Commodity Prices and Inflation

Fred Furlong and
Robert Ingenito

The authors are, respectively, Vice President of the Banking, Finance, and Regional Studies Unit and Senior Research Associate in the Economic Research Department. An earlier version of this paper was presented at the 1995 Western Economics Association Meetings. The authors thank Mark Spiegel, Bharat Trehan, Simon Kwan, and James Wilcox for valuable comments.

This study examines the empirical relationship between changes in commodity prices and inflation by looking at the performance of non-oil commodity prices as stand-alone indicators of inflation and in conjunction with other leading indicators of inflation. The results indicate that the empirical link between commodity prices and inflation has changed dramatically over time. Commodity prices were relatively strong and statistically robust leading indicators of overall inflation during the 1970s and early 1980s, but they have been poor stand-alone indicators of inflation since the early 1980s. When considered in conjunction with other likely indicators of inflation, non-oil commodity prices have had a somewhat more statistically robust relationship with inflation in recent years,though the added information content in commodity prices regarding inflation is limited.

Commodity prices rose sharply from mid-1993 into 1995, more than 20 percent according to the Commodity Research Bureau index for all commodities. This burst in commodity prices raised concerns that overall inflation, which had been running at the lowest rate in years, would soon be on the rise. Despite the run-up in commodity prices, however, overall inflation remained relatively stable.

The role of commodity prices as precursors of inflation has been addressed extensively in the literature, with varying results. A long list of studies has shown that changes in the Commodity Research Bureau index and other commodity price indexes led aggregate inflation in the 1970s and the first part of the 1980s.[1] At the same time, studies by Garner (1995) and Bloomberg and Harris (1995) find that some commodity prices have not been reliable leading indicators of inflation since about the mid-1980s.[2]

This study examines the empirical relationship between changes in commodity prices and inflation by looking at the performance of non-oil commodity prices as stand-alone indicators of inflation and in conjunction with other leading indicators of inflation. The results indicate that the empirical link between commodity prices and inflation has changed dramatically over time, largely because of the changes in the extent to which movements in commodity prices reflect idiosyncratic shocks. Commodity prices were relatively strong and statistically robust leading indicators of overall inflation during the 1970s and early 1980s, a period dominated by relatively high inflation in commodity prices and in overall prices. However, commodity prices have been poor stand-alone indicators of inflation since the early 1980s, a period during which overall inflation has been relatively low and stable while commodity

1. For evidence on the short-run relationships see, for example, Cody and Mills (1991), Hafer (1983), Garner (1985), Defina (1988), Webb (1989), Furlong (1989), Kugler (1991), and Trivedi and Hall (1995).

2. Garner (1995) finds evidence of a decline in the statistical significance of several leading indicator variables in explaining inflation. For commodity prices, the study finds that lagged changes in commodity prices Granger cause inflation for the entire period 1973 to 1994, but were not significant for the period 1983 to 1994. Bloomberg and Harris (1995) look at samples split at 1987 and find similar results.

prices have been more volatile and generally declining relative to the overall price level.

When considered in conjunction with other likely indicators of inflation, non-oil commodity prices have had a somewhat more statistically robust relationship with inflation in recent years, though the added information content in commodity prices regarding inflation still is limited; for example, from 1993 through 1995 inflation may have been low relative to expectations, but shocks to commodity prices contribute little to explaining the puzzle.

The next section provides background for the statistical analysis by discussing the possible links between commodity prices and inflation and by illustrating the general patterns in the behavior of commodity prices and overall prices. Section II presents the empirical analysis relating to the bivariate relationship between commodity prices and overall prices. Section III presents the multivariate analysis results. Conclusions are presented in Section IV.

I. LINKS BETWEEN COMMODITY PRICES AND INFLATION

Commodity prices are argued to be leading indicators of inflation through two basic channels. One is that they respond more quickly to general economic shocks, such as an increase in demand. The second is that some changes in commodity prices reflect idiosyncratic shocks, such as a flood that decimates the supply of certain agricultural products, which are subsequently passed through to overall prices. Depending on the type of the shock, the observed link between commodity prices and inflation would be expected to be different. Moreover, changes over time in the mix of shocks in the economy could affect the stability of a bivariate link between commodity prices and inflation.

The strongest case for commodity prices as indicators of future inflation is that they are quick to respond to economy-wide shocks to demand. Commodity prices generally are set in highly competitive auction markets and consequently tend to be more flexible than prices overall. As a result, movements in commodity prices would be expected to lead and be positively related to changes in aggregate price inflation in response to aggregate demand shocks.[3] In addition, to the extent that demand shocks are not sector-specific, the levels of commodity prices and overall prices also would be linked.

Any commodity, however, also is subject to idiosyncratic shocks. This complicates the empirical relation between commodity prices and inflation. In the case of a direct shock to the supply of a commodity, movements in the price of the commodity could be positively related to overall prices. The observed effect would depend on the relative importance of the commodity being shocked and the flexibility of other prices. Poor weather conditions, for example, could reduce the supply of agricultural commodities and push up their prices. The higher prices would eventually be reflected in the price of the related final food products bought by consumers. To the extent that the shock affects aggregate supply and that the stickiness in the prices of other consumer goods limits their adjustment, the net effect would be higher overall prices. The rise in the prices of the affected agricultural commodities would be larger than the effect on overall prices, which means the relationship of the level of prices of the affected commodities to overall prices would be affected.

One complication, however, is that a shift in relative demand for a commodity might dampen an otherwise positive correlation between the change in the price of a commodity and overall inflation. Take, for example, the case in which an increase in aggregate demand coincides with an increase in demand for manufactured goods or services relative to agricultural products. While this could lead to a rise in overall prices, prices of agricultural commodities might fall. In the short run, changes in commodity prices would not be positively related to inflation, and the levels of prices of the affected commodities and overall prices would drift apart.

These examples do not exhaust the possible permutations of shocks affecting commodity price and inflation; however, they do indicate that the relationship between the movements in commodity prices and inflation depends on what is driving commodity price changes. Given the alternative links between commodity prices and overall prices, two characteristics of empirical patterns are of interest. The first is whether commodity prices and overall prices are tied together in the long run. The second is the nature of the short-run relationship between changes in commodity prices and inflation.

Empirical Patterns

As background for the more formal statistical analysis, this section gives a graphical overview of how commodity prices and overall prices have been related. The series used are the Commodity Research Bureau index for all commodities (CRB), its index for raw materials (CRBRAW), and the Consumer Price Index (CPI) as a measure of aggregate

3. In fact, in theoretical models, such as in Boughton and Branson (1988), the relative flexibility of commodity prices results in their overshooting in order to bring markets into equilibrium in response to monetary shocks. Frankel (1986) also shows commodity prices can be expected to overshoot in response to monetary shocks.

prices.[4] These two commodity price indexes are examples of indexes that previous studies have found to be statistically significant leading indicators of aggregate inflation.

