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Commodity Prices as a Guide for Monetary Policy

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This paper evaluates the usefulness of a commodity price index as an indicator variable for monetary policy purposes. Commodity prices are found to be statistically significant in explaining changes in monetary policy goal variables and to improve somewhat out-of-sample forecast errors of policy variables. However, commodity prices do not by themselves fill the void left by the loss of M1 as an intermediate target, nor do the findings support using a commodity price index in place of M2 as a guide to monetary policy.

The U.S. shed the last vestige of the gold standard in 1971 with the official decision to suspend gold convertibility. This decision actually was just the final step in a long transition, starting at the time of World War I, from a commodity-based monetary system to a pure fiat monetary system. Aside from the brief official consideration of returning to the gold standard in the early 1980s, little serious thought has been given to abandoning the current fiat system in favor of a commodity standard.[1]

Even though the current fiat system is firmly in place, there are important proposals to link the monetary system to commodity prices. These new proposals generally call for using a commodity index to guide monetary policy, either as an intermediate target or as a more general indicator variable. For the most part, these proposals rely on a basket of commodities, rather than on a single commodity price such as that of gold.[2]

To be used as a guide for monetary policy, a commodity price index should have a reliable relationship with the ultimate variables of concern to monetary policy, such as inflation, economic growth, and unemployment. Movements in the commodity index also ought to precede those of the ultimate policy variables to provide policymakers with an early indication of the impact of their policies.

Accordingly, the purpose of this paper is to examine the relationships between selected commodity price indexes and policy variables to evaluate the usefulness of such indexes in the conduct of monetary policy. The paper begins with a discussion of the prerequisites for a commodity price index to serve as a guide to policy and considers the criticisms raised concerning the use of such an index. The empirical analysis then focuses on two composite indexes, those of the Commodity Research Bureau (CRB) and the Journal of Commerce (JOC). The commodities included in those indexes are listed in the Box in the Appendix. The objective of the analysis is to determine whether changes in the commodity price indexes contain information useful to policy beyond that contained in the intermediate targets like M1 and M2.

I. Commodity Prices in a Fiat System

In a fiat monetary system, a commodity price index can be used to guide monetary policy in one of two ways: as an intermediate target or as an indicator variable. The use of a commodity price index as an intermediate target is referred to as a "price rule." Adherence to such a price rule means that monetary policy generally would ease when the price index for the selected basket of commodities was below the predetermined target and tighten when the index was above its target.

Any variable taking on such a vital role in the conduct of policy, first and foremost, would have to lead reliably the ultimate policy variables. That is, policymakers would have to be confident that movements in the price index were signalling future changes in inflation and the performance of the economy. But that alone is not enough. The index also would have to be responsive to changes in monetary policy. An intermediate target that was a reliable indicator of the policy variables but did not respond relatively quickly and predictably to the actions of policymakers would be of little use.

The one intermediate target that satisfactorily exhibited these characteristics for many years was M1. Until 1985, M1 was the primary intermediate target for the Federal Reserve. Since then, evidence of distortions in the relationship between M1 and economic activity and inflation prompted the Federal Reserve to drop M1 as an intermediate target. Targets still are set for the broader monetary aggregates, M2 and M3, but these aggregates generally are not as reliable as M1 once was.

For this reason, a number of economists have looked at commodity indexes as a possible substitute for M1. However, these studies generally have rejected the use of a commodity price index as an intermediate target. Hafer (1983), Garner (1985), and Defina (1988) reject a "price rule" in part because commodity prices cannot be expected to react to open market operations with a sufficiently short and reliable time lag. Moreover, empirical analysis presented in the Appendix suggests that commodity price indexes are affected predominantly by non-monetary shocks. A number of studies also question whether available statistical evidence concerning the relationships between commodity prices and monetary policy objectives is adequate to justify using a commodity price index as the central guide to policy.[3]

However, still open is the question whether a commodity price index would be useful in a more limited role as an indicator variable to guide monetary policy. In the absence of a reliable intermediate target, indicator variables can be useful in formulating monetary policy. Such variables can be used to help forecast movements in the ultimate policy variables.

Currently, this is done systematically through the macro-econometric models that are used at the Board of Governors of the Federal Reserve System and at some of the Reserve Banks (see Judd [1988]). These models are used to project the path for monetary policy that leads to the desired values of the ultimate variables. Indicator variables can be used in this context to improve forecasts of the ultimate policy variables, and, thus, to help determine the appropriate course for monetary policy.

Movements in the commodity price index would not in themselves prescribe a particular path for monetary policy, but would influence policy only to the extent that they affect policymakers' views on the outlook for the ultimate policy objectives. With this more limited role, the criteria for whether a commodity index could be of use in formulating monetary policy can be less stringent than those applied to an intermediate target. In general, the usefulness of an indicator variable can be measured by its marginal contribution to reducing the error in predicting policy variables.[4]

In the remainder of the paper, then, the discussion focuses on the extent to which different commodity price indexes convey information about the future values of two key policy variables, inflation and unemployment.

II. The Usefulness of Commodity Prices

The Supporting Case

One advantage of commodity prices as indicator variables is that they are reported on a more frequent and timely basis than are the data on the policy variables themselves. Data on the prices of many commodities are reported daily with no more than a one day lag. Data on the CPI and employment, on the other hand, are available monthly with about a one month lag. Other measures of economic activity and inflation, such as GNP and the GNP deflator, are available only quarterly.

More fundamentally, some argue that commodity prices ought to lead movements in the ultimate policy variables because they are more flexible and adjust more quickly

than do overall prices and labor markets. Their greater flexibility and speedier adjustment stem from the depth and sophistication of international spot markets. Moreover, because commodities generally are basic inputs that enter at the beginning of the production process, it is reasonable to expect shifts in aggregate demand to be reflected in the prices of commodities before those of finished goods.[5]

Supply shocks are a third factor that makes commodity price indexes potentially attractive as indicator variables. Examples of recent supply shocks include the reduction in agricultural production due to the drought in the U.S. and the increased supply of oil associated with a breakdown in the cohesion of OPEC. Such shocks affect aggregate supply and tend to be inversely related to output and employment. The effect on output, holding money constant, in turn affects the overall level of prices. Movements in a commodity price index containing the commodities subject to a shock would be expected to precede changes in the general price level.[6]

