[15]

The most important observation to make from Table 6 is that SHORT and DEFAULT respond rather differently to increasing monetary tightness, as measured by the Romer and Romer dating. Generally, SHORT rises and falls sympathetically with the federal funds rate RFF during the contractionary episodes; in this sense, its behavior is similar to the term structure spread TILT, which also moves with the funds rate. In contrast, DEFAULT typically responds only with a lag, usually not rising until after RFF and SHORT have fallen back.[16] This is a bit of evidence for the view that SHORT responds more to monetary policy than to changing perceptions of default risk. The fact that SHORT still appears to respond to the funds rate in 1979, when credit crunches were no longer a possibility, seems to favor the alternative "simple imperfect substitutability" version of the monetary policy hypothesis.[17]

The second study of monetary policy we utilize is by Cook and Hahn (1989). Using *Wall Street Journal* reports, Cook and Hahn determined the dates of approximately 75 changes in the federal funds rate target that occurred between September 1974 and September 1979. (This period was chosen because, according to the authors, during this time the federal funds rate was a very precise indicator of monetary policy.) Using daily data, Cook and Hahn showed that changes in the federal funds target caused changes in Treasury bill and bond interest rates; this implies that the target changes conveyed new information and were not simply passive adjustments to the existing level of rates.

Table 7 reports the results of regressing changes in the federal funds rate (ΔRFF), the commercial paper–Treasury bill spread (ΔSHORT), the Baa bond–Aaa bond spread (ΔDEFAULT), and the term structure spread (ΔTILT) against changes in the federal funds target, as identified by Cook and Hahn. Since the federal funds rate did not seem always to respond contemporaneously to the target change (which implied that there may have been market uncertainty about the size and timing of the change), the study used weekly data and regressed changes in the interest rate variables against the current and lagged changes in the federal funds target.[18]

Table 7 shows that, first, the actual federal funds rate responded strongly to changes in the target during this period, with the coefficients over the week of the change and the subsequent week adding up approximately to one. The term structure variable also responded strongly to target changes, and with high statistical significance; this suggests that the tilt of the term structure is in fact largely driven by monetary policy. Most interesting, though, is that the responses of SHORT and DEFAULT to a change in the funds target are found to have been in opposite directions during this period; with a one-week lag, SHORT responded positively and with high statistical significance to an increase in the funds target, while DEFAULT, somewhat surprisingly, actually fell. (The decline in DEFAULT is small but statistically significant.) The rather different responses of these two variables are consistent with the previous observation, based on the Romer and Romer dates, that SHORT is more closely related to monetary policy indicators than to general default risk.

Table 7
Relation of Changes in Interest Rate Variables to Changes in the Federal Funds Target, 1974–79

Dependent Variable	Constant	ΔTARGET	$\Delta TARGET_{-1}$
ΔRFF	−.0063	.488	.668
	(.468)	(4.72)	(6.46)
ΔSHORT	−.0047	−.063	.252
	(.500)	(.863)	(3.45)
ΔDEFAULT	.0011	−.043	−.020
	(.616)	(3.04)	(1.45)
ΔTILT	−.0041	.322	.350
	(.689)	(6.87)	(7.48)

Note: Data are weekly and the sample period is September 1974 until September 1979. ΔTARGET and $\Delta TARGET_{-1}$ are the changes in the federal funds target, in the current and previous week respectively, as identified by Cook and Hahn (1989). Other variable names are defined in Table 1. t-statistics are in parentheses.

An Estimated Equation for the Commercial Paper–Treasury Bill Spread

To get at the determinants of SHORT more directly, this study specified and estimated some simple regressions in monthly data. A first consideration in modelling SHORT empirically is that some account must be taken of tax effects. Unlike commercial paper returns, Treasury bill yields are not taxable at the state and local levels. On this account, the before-tax yields to the two instruments must be related by RCP6MO = t RT6MO, where $t > 1$ is a factor measuring the tax advantage of T-bills. This relationship implies that RCP6MO−RT6MO = (t − 1) RT6MO; that is, the spread increases proportionally to the level of the bill yield. In contrast, the ratio RCP6MO/RT6MO = t should be independent of the level of bill yields. The study followed previous work and used as the dependent variable the ratio RCP6MO/RT6MO rather than the spread RCP6MO−RT6MO;[19] however, estimated equations using the spread as the dependent variable and including the Treasury bill yield on the right-hand side gave similar results.