Figure 1 suggests a lack of a long-run relationship between the two commodity price indexes and the CPI. The figure plots the CRB and CRBRAW along with the CPI, each indexed to 100 in 1947. Over the period shown, the commodity series and the CPI drift apart. The drift is particularly pronounced starting in the 1980s. During the 1980s and 1990s, the CRB and CRBRAW indexes exhibit little if any trend, while the CPI continues to rise. The figure indicates, then, that over the past several years commodity price indexes have been influenced substantially by relative price movements.

To illustrate the short-run relationship between commodity prices and inflation, Figure 2 plots the 12-month percent changes in the CPI against the CRB and CRBRAW indexes. Peaks and troughs in commodity price inflation tend to precede turning points in CPI inflation. The pattern is the most regular in the 1970s and early 1980s. It appears that since the mid-1980s or so, the relation of CPI inflation to commodity price inflation has been looser. In the case of the CRB index, the 1987 peak in commodity price inflation preceded the next peak in CPI inflation by four years; this compares with an average lead of about nine months in the period prior to the mid-1980s. Moreover, commodity price inflation generally was rising from late 1991 on, but CPI inflation still had not picked up noticeably by late 1995.

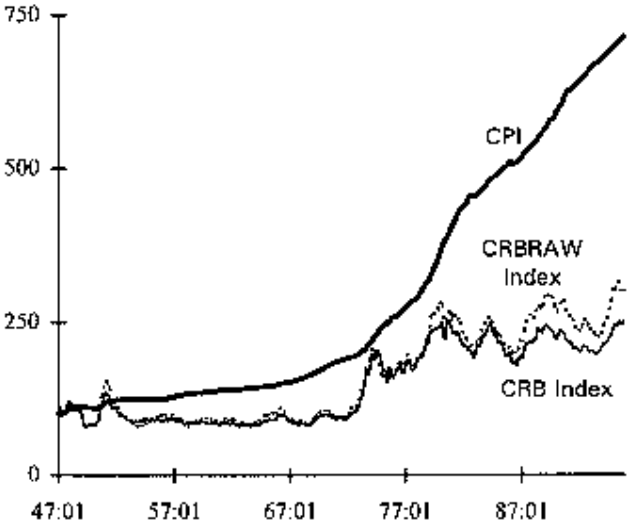
II. BIVARIATE VARS

To investigate the nature and consistency of the bivariate relationship between commodity prices and overall prices more formally, we use vector autoregression (VAR) models. The VARs include one of the Commodity Research Bureau commodity price indexes along with the CPI.

Integration tests on the log of the commodity price indexes indicate that these series have unit roots.[5] The integration tests involving the CPI are more problematic. Using the Augmented Dickey-Fuller (ADF) test for the change in the log CPI, we would reject the null hypothesis that the

FIGURE 1

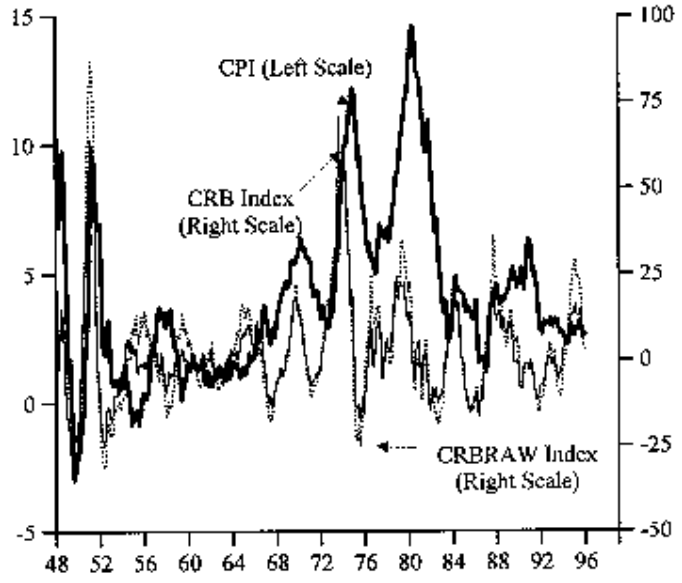
LONG-RUN LINK BETWEEN COMMODITY PRICES AND THE CPI



Note: Index, 1947:01=100

FIGURE 2

SHORT-RUN LINK BETWEEN COMMODITY PRICES AND THE CPI



Note: 12-month percent change

4. The CRB index includes: cereals, meat, sugar, oils and seed oils, coca, cotton, rubber, hides, jutes, pint cloth, burlap, tallow, rosin, copper, iron ore, tin, zinc, lead. The CRBRAW index excluded the food and metals included in the CRB index. Neither index included energy or petroleum products.

5. Based on data for the period 1947:01 to 1995:12 and using an Augmented Dickey-Fuller test, we find that both CRB and CRBRAW are stationary in log-first differences.

series is first-difference stationary. However, additional analysis suggests that first-differencing probably induces stationarity. For example, tests on the second difference indicate overdifferencing.[6] Therefore, we proceed assuming that the log-first difference of the CPI is a stationary series.

The lack of a long-term link between the two commodity price indexes and the CPI suggested by Figure 1 is confirmed by the results from ADF and Johansen tests for cointegration using monthly data for the logs of the three indexes for the period 1955:01 to 1995:12. The ADF tests indicate no bivariate cointegration. The results for the Johansen test vary depending on lag length used; cointegration is rejected at the 1 percent level for more than seven lags and at the 5 percent level for nine or more lags. Given these results, the analysis in this section assumes that the commodity price indexes and the CPI are not cointegrated.

To examine the short-run relationship between commodity prices and the CPI, then, we estimate bivariate VAR models with variables measured in log-first differences. The equations include 12 lags each for a commodity price index and the CPI. The commodity price indexes are ordered first, though the ordering has no effect on the conclusions regarding the relationship of commodity prices to overall inflation.[7]

Rolling Regressions

We first look at the stability of the relationship between CPI inflation and changes in the commodity price indexes using a rolling regression approach. This involves identifying how the sum of the coefficients on the lagged commodity price index terms in the CPI equation vary as the sample length changes. Figure 3A shows the results for the lagged CRB terms when starting with the sample from 1960:01 to 1995:12 and dropping successive observations from the beginning of the sample. After dropping an observation, the equation is reestimated to get another value for the sum of the commodity coefficients and an *F*-statistic for the joint significance of the commodity index terms. The values plotted for a given date are the statistics estimated when the sample begins at that date.[8]

The results in the top left panel show that the sum of the coefficients on the lagged CRB terms begins to decline as the observations in the early 1970s are dropped from the sample. The decline continues through the early part of the 1980s. The results in the bottom left panel show relatively high marginal significance levels through the late 1970s. With the exception of a small spike, the marginal level of significance of the commodity terms is consistently under 5 percent (the dashed line) until the middle of 1979. After that, the marginal level of significance based on the *F*-test deteriorates: Though it goes below 5 percent for a brief period in the late 1980s, its value is generally in the 10 to 60 percent range. Hence, when the observations from the 1970s are removed from the sample, the commodity terms are no longer jointly statistically significant at conventional levels in the CPI equation.