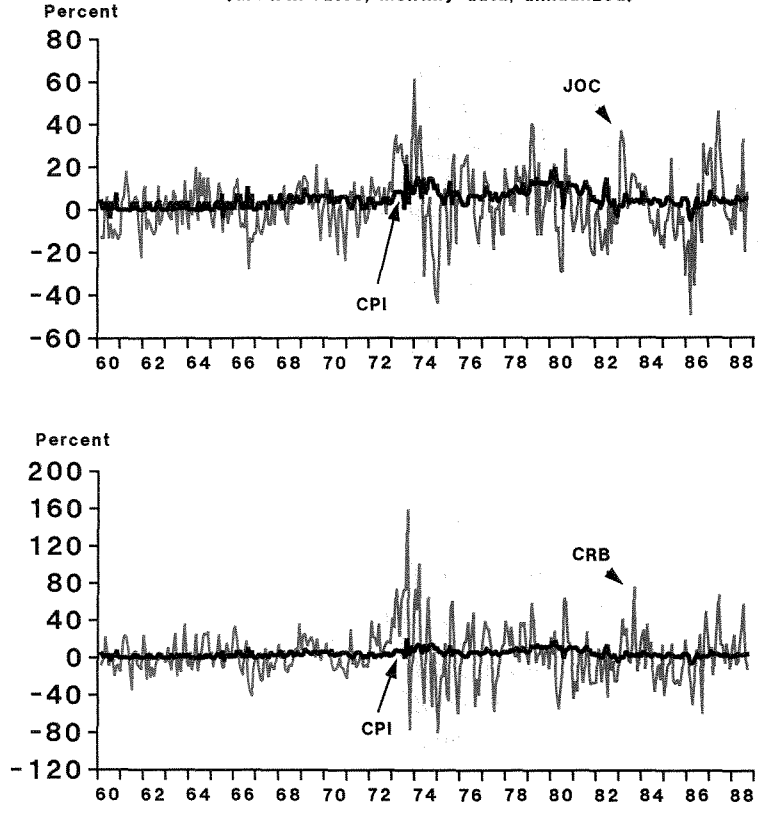
A fourth reason sometimes given for using commodity prices as an indicator variable, at least for overall inflation, is that the movement in the prices of certain commodities may provide information concerning market participants' inflation expectations. According to this argument, the current price of storable commodities, particularly metals, will rise or fall to reflect higher or lower inflation expectations. However, since nominal interest rates also should reflect inflation expectations and nominal interest rates are a principal carrying cost for commodities, movements in commodities prices may not be a perfect yardstick.[7]

Criticisms and Qualifications

The first argument in favor of considering a commodity price index as an indicator variable—that is, the ready availability of data—is not very compelling since data on other potentially useful economic variables are also readily available. For example, data on interest rates and exchange rates also could provide information to policymakers, and are available on as frequent and as timely a basis as are commodity prices.[8]

Second, the features of commodity price indexes that make them potentially beneficial for monetary policy purpose actually may limit their usefulness. For example, the flexibility and rapid adjustment of commodity prices may increase the "noise-to-information" content of a commodity price index. Indeed, commodity prices tend to be quite volatile compared with prices generally. This can be seen in Chart 1, which traces the annualized monthly

Chart 1
CPI and Commodity Indexes
(Growth rates, monthly data, annualized)



growth rates for the CPI relative to those for the two widely cited composite indexes from the CRB and the JOC. Over the period covered by the chart, growth rates for the CRB and the JOC indexes are four to seven times more volatile than the growth rate for the CPI.

Moreover, Table 1 shows that high volatility is not unique to the two indexes examined in this paper. Over the past eight years, the annualized growth rates of other commodity price indexes were 3½ to 20 times more volatile than was the growth in the CPI. The commodity price indexes were also much more volatile than were either M1 or M2.

This volatility makes it difficult to discern from short-run movements in commodity prices the implications for overall inflation. Indeed, as shown in the last column of Table 1, simple correlations for monthly data on CPI inflation and changes in commodity prices are quite low. Thus, month-to-month changes in commodity prices provide little information about overall inflation. On the other hand, short-run movements in the monetary aggregates do not provide much information, either. The correlations for CPI inflation and the month-to-month changes in M1 and M2 are only slightly higher than those for the commodity price indexes, and those for the monetary aggregates have the wrong sign.

The more critical question is whether movements in commodity prices over longer periods precede movements in overall prices in a reliable and predictable manner. The

Table 1

Volatility of Growth in Price Indexes and Monetary Aggregates

(monthly data, 1979:02 to 1988:04)

Series	Mean growth rate (annualized)	Standard deviation of growth rates	Correlation of CPI and series lagged one quarter
CPI	5.82%	4.71	—
CRB	0.30	26.41	.03[1]
JOC	0.82	17.02	.11
Other commodity indexes			
Gold	6.25	88.55	.13
IMF	1.53	27.34	.00
Economist	3.74	35.37	−.02
Dow Jones	9.61	46.98	−.21
Monetary aggregates			
M1	8.24	8.25	−.23
M2	8.24	4.51	−.12

[1]The correlation coefficient for the CRB Futures Index for the period 1981:09 to 1988:04 is .05.

Table 2

Peaks and Troughs in CPI inflation*

Peaks in CPI inflation			Troughs in CPI inflation		
	Months led by the commodity price index			Months led by the commodity price index	
Date	JOC	CRB	Date	JOC	CRB
1966:10	22	5	1967:10	6	3
1970:01	5	5	1972:07	17	18
1974:12	9	16	1976:12	17	17
1980:03	11	15	1983:07	11	20
1984:03	3	2	1986:12	7	8
Mean	10	8.6		11.6	13.2

*Changes in the CPI and the commodity price indexes are 12-month averages.