The previous discussion suggests that the ratio RCP6MO/RT6MO should depend on perceived default risk and the stance of monetary policy. The Baa–Aaa spread (DEFAULT) was used as a measure of default risk and the federal funds–Treasury bond spread (FUNDS) as an indicator of monetary policy.[20] Regressions of RCP6MO/RT6MO against these two variables yielded significant coefficients with the right sign, but the equations exhibited high serial correlation. After correction for first-order serial correlation, the results were:

1) for January 1961 to June 1978 (the "credit crunch" period):

$$\text{RCP6MO/RT6MO} = \underset{(46.8)}{1.10} + \underset{(0.87)}{.0215}\ \text{DEFAULT} + \underset{(6.49)}{.0347}\ \text{FUNDS}$$

$$\text{rho} = .84 \qquad R^2 = .743$$

2) and for August 1978 to December 1989:

$$\text{RCP6MO/RT6MO} = \underset{(51.9)}{1.06} + \underset{(0.66)}{.0077}\ \text{DEFAULT} + \underset{(4.02)}{.0084}\ \text{FUNDS}$$

$$\text{rho} = .84 \qquad R^2 = .709$$

where rho is the estimated first-order serial correlation coefficient and t-statistics are in parentheses.[21]

These results show that the ratio of commercial paper and Treasury bill yields is positively related to default risk, as the theory suggests, but that the relationship is rather weak.[22] The relationship to monetary policy, as measured by FUNDS, is statistically much stronger, and in the earlier period is economically significant as well. (For example, if the Treasury bill rate is 6 percent, and the federal funds rate spread rises by 1 percentage point, the equation for the earlier period implies an increase in the commercial paper–Treasury bill spread of about 21 basis points.) In contrast, after 1978 the effect of the federal funds rate spread on the commercial paper–Treasury bill spread is only about one-fourth as large as before.

That the relationship of SHORT to monetary policy weakens but does not disappear after 1978 is more consistent with the simple imperfect substitutes version of the monetary hypothesis than with the credit crunch version. In order to make a more direct comparison of the two versions of the monetary hypothesis, the study examined the effects of adding to the equation for RCP6MO/RT6MO a variable equal to the spread between the six-month Treasury bill rate and the deposit rate ceiling imposed by Regulation Q, whenever that difference was positive.[23] This new variable, called CRUNCH, is supposed to capture episodes of disintermediation.

When CRUNCH and DEFAULT were included together in the equation for RCP6MO/RT6MO, for the sample period January 1961–June 1978, CRUNCH entered significantly and with the right sign in the ordinary least squares (OLS) estimates. However, with correction for serial correlation, CRUNCH entered with the wrong sign. When both CRUNCH and FUNDS were included in the equation, with correction made for serial correlation, the result was

$$\text{RCP6MO/RT6MO} = \underset{(42.2)}{1.15} + \underset{(0.43)}{.0112}\ \text{DEFAULT} + \underset{(8.24)}{.0499}\ \text{FUNDS} - \underset{(5.86)}{.0539}\ \text{CRUNCH}$$

$$\text{rho} = .82 \qquad R^2 = .779.$$

In this equation FUNDS enters much as before but CRUNCH has the wrong sign. Although these results should be taken only as suggestive, they do tend to support the simple imperfect substitutes version of the monetary hypothesis over the credit crunch version.

The Information Content of SHORT

At this point, it is appropriate to return to the question of why SHORT is such a good predictor. Some part of the reason appears to be that this spread combines information about both monetary policy (and the state of the money market) and expected default risk.[24] As a test of this answer, one more experiment was run: prediction equations were estimated for each of the ten macro variables used in Section I, over the entire sample period 1961–89. Each equation included a constant, a trend, six lags of the forecasted variable, six lags of DEFAULT (as a measure of default risk), six lags of FUNDS (as a measure of monetary policy), and six lags of SHORT. If SHORT is a good forecaster because it contains information about both default risk and monetary policy, in the presence of DEFAULT and FUNDS its predictive power should be much weakened.

The results are in Table 8. For each prediction equation the probabilities are given 1) that *both* DEFAULT and FUNDS should be excluded from the equation (leaving only SHORT) and 2) that SHORT should be excluded from the equation. The results are

Table 8
The Marginal Forecasting Power of the Commercial Paper Rate–Treasury Bill Rate Spread in Equations Containing Alternative Variables

	Marginal Significance Levels	
Forecasted Variable	H_0: All lags of FUNDS, DEFAULT equal zero	H_0: All lags of SHORT equal zero
Industrial Production	.0000	.0004
Unemployment Rate	.0048	.0133
Capacity Utilization	.0001	.0076
Employment	.0007	.2615
Housing Starts	.0000	.0022
Retail Sales	.0080	.9680
Personal Income	.2534	.0171
Durables Orders	.0156	.0530
Consumption	.0002	.0959
Inflation	.0000	.1211