The two right-hand panels present results from the reverse experiment. We begin with a relatively small number of observations from the beginning of the sample and show how the sum of the commodity coefficients and their level of significance change when the sample is extended. The figures plotted for a given date are the statistics estimated when the sample ends at that date. The top right panel shows that the sum of the coefficients for the lagged CRB terms increases and then drops sharply as observations for the 1960s are added. The sum of the coefficients rises through the first half of the 1970s, then dips, rebounds, and dips again in the early 1980s. The bottom right panel shows that the marginal level of significance based on the *F*-test improves when data for the early 1970s are included in the sample, but it falls below 5 percent only after observations for 1973 are included in the sample.

As Figure 3B shows, the results for the rolling regressions for the CPI equation when CRBRAW is included in the bivariate system are very similar to those for CRB. For the non-oil commodity indexes then, the empirical relationship with inflation is stronger and more robust for samples that include the 1970s. Moreover, a shift in the bivariate relationship appears to have occurred in the early to mid-1980s. Therefore, we consider below two subperiods, one from 1973 to 1983 and the second from 1984 to 1995.[9]

Subperiods

Table 1 and the related Figures 4A and 4B show results from the bivariate VARs for the subperiods and serve as the basis for comparison with the results from the multivariate models presented in the next section. Table 1A reports the results for Granger causality tests for the CPI equations. As

6.Miller (1991) finds a similar result for the implicit price deflator.

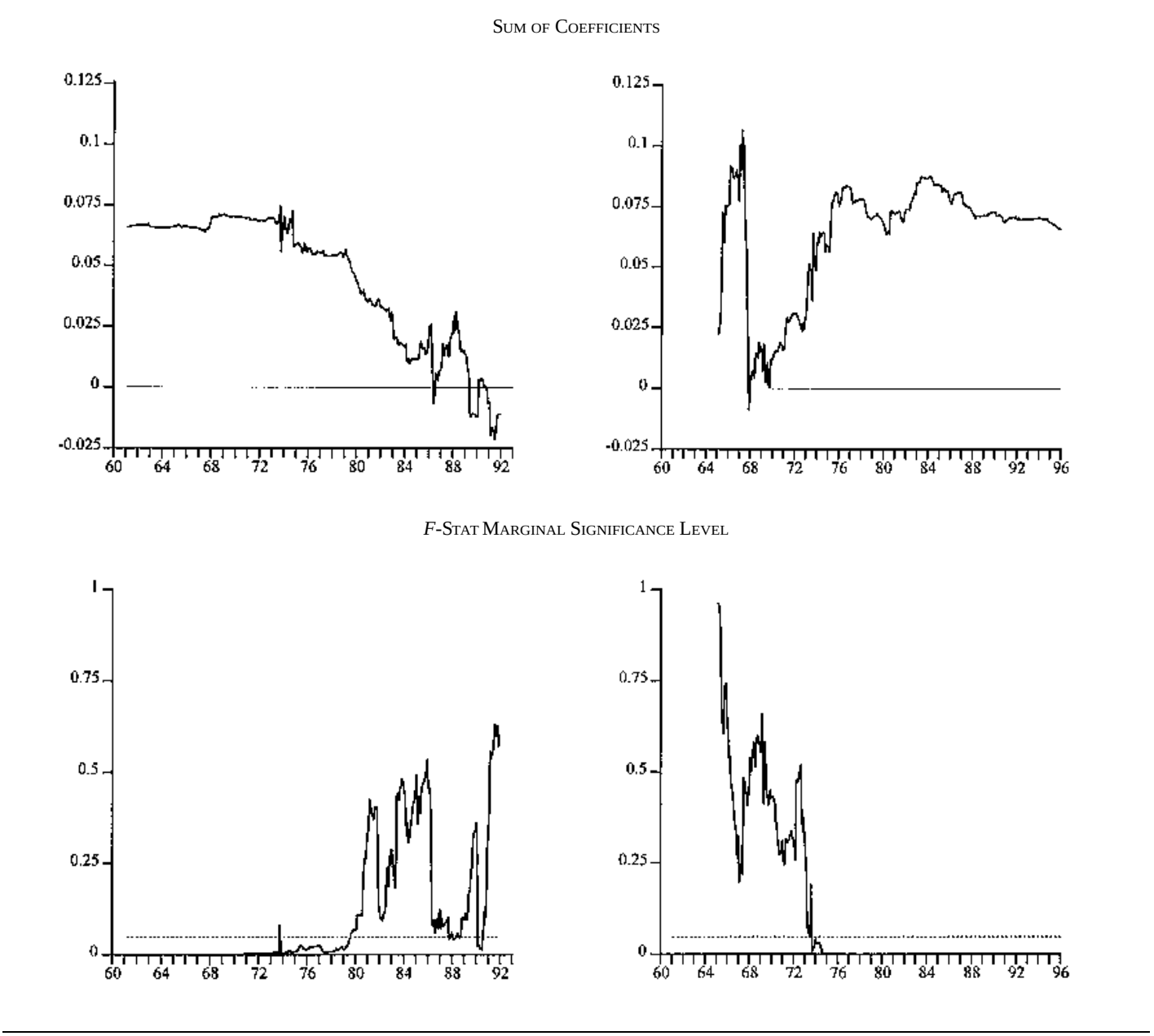
7. All of the variance decompositions and impulse responses reported below are derived using a Choleski Factorization.

8. Note that because we are dropping observations as we move from left to right in the graph, there are fewer degrees of freedom in the denominator as we move to the right; the last significance level plotted in the graph is from an *F*- (12,24) test.

9.The first sample was started in 1973 to facilitate the inclusion of the foreign exchange value of dollar in the multivariate analysis presented in the next section. Also see Bryden and Carlson (1994).