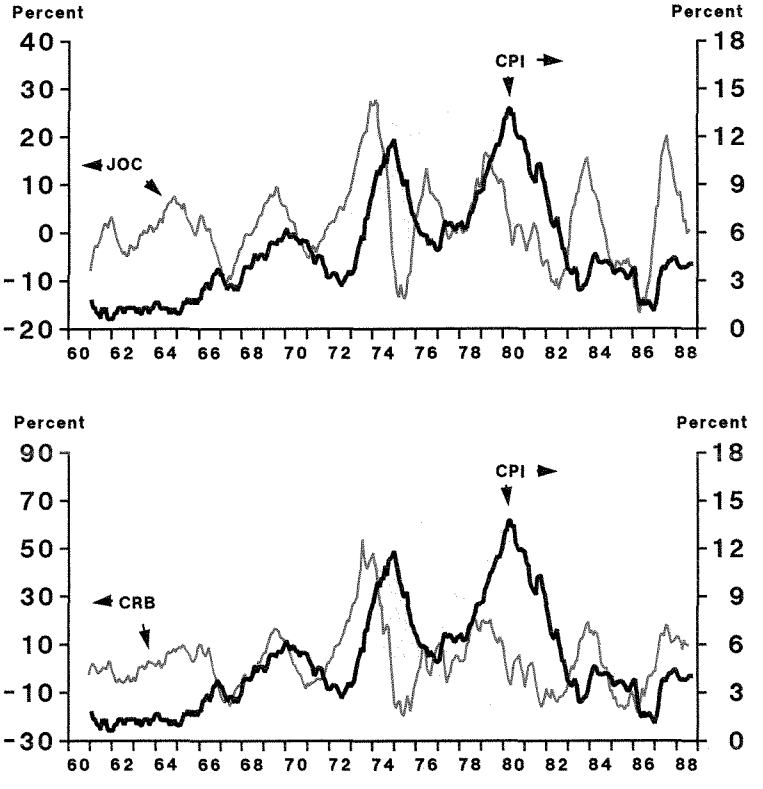
panels in Chart 2, which plot 12-month moving average growth rates, provide some perspective on this question. From the chart, a number of observations can be made. In support of the usefulness of commodity indexes, movements in the commodity indexes did tend to precede movements in overall inflation. Peaks and troughs in the moving average of CPI inflation were preceded by turning points in both of the commodity indexes.

However, the usefulness of the commodity indexes is limited for several reasons. To start with, the number of months by which changes in the commodity price indexes preceded turning points in CPI inflation varied unpredictably over the 28 years covered in the chart. Table 2 shows that the range for each of the two indexes is wide. The range for the JOC index, at three to 22 months, is only slightly wider than is the range for the CRB index.

Another weakness of the commodity price indexes, as Chart 2 shows, is that even when the series are smoothed, growth rates for the commodity price indexes still are more variable. Not only are the general swings in growth rates for commodity prices indexes more pronounced, they are more frequently interrupted by relatively sharp reversals. Had these indexes been used to guide policy at the time, such reversals would have given false signals regarding overall inflation. The signals are false in the sense that they would have been assumed to represent true turning points to contemporaneous observers.

The last observation is that the rise and fall in CPI inflation relative to the rise and fall in the growth rates for the composite commodity price indexes was much larger in the 1980s than in the 1970s. This by itself does not necessarily mean that the relationship between the CPI and the commodity price indexes is unstable; the difference in the magnitudes of the swings in CPI inflation may have been due to the influence of other variables. However, it does suggest that policymakers should not rely on a simple relationship between a commodity price index and inflation.[9]

Chart 2
CPI and Commodity Indexes
(Growth rates, 12 month moving averages)



III. Empirical Evidence on Commodity Prices

In this section, the potential contributions of the CRB and the JOC indexes as indicator variables for monetary policy are examined empirically. The analysis employs Vector Autoregressions (VARs). The basic model comprises four equations. The dependent variables are a monetary aggregate (either M1 or M2), a commodity price index, and two policy variables. One policy variable is represented by the CPI. The other policy variable, NUR, measures the strength of economic activity relative to potential. NUR is the difference between the actual civilian unemployment rate and the Congressional Budget Office's measure of full employment unemployment.

With the exception of NUR, the variables in the VARs are log-first differences. In the VARs, the explanatory variables in the equations are lagged values of all the dependent variables in the system and a constant. Separate lag lengths were selected for each variable in each of the equations to minimize the one-period-ahead prediction errors, allowing for a maximum lag of eight quarters for each variable.

The analysis is directed first at whether the CRB index or the JOC index might have been useful for monetary policy purposes had either index been used in conjunction with M1. This analysis uses quarterly data for the period cover-

Table 3
Results for CPI Equations using M1
(1965:1 to 1982:3)

Explanatory Variables	No CI	CI = JOC	CI = CRB
	F-ratio (M.L.S.)[1]	F-ratio (M.L.S.)[1]	F-ratio (M.L.S.)[1]
M1	F = 3.58 (.002)	F = 3.15 (.007)	F = 3.33 (.004)
Commodity Index (CI)		F = 2.39 (.038)	F = 0.99 (.377)
CPI	F = 20.19 (.000)	F = 15.46 (.000)	F = 18.62 (.000)
NUR	F = 3.31 (.011)	F = 4.83 (.001)	F = 2.42 (.049)
	R^2 = .87	R^2 = .89	R^2 = .87

Variance Decomposition

Quarters Ahead	% of variation in forecast errors for the level of CPI due to:			
	M1		CPI	NUR
1	8.5		91.5	0.0
4	29.7		56.0	14.3
8	41.7		35.8	22.6
12	56.0		25.3	18.7
	M1	JOC	CPI	NUR
1	4.9	3.6	91.5	0.0
4	27.3	26.7	36.6	9.4
8	35.3	33.9	19.5	11.3
12	48.3	28.9	14.3	8.5
	M1	CRB	CPI	NUR
1	12.7	0.7	86.6	0.0
4	37.0	13.4	43.0	6.6
8	46.1	17.5	26.2	10.2
12	58.3	14.5	19.4	7.8

[1]Marginal level of significance.

ing the early 1960s to the early 1980s. This is a period for which M1 was a reasonably good indicator of monetary policy. As Judd and Trehan (1987) show, the usefulness of M1 as a guide to policy deteriorated in the early 1980s as that aggregate became highly interest sensitive and subject to greater portfolio substitution.[10]

The discussion then turns to the performance of the CRB index and the JOC index when they are used with M2. For the most part, the sample period used for the systems that include M2 covers the early 1960s to the end of 1987.

In the VARs, dummy variables are included in the CPI (inflation) equations to control for the effects of the imposition and subsequent lifting of wage and price controls in the early 1970s. Dummy variables also are included in the monetary aggregate equations to control for the effects of Credit Controls in 1980.