Note: Entries are the probabilities that the given set of forecasting variables can be excluded from a prediction equation that includes six lags each of the forecasted variable, FUNDS, DEFAULT, and SHORT. The data are monthly and the sample period is 1961–89. Variable names are defined in Table 1.

mildly supportive of the view that information about default and monetary policy is important for forecasting: In nine of the ten cases, the probability that both DEFAULT and FUNDS can be excluded from the equation is lower than the probability that SHORT can be excluded. On the other hand, SHORT retains significance at conventional levels in a number of the equations, despite the presence of the other two variables. It must be either that SHORT somehow measures default risk and monetary policy more accurately than do DEFAULT and FUNDS, or that this variable also contains other kinds of information.[25]

III. Conclusion

This paper began by comparing the predictive power of a number of different interest rates and spreads. While several of these variables were found to contain a great deal of information about the future evolution of the economy, the spread between the commercial paper rate and the Treasury bill rate appears to be the best predictor—although this predictive power has weakened recently.

Some progress was made toward explaining why this interest rate spread is so informative. Besides containing information about default risk, which is the natural first hypothesis, this spread seems also to be a measure of monetary policy. (Indeed, if anything, the relationship between the commercial paper–Treasury bill spread and monetary policy has historically been more clearcut than the spread's relationship with default risk.) The commercial paper–Treasury bill spread predicts well because it registers developments in both the nonmonetary and monetary sectors of the economy.

At least two possible explanations can be offered as to why the predictive power of the commercial paper–Treasury bill spread was lower in the 1980s than previously. First, a number of changes in Federal Reserve operating procedures during the decade reduced the reliability of interest rates in general as indicators of the stance of monetary policy. Second, financial innovation, deregulation, and international integration may have increased the substitutability among various money market instruments; all else equal, this would act to reduce the sensitivity of interest rate spreads to monetary policy.

Whether the commercial paper–Treasury bill spread will be as useful a predictor in the future as it was in the past depends very much on which of the two explanations just given is the more important. If the first is correct, then to the extent that the Federal Reserve returns to its earlier emphasis on interest rates as targets or indicators, the predictive power of the spread (and of other interest rate variables) should return. If the second explanation is the right one, and commercial paper and Treasury bills have become effectively perfect substitutes, then the spread should not be a useful predictor in the future. Unfortunately, it is too soon to tell which of these explanations should be given the greater weight.

Data Appendix

All the data used are from Data Resources, Inc. Variable definitions and DRI code names are listed below:

Monthly Variables

Industrial production index – total (JQIND)
Unemployment rate – civilian (RUC)
Capacity utilization – manufacturing – total (UCAPFRBM)
Employed persons – nonagricultural establishments (EEA)
Housing starts – private, including farms (HUSTS)
Retail sales – 1982 dollars (STR82)
Personal income – 1982 dollars (YP82)
New orders, manufacturing durables goods – 1982 dollars (OMD82)
Personal consumption expenditures (C)
Consumer price index (CPIU)
M2 money supply (MNY2)
Leading indicators – composite index (JLEAD)
Effective rate on federal funds (RMFEDFUNDNS)
Average market yield on 3-month government bills (RMGBS3NS) and 6-month government bills (RMGBS6NS)
Rate on prime commercial paper – 6 months (RMCML6NS)
Rate on prime certificates of deposit, secondary market – 6 months (RMCD6SECNS)
Yield on Treasury securities at constant maturity of 1 year (RMGFCM@1NS) and 10 years (RMGFCM@10NS)
Yield on Moody's Aaa corporate bonds (RMMBCAAANS) and Baa corporate bonds (RMMBCBAANS)

Weekly Variables

Federal funds rate – effective (FFYW)
Commercial paper rate, industrial – 6 months (FIP180YW)
Treasury bill rate – 6 months (FBL6YW)
Treasury bond rate, constant maturities – 1 year (FCN1YYW) and 10 years (FCN10YYW)
Seasoned corporate bond rate (Moody's Baa and Aaa), weekly averages of daily figures (CAVBAA and CAVAAA)

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[1] Actually, the predictive power of this particular spread was first noticed not by Stock and Watson but by Benjamin Friedman and Kenneth Kuttner, as discussed below.

[2] Obviously the ten macroeconomic variables are not independent, since they are all related to the aggregate business cycle; thus, one should not overstate the advantage of looking at a number of different variables. On the other hand, the ten variables do reflect different measurement techniques, different sectors, and different cyclical dynamics; thus a finding that an interest rate variable predicts many of the macro variables is less likely to be spurious than a finding that an interest rate variable predicts a single macro variable.