FIGURE 3A

CRB IN CPI EQUATION: ROLLING REGRESSION RESULTS

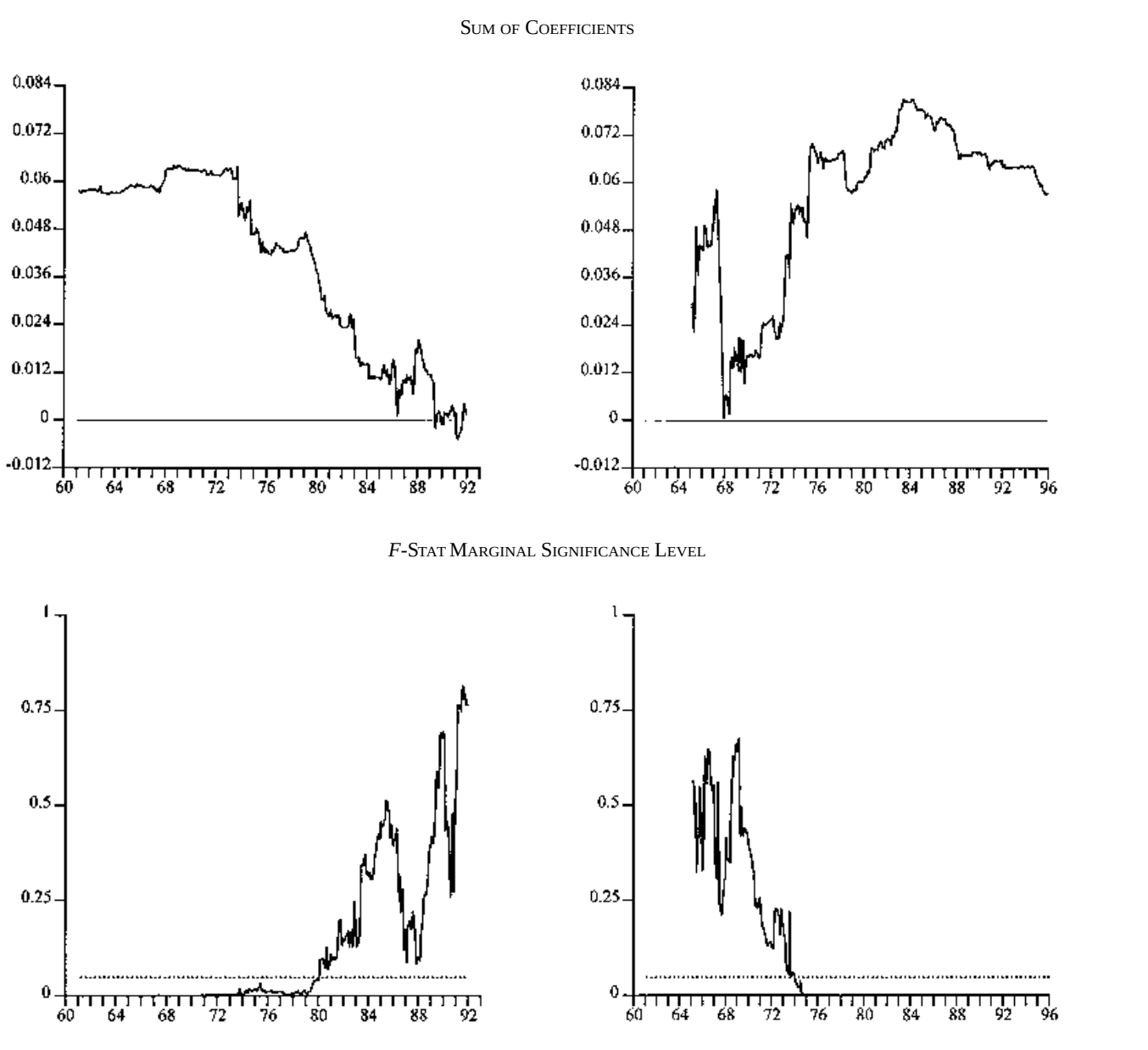


would be anticipated from Figure 3, the *F*-statistics indicate that the lagged coefficients for the commodity price terms are jointly significant only for the first period. Moreover, the overall explanatory power of the equation is almost three times larger for the first period than for the second. These results point to a change in the usefulness of commodity price indexes as stand-alone leading indicators of inflation.

Evidence on the variance decompositions also confirms a large difference in the relative importance of movements in commodity prices in explaining overall inflation in the two subperiods. Table 1B reports the forecast errors for CPI inflation over three horizons along with the share of that error accounted for by shocks to the commodity indexes and to the CPI. For the 24- and 36-month horizon, the share of the forecast error in CPI inflation attributed to the

FIGURE 3B

CRBRAW IN CPI EQUATION: ROLLING REGRESSION RESULTS



commodity price indexes is more than three times larger in the first period than in the second period.

The differences in the variance decomposition results for the time periods reflect the combined effects of differences in the size and frequency of shocks as well as the magnitude of the response of the CPI to a given shock to the commodity price indexes. To some extent, the greater variance decomposition shares for the commodity price indexes for 1973–1983 may reflect the relatively greater volatility of commodity prices. Shocks to the commodity price indexes were 1.7 times greater in the first period than in the second, while the comparable figure for the CPI is 1.5 times. However, the results in Figure 3 suggest that the average response of the CPI to a given size shock to commodity prices also differs between the two periods.

The impulse responses for the CPI to shocks to the commodity price indexes for the bivariate VARs illustrate that this is the case. In Figures 4A and 4B, the responses are

TABLE 1A

CPI EQUATION RESULTS

SPECIFICATION	CRB, CPI		CRBRAW, CPI	
PERIOD	1973–1983	1984–1995	1973–1983	1984–1995
F-STAT. CRB (MSL)	1.99 (.032)	1.01 (.448)	2.74 (.003)	1.15 (.326)
F-STAT. CPI (MSL)	6.08 (.000)	3.41 (.000)	6.66 (.000)	3.29 (.000)
R^2	.44	.16	.47	.17

TABLE 1B

VARIANCE DECOMPOSITIONS: TWO-VARIABLE VAR

	1973–1983			1984–1995		
FORECAST HORIZON	STANDARD ERROR	SHARE OF ERROR DUE TO:		STANDARD ERROR	SHARE OF ERROR DUE TO:	
		CRB	CPI		CRB	CPI
12 Months	.00296	26.4	73.6	.00183	11.8	88.2
24 Months	.00325	37.1	62.9	.00184	11.7	88.3
36 Months	.00332	36.5	63.5	.00184	11.7	88.3
		CRBRAW	CPI		CRBRAW	CPI
12 Months	.00305	32.0	68.0	.00184	14.1	85.9
24 Months	.00335	42.1	57.9	.00185	14.3	85.7
36 Months	.00339	41.9	58.1	.00185	14.3	85.7

derived using the same size shock for each of the time periods. The shocks are the average shocks to the log changes in the CRB or the CRBRAW indexes over the entire sample period, which equal about .018. The figures show the average responses and the upper and lower two standard deviation bands (the bands are four standard deviations wide).[10] The upper panels of Figures 4A and 4B show the response of CPI inflation. The bottom panels show the implied response (and error bands) for the log level of CPI. Multiplying the response in the lower panels by 100 gives the compounded percent change in prices for each forecast horizon.

The figures indicate that the responses of overall prices to the shocks to commodity prices changed significantly between the two periods. For shocks to CRB and CRBRAW, the response of CPI inflation in the first period is two standard errors above the zero axis out to about the two-year horizon. With a few exceptions, the response of inflation in the post-1983 period is not significantly above zero.

The bottom panels of Figures 4A and 4B provide a perspective on the relative size of the cumulative response, with the increase in CPI being eight times greater in the first period than in the second. The results in the bottom panels also indicate that the more pronounced responses

10. Bands for the impulse responses were calculated from the results of 1,000 impulse responses, with each response generated using a covariance matrix of residuals altered by a random draw from a standard normal distribution. We then computed the variance from the first and second moments and set the band width equal to two standard errors above and below the average response.