M1 and Commodity Price Indexes

Tables 3–5 present evidence on the statistical and economic importance of the commodity price indexes in predicting inflation and NUR from the mid-1960s to the early 1980s. Table 3 reports the results from three different VAR models used to explain changes in the CPI: one without a commodity price index, one that includes JOC, and one that includes CRB. Table 3 shows that for the period considered, the JOC index did better than the CRB

Table 4

Results for NUR Equations using M1

(1965:1 to 1982:3)

Explanatory Variables	No CI	CI = JOC	CI = CRB
	F-/t-ratio (M.L.S.)[1]	F-/t-ratio (M.L.S.)[1]	F-/t-ratio (M.L.S.)[1]
M1	t = −1.44 (.150)	t = −0.99 (.363)	t = −1.02 (.312)
Commodity Index (CI)		F = 3.59 (.043)	F = 1.57 (.214)
CPI	F = 9.45 (.000)	F = 8.70 (.000)	F = 9.97 (.000)
NUR	F = 692.6 (.000)	F = 720.8 (.000)	F = 640.9 (.000)
	R^2 = .97	R^2 = .98	R^2 = .98

Variance Decomposition

Quarters Ahead	% of variation in forecast error due to:			
	M1		CPI	NUR
1	3.0		2.2	97.9
4	5.4		3.2	91.3
8	5.0		5.7	89.3
12	20.4		10.9	68.8
	M1	JOC	CPI	NUR
1	2.1	6.5	0.6	90.8
4	6.9	25.7	2.7	64.8
8	7.2	20.8	10.6	61.5
12	18.8	19.5	14.7	46.9
	M1	CRB	CPI	NUR
1	3.9	13.2	0.9	82.0
4	5.2	17.9	0.8	76.2
8	5.2	15.3	8.4	72.1
12	21.9	13.5	10.1	54.4

[1]Marginal level of significance.

index in predicting inflation. The F-statistics on the lagged values of the JOC index are statistically significant, but not on those of the CRB index.

The variance decompositions in the bottom portion of Table 3 also favor the JOC index. Variance decomposition is used to assess the relative importance of the variables in "explaining" movements in the dependent variable. This technique permits us to decompose the variation in the forecast errors of the equations into proportions associated with "shocks" to the various explanatory variables in the system. (Shocks are defined as movements in the explanatory variables that are not predicted by the system of equations.) The higher is the proportion of the error variance that is attributed to a particular variable, the greater is that variable's influence on inflation.[11] The variance decomposition in Table 3 shows that shocks to the JOC index account for about twice as much of the variance in the forecast error as does the CRB index. The variances are for the errors in forecasting the level of CPI.

The variance decompositions in Table 3 also indicate that the percent of the variance of the forecast error attributable to lagged values of the policy variables drops noticeably when the commodity price indexes are included in the model. This suggests that the commodity price indexes are affected by non-M1 shocks that also affect the policy variables. But it does not necessarily mean that the shocks affect the commodity price indexes sooner than the policy variables: when the commodity price indexes are ordered last, the percent of the variance of the policy variable forecast errors attributed to the commodity price indexes becomes quite small. However, since the information on the commodity prices becomes *available* before that on the policy variables, there may have been at least a small advantage to considering commodity prices along with M1 in the past. Such an advantage does not argue in favor of placing much weight on the commodity price indexes, though.

Perhaps more important than the variance decomposition for evaluating the role of the commodity price indexes as indicator variables is the extent to which they reduce the errors in predicting the CPI. The upper portion of Table 5 presents the standard errors of the forecasts for CPI. In contrast to the picture presented by the variance decompositions, the standard errors for the equation with the JOC index included are not appreciably lower than are those for the equation with the CRB index. In addition, neither commodity index appreciably reduces the standard errors compared with the system with only M1 and the policy variables.

The results relating to NUR are slightly more favorable to the inclusion of a commodity price index, if only because M1 itself performs rather poorly. In the top panel of Table 4, the lagged values of the JOC index are significant, but not those for M1 and the CRB index. From the variance decompositions, the JOC index is somewhat more important in predicting NUR than is M1 over the short to intermediate term. By far the most important variable is NUR itself. Taken together, the lagged values of the policy variables are much more important than those of either M1 or the commodity indexes in explaining NUR. Still, the inclusion of the JOC index does reduce somewhat the standard deviation of the forecast errors for NUR over the intermediate term, as shown in Table 5. Once again, these results point to a possible role for commodity prices, but not a particularly prominent one.

Table 5

Standard Errors of In-sample Forecasts

CPI forecast errors[1]

(1965:1 to 1982:3)

System	Quarters ahead 1	4	8	12
M1, CPI, NUR	.25	1.04	2.53	4.02
M1, JOC, CPI, NUR	.21	.98	2.49	4.03
M1, CRB, CPI, NUR	.25	1.04	2.52	3.98
M2, CPI, NUR	.29	1.17	3.04	4.94
1965:1 to 1987:4				
M1, CPI, NUR	.30	1.32	3.29	5.32
M2, CPI, NUR	.32	1.24	2.87	4.77

NUR forecast errors

1965:1 to 1982:3

	1	4	8	12
M1, CPI, NUR	.25	.70	.87	.99
M1, JOC, CPI, NUR	.21	.65	.79	.90
M1, CRB, CPI, NUR	.24	.69	.85	.98
M2, CPI, NUR	.24	.71	.89	1.00
1965:1 to 1987:4				
M1, CPI, NUR	.25	.72	.94	1.10
M2, CPI, NUR	.24	.71	.96	1.10

[1]The forecast errors are for the level of CPI and are expressed as a percent of the level of CPI at the end of the estimation period.

M2 and Commodity Price Indexes

Distortions to M1 in the 1980s induced the Federal Reserve to cease targeting that aggregate. As noted earlier, the Federal Reserve continues to set targets for M2. Thus, it would be helpful to know whether a commodity price index might augment the information contained in M2.

Indeed, when considered in conjunction with M2, a commodity price index may be more important on the margin since M2 is not as good an intermediate target variable as M1 once was. As shown in Table 5, for the sample period ending 1982:3, the standard errors of the forecasts from a VAR that includes M2 and the policy variables are larger than those from the model with M1. Over the longer period ending 1987:4, the model with M2 performs somewhat better relative to M1. However, that is mainly because of the deterioration in the relationship between M1 and the policy variables.