[3] The start date is determined by data availability. Using one-month rather than longer forecasting horizons gets at the main issue of information content while avoiding technical problems arising from overlapping forecast errors. Some evidence from six-month-ahead forecasts presented below suggests that the main results are robust to the choice of forecast horizon.

[4] Stock and Watson (1989) used a similar procedure. Only real money growth was added in the prediction equation for inflation, since lags of inflation were already included in the first equation. Deflation of M2 was by the CPI.

[5] This is the traditional index, not to be confused with the Stock and Watson experimental index. The traditional index of leading indicators is a weighted average of twelve macroeconomic time series that have been found historically to be quite useful for forecasting real activity. The available leading indicator series includes revisions that were not available at the time of actual forecasts; since interest rates are rarely revised, this introduces a bias against finding marginal predictive power for interest rate variables.

[6] The short-term Treasury rate is still implicitly included, since it is a linear combination of the commercial paper rate and the commercial paper rate–Treasury bill spread.

[7] The spread between short-term and long-term Treasury bonds (TILT) was retained, even though it did relatively poorly in the univariate comparison, because it has been strongly advocated as a forecasting variable.

[8] See, for example, Priestly (1981, pp. 372–6). The best equation by each of these criteria is the one that minimizes the log of the sum of squared residuals plus a penalty term that is increasing in the number of right-hand side variables. The Schwarz criterion assesses the heaviest penalty for adding extra independent variables, the adjusted R^2 criterion the lightest.

[9] This poor showing for TILT was not due to the inclusion in the analysis of another term structure variable, the spread between the federal funds rate and the long-term bond rate (FUNDS). Exclusion of FUNDS from the analysis gave approximately the same results for TILT.

[10] This is also true in sample. For example, if the prediction equations reported in Tables 2 to 4 are re-estimated for 1961–79, the results remain strong; if they are re-estimated for 1980–89, there is a substantial reduction in fit.

[11] It is also the case that credit crunches, because they reduced the funds available for bank lending, led to large increases in the issuance of commercial paper by nonfinancial firms. This would also tend to raise the yield on commercial paper relative to Treasury securities. See Rowe (1986).

[12] For a formal model related to the following discussion, see Judd and Scadding (1981).

[13] The correlation of monthly changes in the commercial paper–Treasury bill spread and the CD–Treasury bill spread is .88 over 1970–89, the period for which data were available.

[14] It may be that monetary policy has appeared less important in recent years because the Federal Reserve has acted aggressively to forestall any increase in inflationary expectations; with inflation under control, there has been no need for the Fed to administer the strong contractionary medicine (with the resulting effects on real activity) that it did in some previous episodes. The author thanks Timothy Cook for this suggestion.

[15] The author thanks Richard Kopcke for pointing this out.

[16] For a similar result, compare the cyclical behavior of the federal funds rate, the commercial paper–Treasury spread, and the spread between Baa and government bonds (an alternative default

measure) in Figures 1, 3, and 4. RFF and SHORT tend to lead the cycle, while LONG clearly lags. It is odd, though, that changes in default premia appear to be forecastable, since if true this would imply potential profit opportunities.

[17] A caveat is that, because of tax considerations, SHORT should respond to the level of interest rates in general. This is analyzed further below.

[18] Reported results are for the whole sample, which contains many weeks in which the change in the federal funds target was zero. Regressions restricted to weeks of non-zero change in targets gave essentially the same results.

[19] See Cook and Lawler (1983).

[20] The spread variable FUNDS was used rather than the federal funds rate itself in order to avoid attributing to monetary policy possible effects (such as tax effects) arising from changes in the general level of nominal interest rates. However, for the record, replacing FUNDS with the federal funds rate RFF led to essentially the same results.

[21] The relatively high serial correlation suggested the alternative of doing the estimation in first differences. This gave about the same results as in the reported equations.

[22] Higher t-statistics for DEFAULT were obtained in the alternative specification with SHORT on the left-hand side and the level of the Treasury bill rate on the right-hand side.

[23] The ceiling rate used was the one corresponding to time deposits of six months to one year.

[24] The reader will have noticed that, based on the statistical evidence reported, the relationship of SHORT to default risk looks rather weak. That conclusion should not be pushed too far: during some periods, such as 1970 (following the Penn Central bankruptcy) and the spring and summer of 1982 (following the collapse of Drysdale Securities and Penn Square), SHORT seems to have responded strongly to fears about possible defaults.

[25] Also considered was the question of whether SHORT remains informative when the CD–Treasury bill spread is included in the forecasting equations; under the imperfect substitutes story, the two spreads should contain similar information. In this case SHORT can almost always be excluded. These two spreads move so similarly that it does not appear to matter which one is used for forecasting.

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