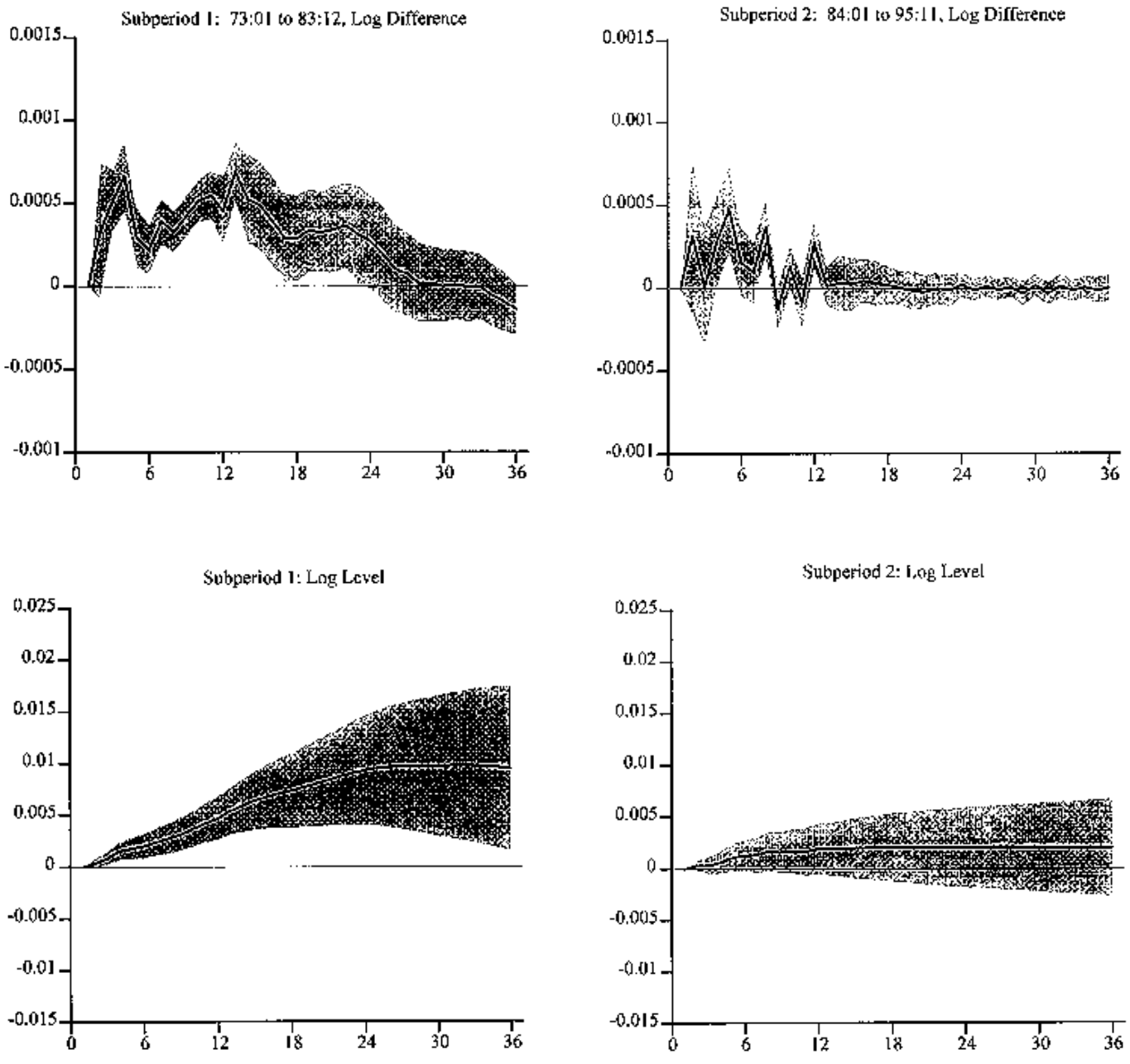
in the first subperiod are significantly greater than those estimated for the more recent years. The average responses of CPI for the 1973–1983 period are above the upper two-standard deviation bands for the 1984–1995 period. The average responses for the second period, in turn, are below the lower bands for the 1973–1983 period.

Out-of-Sample Forecasts

The implications of the change in the relationship between the commodity price indexes and inflation in the bivariate models can be illustrated more concretely by relating it to the recent behavior of prices. Out-of-sample forecasts

FIGURE 4A

IMPULSE RESPONSE OF CPI TO A SHOCK TO CRB: TWO-VARIABLE VAR



were derived using the CPI equation from the bivariate VAR that included CRB and a univariate equation for CPI inflation with 12 lagged terms. The equations were estimated for the period 1973:01 to 1993:12. Dynamic simulations were used to derive the forecast for CPI inflation for 1994 and 1995, with the changes in commodity prices equal to the actual values. The forecasts for CPI inflation are translated into log levels of the CPI.

Figure 5 shows the forecasted series for the log CPI along with the corresponding actual series. The baseline is the forecasted series obtained from the univariate CPI equation. In the figure, the baseline overestimates the CPI by