The results from the systems with M2 in Tables 6–8 are a bit more favorable to the CRB index than those from the systems with M1. From Table 6, the lagged values of the CRB index in the CPI equation are statistically significant. The F-statistic for the lagged values of the JOC index, on the other hand, is relatively low. Nevertheless, from the variance decompositions in Table 6, it is clear that the JOC

Table 6

Results for CPI Equation using M2

(1965:1 to 1987:4)

Explanatory Variables	No CI	CI = JOC	CI = CRB
	F-ratio (M.L.S.)[1]	F-ratio (M.L.S.)[1]	F-ratio (M.L.S.)[1]
M2	F = 2.00 (.059)	F = 1.90 (.075)	F = 2.44 (.020)
Commodity Index (CI)		F = 1.58 (.156)	F = 2.53 (.048)
CPI	F = 63.17 (.000)	F = 34.2 (.000)	F = 42.7 (.000)
NUR	F = 4.77 (.025)	F = 3.64 (.010)	F = 2.45 (.054)
	R^2 = .80	R^2 = .82	R^2 = .82

Variance Decomposition

Quarters Ahead	% of variation in forecast errors for the level of CPI due to:			
	M2		CPI	NUR
1	0.7		99.2	0.0
4	4.9		81.1	9.6
8	18.3		70.0	11.7
12	35.3		57.9	9.8
	M2	JOC	CPI	NUR
1	0.1	8.1	91.8	0.0
4	10.2	33.5	53.2	3.0
8	24.9	37.7	34.8	2.8
12	40.0	31.5	26.0	2.5
	M2	CRB	CPI	NUR
1	0.0	7.6	92.4	0.0
4	13.8	30.2	54.3	1.7
8	29.5	32.4	36.7	1.4
12	41.5	27.7	29.2	1.5

[1]Marginal level of significance.

and CRB indexes are about equally important in predicting the level of CPI. Both indexes are more important than M2 up to eight quarters ahead, but less important over a longer horizon.

The statistics on the CPI prediction errors in Table 8 for the systems that include the JOC and the CRB index are not much different, and do not provide a basis for choosing one index over the other. Moreover, a comparison of the prediction errors for the CPI from the system that *does not include* commodity prices with the errors from systems that *do include* the JOC or the CRB reveals that the inclusion of either commodity price index would mean only modest improvement in the near-term forecast. In the longer term, the standard errors are somewhat larger for the systems that include commodity prices. The forecast errors are uniformly larger for the systems that include a commodity price index but not M2.

On balance, the inclusion of the commodity price indexes does not improve inflation predictions very much. Once again, because the commodity price indexes apparently are affected by non-M2 (as well as non-M1) shocks that also affect policy variables, the principal advantage of incorporating a commodity price index appears to be that the data for commodity prices are available sooner than those for the policy variables.

The results from the NUR equations including M2 and

Table 7

Results for NUR Equation using M2

(1965:1 to 1987:4)

Explanatory Variables	No CI	CI = JOC	CI = CRB
	F-ratio (M.L.S.)[1]	F-ratio (M.L.S.)[1]	F-ratio (M.L.S.)[1]
M2	F = 4.66 (.012)	F = 2.87 (.062)	F = 4.38 (.002)
Commodity Index (CI)		F = 2.26 (.046)	F = 2.34 (.040)
CPI	F = 10.04 (.000)	F = 10.67 (.000)	F = 10.95 (.000)
NUR	F = 1430 (.000)	F = 1419 (.000)	F = 1341 (.000)
	R^2 = .98	R^2 = .98	R^2 = .98

Variance Decomposition

Quarters Ahead	% of variation in forecast error due to:			
	M2		CPI	NUR
1	1.1		4.7	94.1
4	9.2		1.7	90.6
8	18.3		8.5	73.2
12	16.8		21.0	62.2
	M2	JOC	CPI	NUR
1	3.6	7.5	0.4	88.5
4	11.2	17.5	3.3	67.9
8	19.0	12.0	11.3	57.7
12	17.5	12.3	20.9	48.3
	M2	CRB	CPI	NUR
1	2.2	20.9	0.3	76.5
4	13.7	15.9	0.4	70.0
8	22.5	10.3	2.5	64.5
12	19.8	12.0	8.1	60.1

[1]Marginal level of significance.

the commodity indexes parallel those derived earlier with M1. The one exception is that the lagged values of M2 are significant, as shown in Table 7. Otherwise, the commodity price indexes are significant but tend to account for only a small proportion of the variance in the forecast error for NUR. The policy variables are far more important than M2 or the commodity indexes. And, from Table 8, we see that standard errors tend to be slightly lower with the JOC index and slightly higher with the CRB index, compared with the model that has only M2 and the policy variables.[12]

Table 8

Standard Errors of In-sample Forecasts

1965:1 to 1987:4

	CPI[1]				NUR			
	Quarters ahead				Quarters ahead			
System	1	4	8	12	1	4	8	12
1. M2, CPI, NUR	.32	1.24	2.87	4.77	.24	.72	.98	1.07
2. M2, JOC, CPI, NUR	.30	1.16	2.98	5.08	.22	.70	.95	1.06
3. M2, CRB, CPI, NUR	.30	1.23	3.08	5.13	.25	.76	.99	1.09
4. JOC, CPI, NUR	.33	1.35	3.09	5.40	.23	.71	.93	1.07
5. CRB, CPI, NUR	.34	1.35	3.10	4.79	.25	.72	.96	1.10

[1]The forecast errors are for the level of CPI and are expressed as a percent of the level of CPI at the end of the estimation period.

Table 9

Errors for Out-of-Sample Forecasts

(1981:4 to 1988:2)

	CPI				NUR			
	Quarters ahead							
	4		8		4		8	
System	ME[1]	AME[1]	ME[1]	AME[1]	ME	AME	ME	AME
	Estimation starting 1965:1							
1. M2, CPI, NUR	.10	1.87	1.68	4.00	−.5	−1.0	.8	1.0
2. M2, JOC, CPI, NUR	−.25	.54	1.51	3.55	−.5	−1.1	.9	1.2
3. M2, CRB, CPI, NUR	−.06	1.56	1.25	3.38	−.5	−1.1	.8	1.1
4. JOC, CPI, NUR	.86	3.61	1.93	5.51	−.6	−1.1	1.0	1.3
5. CRB, CPI, NUR	.67	3.02	1.64	3.82	−.8	−1.2	.9	1.2

ME = Mean forecast error. AME = Absolute mean forecast error.

[1]The forecast errors are for the level of CPI and are expressed as a percent of the level of CPI at the end of the estimation period.