FIGURE 4B

IMPULSE RESPONSE OF CPI TO A SHOCK TO CRBRAW: TWO-VARIABLE VAR

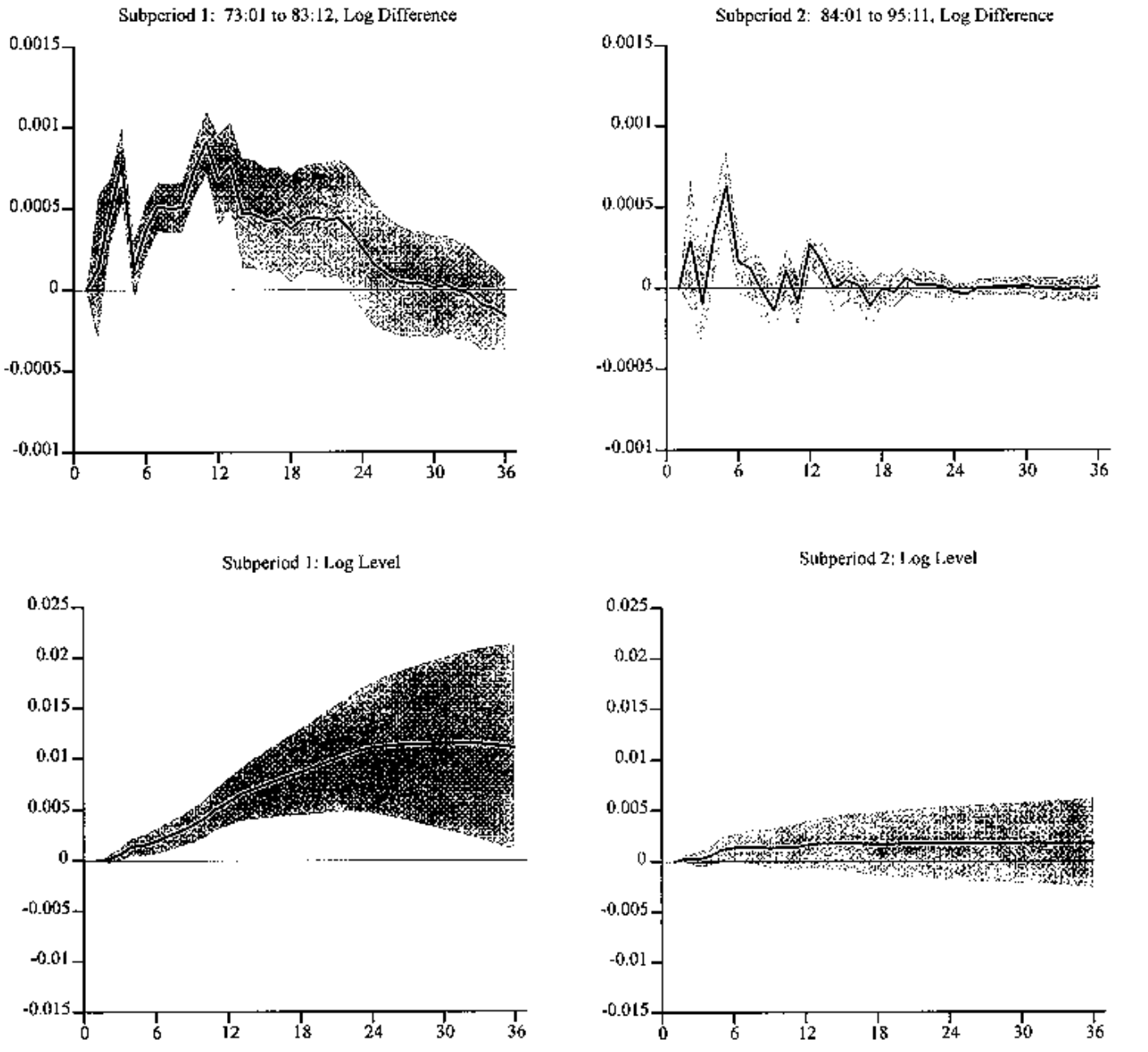
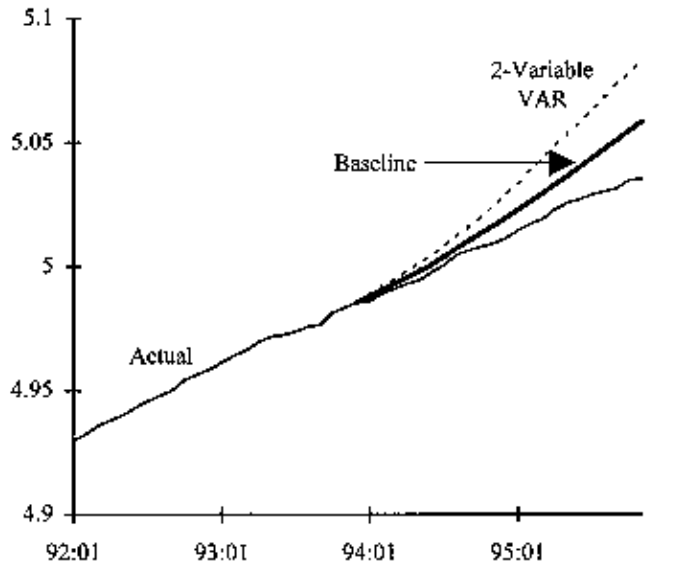


FIGURE 5

FORECASTS OF THE LOG CPI



about $2^1/_2$ percent over the two years. Using that as the benchmark, the forecasted series from the equation that includes the commodity price index adds another $3^1/_2$ percent to the estimate for the CPI.[11] This says that based on the historical relationship between commodity prices and inflation, inflation should have picked up noticeably in 1994 and 1995. However, as indicated earlier, CPI inflation did not.

III. MULTIVARIATE VARS

The results in the previous section indicate that the commodity price indexes have not been reliable stand-alone indicators of inflation. It still is possible that commodity price indexes can provide some unique and reliable information about overall price movements if considered in conjunction with other leading indicators of inflation. The inclusion of additional variables also can help to sort out whether the shift in the bivariate relationship between changes in commodity prices and inflation was due to differences in the extent to which commodity prices conveyed more general economic shocks versus idiosyncratic ones. To investigate these issues, we consider other possible leading indicators of inflation, along with the commodity price indexes.

One of the additional variables is a measure of the tightness in labor markets, namely, the difference between the actual unemployment rate and the Congressional Budget Office estimate of full employment unemployment (NUR). This is meant to capture the notion that a tight labor market tends to be associated with shocks that lead to upward pressure on inflation and a slack labor market with ones that lead to disinflation.

Two other variables are the spot price of oil (OIL) and a multilateral trade-weighted exchange value of the U.S. dollar (FX). The price of oil is considered because oil shocks are widely viewed as having temporary effects on the rate of inflation in the U.S. Also, since CRB and CRBRAW do not include petroleum, the oil price augments them with a potentially important commodity. The foreign exchange rate is included since currency markets are highly liquid and prices can adjust quickly in response to changes in information that has a bearing on future inflation.

Finally, the analysis includes the federal funds (FF) interest rate as one indicator of monetary policy. This allows for the possibility that a shift in the response of monetary policy to movements in commodity prices has affected the simple bivariate relationship between changes in commodity prices and inflation.

Integration tests for the additional variables indicate that they are stationary in log-first differences, with the exception of NUR, which is stationary in levels.[12] For comparison with the bivariate benchmarks in the previous section, the multivariate VARs are estimated in levels for NUR, and log first-differences for the other variables.[13] The ordering

11. The forecasts from the two-variable VAR are more than two standard deviations above the actual CPI from mid-1994 to the end of 1995. We estimated a two-variable system (in difference of logarithms) containing 12 lags each of a commodity term (CRB and CRBRAW, respectively) and inflation. The estimation range was 1973:01 to 1993:12. We then did a dynamic forecast of inflation from 1994:01 to 1995:12 assuming we knew the value of the commodity with certainty. We calculated the standard error bands around the forecast by bootstrapping the residuals from the estimated inflation equation and feeding them back into the forecasting exercise as shocks. We bootstrapped the residuals 1,000 times, generating 1,000 fore-

12. In the VAR models used in the analysis, own shocks to NUR dissipate to zero over time.

13. Some studies have found evidence of cointegration for commodity prices, inflation, and other variables. Marquis and Cunningham (1990) find evidence that industrial production, commodity prices, and aggregate prices are cointegrated using data from 1968 to 1986. The results in Kugler (1991) suggest that commodity prices, CPI, and the dollar exchange rate might be cointegrated.

In this study, we also tested for cointegration using the levels of the commodity indexes, CPI, OIL, FX , and FF. The test results suggest cointegration over the period 1973 to 1995 using 12 lags. However, the results from our analysis indicate that, when a common cointegrating vector is used for the subperiods, the results are very similar with and without the cointegrating vector.

19. Central Valley banks tended to report relatively high problem loan ratios for most of the period from 1985 until 1989, a period when this

of the variables is NUR, FX, OIL, CRB or CRBRAW, CPI, and FF.

Effects of Changes in Commodity Prices

Table 2 and Figure 6 present the results from the estimations of the multivariate VARs. A comparison of the results with those from the bivariate VARs points to two characteristics of the additional variables. One is that the variables contain added information about inflation that is not contained in either the commodity price indexes or lagged inflation. This is indicated by the higher overall explanatory power of the estimated CPI equations and the smaller forecast errors in Table 2 compared to the results in Table 1. The variables contributing the added information, however, differ between the two periods. Separate estimates of CPI equations with lagged values of CPI, a commodity price index, and one of the other variables indicate that NUR, FX, OIL, and FF each add something to the higher overall explanatory power and smaller forecast errors in the multivariate VARs in the first period. In the second period, however, the oil price is the main source of added explanatory power.

The second characteristic is that the added variables contain information about inflation that was attributed to the commodity price indexes in the bivariate VARs. That is, their inclusion reduces the amount of independent information associated with the commodity prices. This is primarily true for the 1973–1983 period. For that subperiod, the marginal levels of significance of the coefficients on the commodity terms are raised appreciably compared to the bivariate cases.

The variance decomposition shares for the commodity indexes in the CPI equation in Tables 2B and 2C also show less of a relative role for commodity price indexes, with the bigger change evident for the first subperiod. The other major differences in the variance decomposition shares are in the roles of the oil price and the CPI. Consistent with the above mentioned differences in the added information content of the variables in the two periods, the table shows that changes in the price of oil account for a small share of the forecast error in CPI inflation in the first period and a larger share in the second period. The variance decompositions also show that a higher share of the forecast error for CPI is attributed to itself in the second period. These results suggest that sources of short-run variation in inflation were different for the two periods.

The effect of including the additional macroeconomic variables is most striking in the responses of CPI inflation to shocks to the commodity price indexes. A comparison of the lower-left panels in Figures 6A and 6B with those in Figures 3A and 3B indicates that the average responses of inflation to the same size shock to the commodity price indexes are much less in the multivariate cases than in the

TABLE 2A

CPI EQUATION RESULTS
SIX-VARIABLE VAR: NUR, FX, OIL, CRB/CRBRAW, CPI, AND FF

SPECIFICATION	CRB		CRBRAW	
PERIOD	1973–1983	1984–1995	1973–1983	1984–1995
F-STAT: NUR (MSL)	1.68 (.096)	1.11 (.367)	1.80 (.068)	1.30 (.237)
F-STAT: FX (MSL)	1.96 (.045)	1.36 (.206)	2.05 (.035)	1.82 (.062)
F-STAT: OIL(MSL)	1.16 (.333)	4.08 (.000)	0.80 (.652)	4.04 (.000)
F-STAT: CRB/CRBRAW (MSL)	0.38 (.967)	0.79 (.656)	0.75 (.698)	1.09 (.384)
F-STAT: CPI (MSL)	1.70 (0.89)	3.46 (.000)	2.12 (0.28)	3.48 (.000)
F-STAT: FF (MSL)	1.92 (.051)	1.13 (.350)	1.76 (.076)	1.29 (.246)
R^2	.61	.42	.63	.44

TABLE 2B

VARIANCE DECOMPOSITIONS: NUR, FX, OIL, CRB, CPI, FF; 1973–1983

FORECAST HORIZON	STANDARD ERROR	SHARE OF FORECAST ERRORS FOR CPI DUE TO:					
		NUR	FX	OIL	CRB	CPI	FF
12 Months	.00223	14.2	11.2	8.3	8.8	44.7	12.8
24 Months	.00270	13.8	16.3	8.9	11.6	32.9	16.5
36 Months	.00306	12.4	13.9	7.9	20.3	28.2	17.3

TABLE 2C

VARIANCE DECOMPOSITIONS: NUR, FX, OIL, CRB, CPI, FF; 1984–1995

FORECAST HORIZON	STANDARD ERROR	SHARE OF FORECAST ERRORS FOR CPI DUE TO:					
		NUR	FX	OIL	CRB	CPI	FF
12 Months	.00162	10.2	5.9	22.9	7.6	40.7	12.7
24 Months	.00175	11.2	6.6	23.0	8.1	38.4	12.7
36 Months	.00179	11.3	6.7	23.1	7.9	38.4	12.6

TABLE 2D

VARIANCE DECOMPOSITIONS: NUR, FX, OIL, CRBRAW, CPI, FF; 1973–1983

FORECAST HORIZON	STANDARD ERROR	SHARE OF FORECAST ERRORS FOR CPI DUE TO:					
		NUR	FX	OIL	CRBRAW	CPI	FF
12 Months	.00225	13.5	15.4	4.9	12.7	42.3	11.2
24 Months	.00274	13.9	23.6	6.3	12.6	31.2	12.4
36 Months	.00304	12.0	21.4	6.2	19.4	28.1	12.9

TABLE 2E

VARIANCE DECOMPOSITIONS: NUR, FX, OIL, CRBRAW, CPI, FF; 1984–1995

FORECAST HORIZON	STANDARD ERROR	SHARE OF FORECAST ERRORS FOR CPI DUE TO:					
		NUR	FX	OIL	CRBRAW	CPI	FF
12 Months	.00162	10.6	8.7	21.1	6.2	40.7	12.7
24 Months	.00176	11.5	8.2	21.5	6.9	37.9	14.0
36 Months	.00181	12.2	8.4	21.4	6.8	37.4	13.8