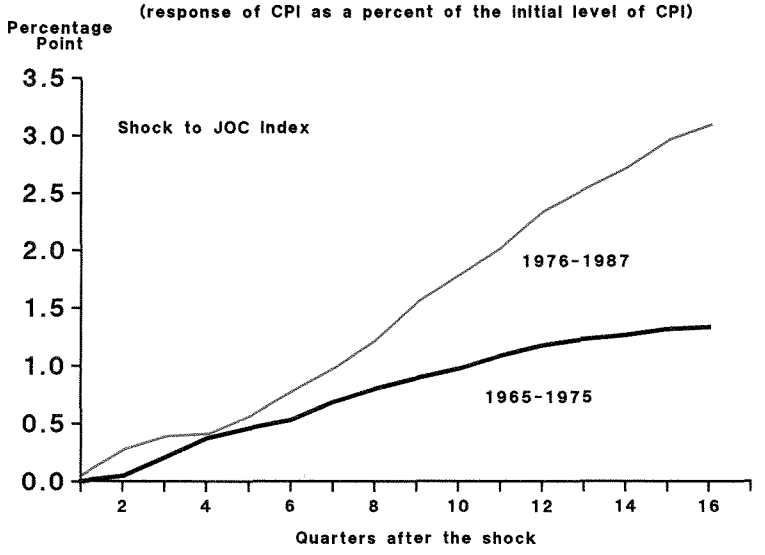
IV. Problems with Stability

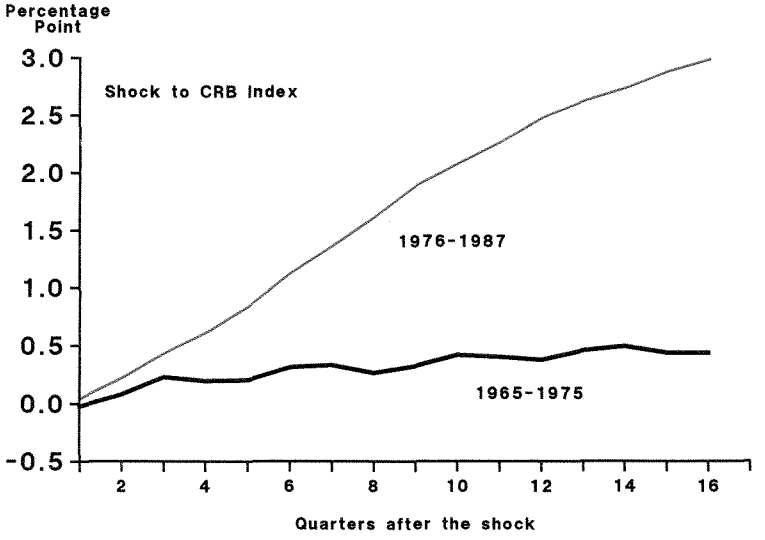
A question concerning the stability of the relationships between the commodity price indexes and the policy variables was raised in connection with the discussion of Chart 2. This issue can be examined using the VARs from the previous section. From the VARs, it is possible to derive the reactions of the policy variables to shocks to the commodity price indexes. The relationship between the policy variables and the indexes would be considered stable if the reactions, or impulse responses, of the policy variables are similar when the models are estimated over different time periods.

To test for stability, then, the VAR models with M2, a commodity index (JOC or CRB), and the two policy variables were estimated for the periods 1965:1 to 1975:4 and 1976:1 to 1987:4. Chart 3 plots the responses of the CPI, expressed as a percent of the initial level of CPI, to one standard deviation shocks to the growth rates of the JOC and the CRB indexes. Both panels point to instability. The response of the CPI is more pronounced when the model is estimated over the second period. The differences in the responses tend to widen as the number of quarters after the shock increases.

The responses of NUR to shocks to the commodity price indexes also show instability. In Chart 4, the response of NUR to a shock to JOC 16 quarters later is about the same in both time periods. However, for shocks to both the JOC

Chart 3
Impulse Response Functions for CPI
(response of CPI as a percent of the initial level of CPI)





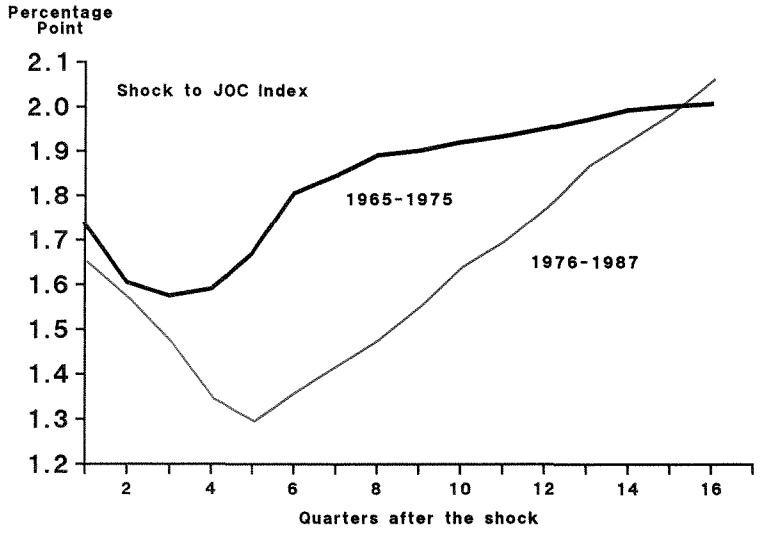
and CRB indexes, the paths of the interim responses differ for the two time periods.

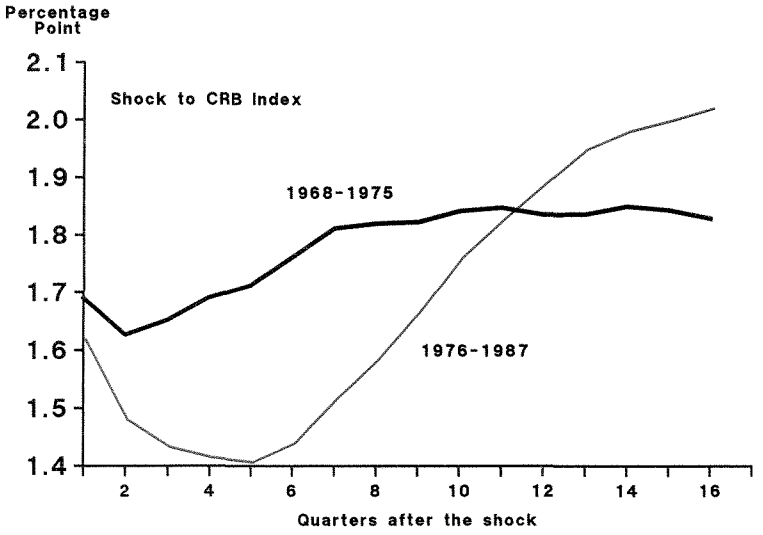
Given that the relationships between changes in the commodity price indexes and the policy variables are subject to structural shifts, the earlier VAR results could understate the statistical significance of commodity prices and misrepresent their economic importance. It is possible that estimating the models over separate time periods would control for structural shifts and would result in stronger relationships between the commodity price indexes and the policy variables in each period. However, better in-sample fits for the two subperiods would not necessarily tell us whether those relationships provide useful guidance for monetary policy in the future because they do not eliminate problems caused by subsequent structural shifts.

In an effort to gauge how instability might affect the usefulness of the commodity price indexes for policy purposes, I generated a series of out-of-sample forecasts using the VARs identified in Table 8. The forecasts were for four and eight quarters ahead. The sample period for the first set of forecasts ends on 1980:4. The first four-quarter ahead forecast, then, is for 1981:4 and the first eight-quarter ahead forecast is for 1982:4. The estimation

Chart 4

Impulse Response Functions for NUR





period is extended one quarter each time for successive forecasts. The last forecast is for 1988:2. The mean forecast errors and the absolute values of the mean forecast errors from this exercise are reported in Table 9.

The benchmark for gauging the contribution of the commodity price indexes is the three variable VAR with M2, CPI, and NUR. In setting this benchmark, it is recognized that the relationship between M2 and the policy variables likely also shifted to some extent in the 1980s.[13] Thus, the three variable VAR with M2 does not necessarily give the best (lowest prediction error) forecast of the policy variables—CPI inflation and NUR. Nonetheless, this VAR is the appropriate benchmark since the Federal Reserve still sets targets for M2 and the aggregate still affects policy considerations.

The first observation is that, among the three variable systems, the models with the commodity price indexes tend to perform the worst in predicting CPI. The out-of-sample forecasts support the earlier conclusion that the commodity price indexes should not be used to replace M2 as a target variable.

Second, despite the problems with structural shifts raised earlier, including the composite commodity price indexes along with M2 does tend to improve the prediction errors for CPI eight quarters ahead. However, judging from the mean absolute errors, sizable mistakes remain in predicting CPI.

Regarding NUR, it is evident in Table 9 that including the commodity price indexes does not improve the out-of-sample forecasts for NUR, and in most cases, the price indexes make the forecasts worse. The three variable model with M2 and the policy objective variables generally does the best.

V. Conclusion

The evidence on commodity price indexes suggests that these series would not fill the void left by M1 when it was dropped as an intermediate target. Nor is there a case for using these commodity price indexes in place of M2, even though the performance of M2 falls short of that observed for M1 when that aggregate was the primary intermediate target. And certainly, neither the in-sample nor the out-of-sample evidence supports according any special status to commodity prices.

The findings in this paper do provide some support for considering one of the two composite commodity indexes along with other information variables. One advantage is the more timely availability of commodity price data relative to those on overall prices. Moreover, despite some concerns about stability, the inclusion of the JOC or the CRB index tended to improve the near-to-intermediate-term out-of-sample forecasts of the CPI, though not for the forecasts of unemployment.

APPENDIX

Commodity Prices and Money

There is evidence that the prices of at least some commodities do respond to monetary developments. Frankel and Hardouvelis (1985) find a positive and statistically significant response of the prices of several commodities to surprises in weekly money supply announcements. (See also Kitchum and Denbaly [1982].) The adjustments occur within the trading day following the money supply announcement.

Frankel and Hardouvelis also find, however, that money supply developments account for only a small fraction of the variation in commodity prices. In the short run, movements in commodity prices appear to be dominated by developments affecting their relative prices rather than by more general macroeconomic developments, including monetary policy.

To measure the relative importance of monetary influences on commodity prices, I used a system of VARs that includes a commodity index, M1, the CPI, and a measure of slack in the labor market, NUR, which is defined in the text. The data are quarterly and cover the mid-1960s to the early 1980s. With the exception of NUR, all the variables are log-first differences.

As stated in the text, separate lag lengths were selected for each variable in each of the four equations of the models to minimize the one period ahead prediction error, allowing for a maximum lag of eight quarters for each variable. Under this procedure, M1 enters the commodity price equations with a one-quarter lag and an eight-quarter lag in the CPI equation. This finding is consistent with the argument that commodity prices adjust more quickly to monetary developments than do overall prices.

The results from estimating the two models, one with the CRB index and one with the JOC index, are presented in the Table. In the commodity price index equations for both models, the lagged values of the changes in the commodity indexes themselves are highly significant, while CPI inflation is marginally significant. In the model with the JOC index, M1 is statistically significant in explaining the commodity price index, but M1 is not significant in the equation for the CRB index. Experimenting with longer lags did not alter these results.

One possible explanation for the insignificant coefficient on M1 in the CRB equation is that the CRB index reacts so quickly to M1 that the lagged values of the aggregate in the VARs do not provide additional explanatory power. However, rapid adjustment to changes in M1 should imply that lagged values of CRB beyond one

Components of the Commodity Price Indexes

Journal of Commerce 18 Industrial Materials Price Index

Textiles	Other
Cotton	Rubber
Burlap	Hides
Polyester	Tallow
Print Cloth	Plywood
	Old Corrugated Boxes
Metals	Red Oak
Scrap steel	Benzine
Copper scrap	Crude oil
Zinc	
Tin	
Lead	
Aluminum	

Commodity Research Bureau Index, 23 Spot Prices

Textiles	Other
Cotton	Rubber
Burlap	Hides
Print cloth	Tallow
	Sugar
Metal	Steers
Scrap steel	Soybean oil
Copper scrap	Wool tops
Zinc	Butter
Tin	Corn
Lead	Hogs
	Lard
	Rosin
	Wheat (MPLS)
	Wheat (KC)

quarter do not contain much information either. Yet the coefficients on both the two- and three-quarter lags for the CRB index are statistically significant and of the same magnitude as the coefficient on CRB lagged one quarter.

The variance decompositions presented in the bottom panel of the Table indicate that shocks to M1 accounted for a relatively small portion of variance in the forecast errors for levels of the CRB and the JOC indexes. In contrast, the commodity indexes themselves account for an extremely high proportion of the variance in the forecast error. This suggests that they could be treated as more or less exogenous with respect to the other variables in the system. Thus, it appears that both indexes are subject to nonmonetary shocks primarily and it is not likely that either commodity price index can be used as a substitute for an aggregate like M1.

Table

Results for Commodity Price Index Equations

(1965:1 to 1982:3)

Explanatory Variables	JOC equation F-/t-ratio (M.L.S.)[1]	CRB equation F-/t-ratio (M.L.S.)[1]
M1	t = 2.14 (.032)	t = 0.77 (.441)
Commodity Index (CI)	t = 6.46 (.000)	F = 4.64 (.001)
CPI	F = 4.35 (.075)	F = 2.76 (.071)
NUR	t = 1.12 (.263)	t = 0.32 (.749)
	R^2 = .47	R^2 = .22

Variance Decomposition

Quarters Ahead	% of variation in forecast errors for the level of JOC due to:			
	M1	JOC	CPI	NUR
1	2.9	97.1	0.0	0.0
4	10.1	89.6	0.1	0.2
8	12.2	85.7	0.1	1.9
12	11.1	83.4	0.1	5.4

Quarters Ahead	% of variation in forecast errors for the level of CRB due to:			
	M1	CRB	CPI	NUR
1	6.0	94.0	0.0	0.0
4	8.7	90.6	0.6	0.1
8	8.6	90.3	0.9	0.2
12	7.2	91.4	1.1	0.3

[1] Marginal level of significance.

ENDNOTES

1. The Presidential Gold Commission, established in June 1981, was charged with researching the virtues of reinstating the gold standard. The Commission's report in March 1982 rejected the idea of adopting a formal monetary role for gold. (See Cooper [1982].)

2. Two recent proposals for incorporating a composite commodity index into the conduct of monetary policy were made by then Treasury Secretary James Baker III (*Wall Street Journal* [1987]) and Governor Wayne Angell of the Board of Governors of the Federal Reserve System (Angell [1987]).

3. Other empirical evidence on the relationships of commodity prices and possible policy variables is reported in Yeats (1973), Neftci (1979), and Melton and Smith (1987).

4. The extent to which a commodity price index is responsive to monetary policy is not irrelevant, however.

5. Frankel (1986) shows commodity prices can be expected to overshoot in response to monetary shocks. This result stems from the effects of monetary shocks to real interest rates, which in turn is related to the sluggish adjustment of the general level of prices.

Another complication is that real shocks to aggregate demand also should affect the real rate of interest, and real interest rates affect the price of durable commodities. A positive shock that raises the real rate of interest would tend to reduce the price of durable (storable) commodities, but not necessarily the prices of goods and services more generally.

6. Other studies have found that oil prices do help explain inflation. For example, Throop (1988) includes the change in the real price of oil in an augmented Phillips Curve equation in the structural forecasting model of the Federal Reserve Bank of San Francisco.

7. It is true that an expected change in the relative price of a commodity can affect current decisions to hold inventories and thereby affect current spot prices. It is also the case that prices of commodities can be expected to rise as part of an increase in overall prices. That is one reason many durable commodities such as gold have been used as inflation hedges (see Bird [1984]), particularly when tax rates on capital gains and ordinary income differ. Nevertheless, because nominal interest rates also tend to rise, expectations of a general rise in prices will not necessarily mean higher current commodity prices.

8. For an analysis of exchange rates and inflation, see Kahn (1987).

9. From a policy perspective, it is useful to know whether commodity prices respond more to monetary or nonmonetary shocks. If monetary influences are more important, then a commodity price index would be a useful guide to policy even though these indexes exhibit great volatility. On the other hand, if nonmonetary shocks dominate, it would be difficult to determine whether movements in a commodity price index were signalling that monetary policy was off course.

This distinction is important since the loss of M1 as an intermediate target makes the need for reliable indicator variables more pressing. In this regard, the contribution of a commodity price index would be stronger if it were able to capture information formerly captured by M1. As discussed in the Appendix, this does appear to be the case.

10. These changes in the behavior of M1 are attributed to deposit deregulation, particularly the introduction of money market deposit accounts and interest-bearing NOW accounts.

11. The variance decompositions were derived by ordering the variables as indicated in Table 3. The order in which the variables are placed can affect the results of the variance decomposition. The ordering chosen here permits us to develop an upper bound estimate of the impact of M1.

12. In addition to M2 and the commodity indexes, there are a number of other variables that policymakers might consider as guides to monetary policy. Two possibilities are interest rates and exchange rates. However, the inclusion of the one-year Treasury note rate and the trade weighted exchange value of the dollar does not weaken materially the case for limited reliance on the commodity price indexes.

13. Indeed, impulse responses for the policy variables to shocks to M2 show that these responses for both the measure for inflation and for unemployment were different for the VARs estimated over the two subperiods used for Charts 3 and 4.

REFERENCES

Angell, Wayne D. "A Commodity Price Guide to Monetary Targeting," Speech before the Lehram Institute, December 10, 1987.

Bird, P.J.W.N. "Commodities as a Hedge Against Inflation," *Applied Economics*, 1984, 16.

Cooper, Richard N. "The Gold Standard: Historical Facts and Prospects," *Brooking Papers on Economic Activity*, No. 1, 1982.

Defina, Robert H. "Commodity Prices: Useful Intermediate Targets for Monetary Policy?" *Business Review*, Federal Reserve Bank of Philadelphia, May/June 1988.

Frankel, Jeffrey A. "Expectations and Commodity Price Dynamics: The Overshooting Model," *American Journal of Agricultural Economics*, May 1986.

Frankel, Jeffrey A. and Gikas A. Hardouvelis. "Commodity Prices, Money Surprises and Fed Credibility," *Journal of Money Credit and Banking*, November 1985.

Garner, C. Alan. "Commodity Prices and Monetary Policy Reform," *Economic Review*, Federal Reserve Bank of Kansas City, February 1985.

Hafer, R.W. "Monetary Policy and the Price Rule: The Newest Odd Couple," *Review*, Federal Reserve Bank of St. Louis, February 1983.

Judd, John P. "Looking Forward," *Weekly Letter*, Federal Reserve Bank of San Francisco, July 8, 1988.

Judd, John P. and Bharat Trehan. "Portfolio Substitution and the Reliability of M1, M2, and M3 as Monetary Policy Indicators," *Economic Review*, Federal Reserve Bank of San Francisco, Summer 1987.

Kahn, George A. "Dollar Depreciation and Inflation," *Economic Review*, Federal Reserve Bank of Kansas City, November 1987.

Kitchen, John and Mark Denbaly. "Commodity Prices, Money Surprises, and Fed Credibility: A Comment," *Journal of Money Credit and Banking*, May 1987.

Melton, William C. and Bruce Smith. "Do Commodity Prices Presage Inflation?," *Economic Perspective*, IDS Financial Services Inc., December 1987.

Neftci, Salih N. "Leading-Lag Relations, Exogeneity and Prediction of Economic Time Series," *Econometrica*, January 1979.

Throop, Adrian. "A Macroeconomic Model of the U.S. Economy," *Working Paper, No. 88-06*, Federal Reserve Bank of San Francisco, September 1988.

Wall Street Journal. "Baker Suggests Role for Gold in Setting World Economic Policy," October 1, 1987.

Yeats, A.J. "An Evaluation of the Predictive Ability of the FRB Sensitive Price Index," *Journal of the American Statistical Association*, December 1973.