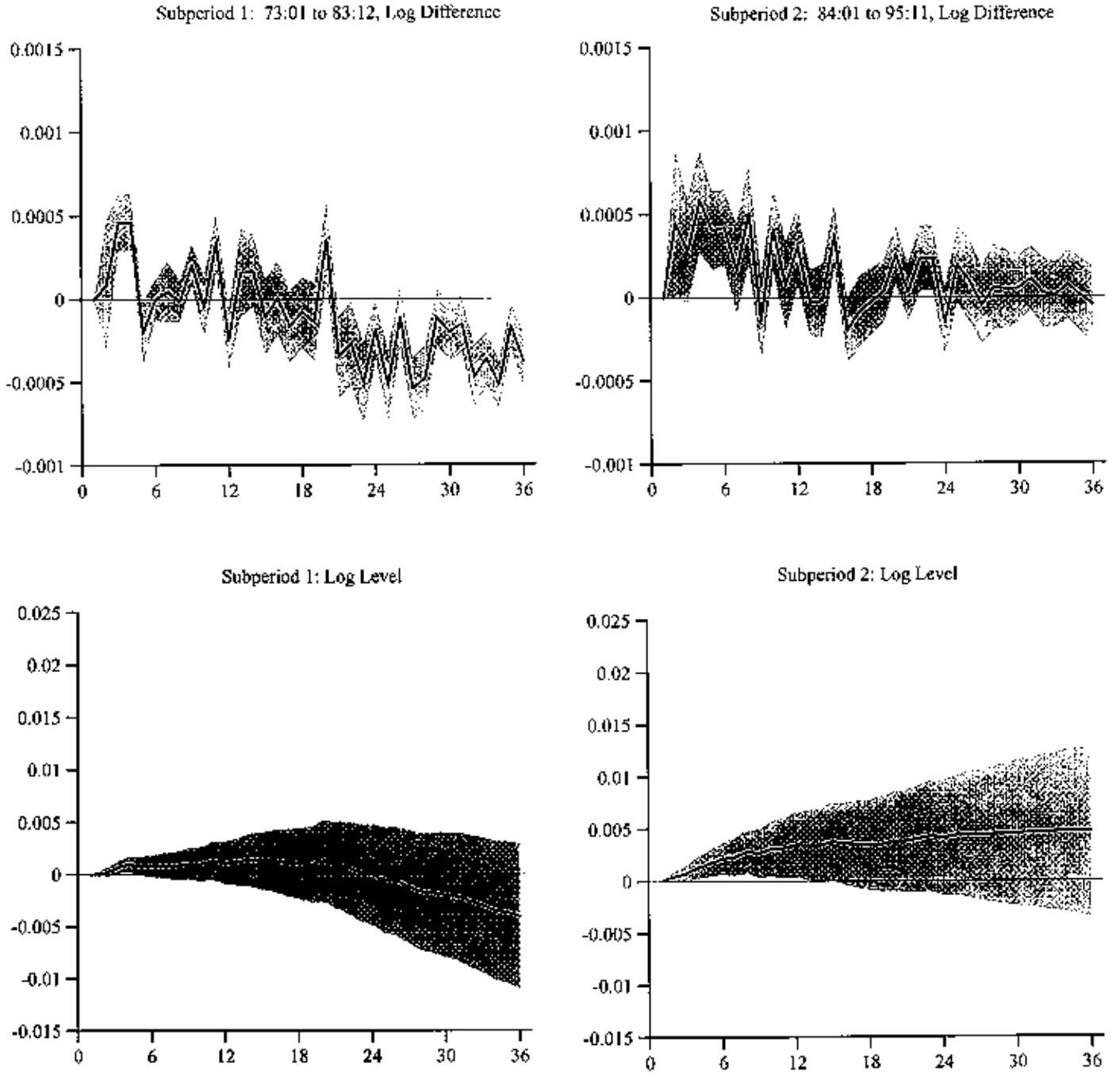
bivariate cases for the first period.[14] For that period, the average responses of the CPI to a shock to CRB or CRBRAW in the multivariate VARs generally are below the lower two standard deviation bands for the responses in the bivariate models. Moreover, the responses from the multivariate VAR are not statistically significant beyond the very near-term horizons in the first period.

The results relating to the effects of the commodity price indexes are not sensitive to their ordering in the VAR models.

14. The size of the shocks to the commodity indexes are the same as those used in the bivariate analysis.

FIGURE 6A

IMPULSE RESPONSE OF CPI TO A SHOCK TO CRB: SIX-VARIABLE VAR

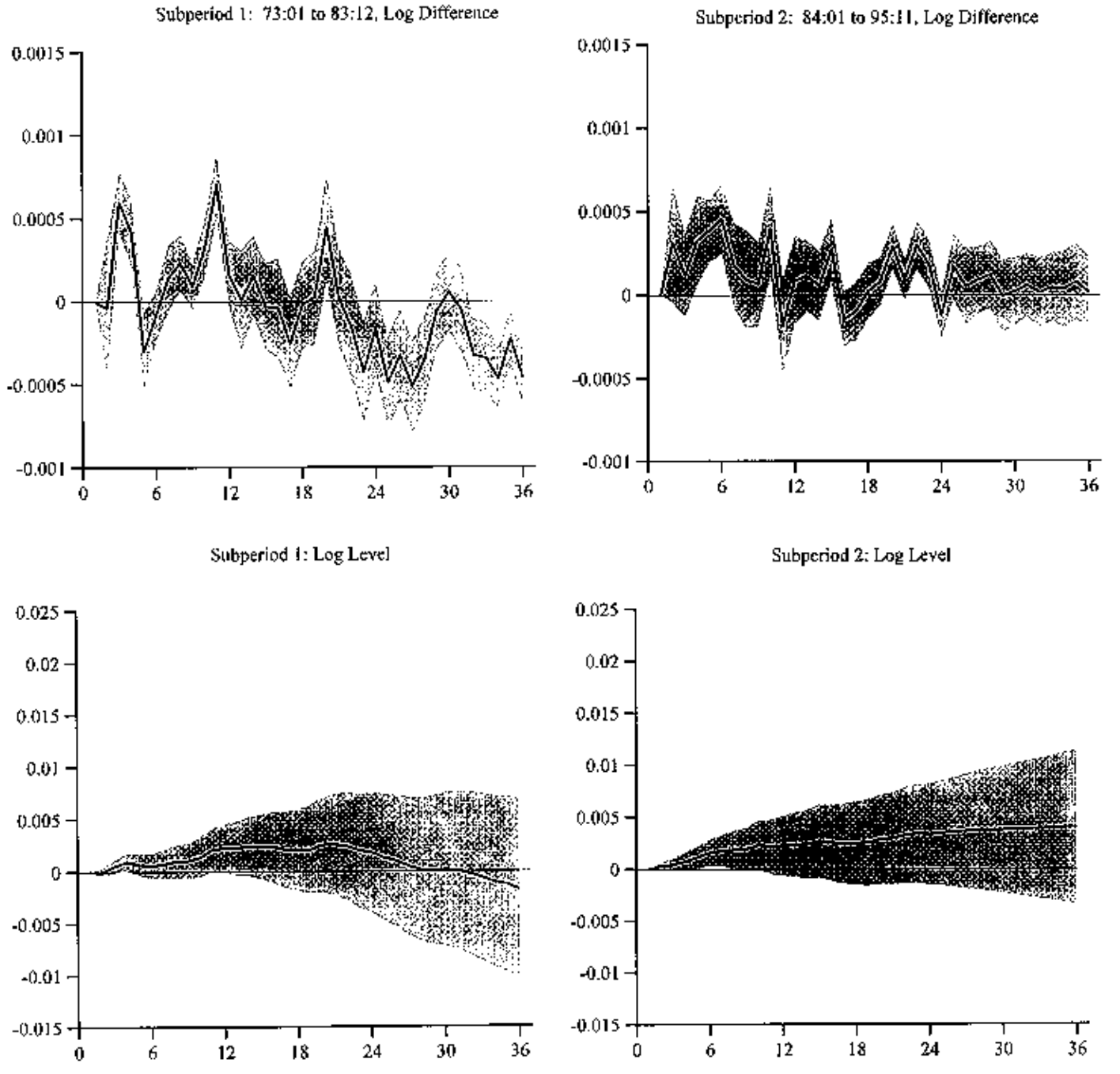


The variance decomposition shares and the responses of CPI when the indexes are ordered first are almost identical to those shown in the tables and figures. This suggests that commodity prices in the first period were responding to the shocks affecting employment and the foreign exchange value of the dollar. In other words, commodity prices likely were signaling more general economic shocks affecting inflation in the first period and not just idiosyncratic shocks.

A comparison of the results for the second period presents a different picture. The lower-right panels in Figures 6A and 6B and those in Figures 3A and 3B show that the average response of the CPI to a shock to CRB or CRBRAW

FIGURE 6B

IMPULSE RESPONSE OF CPI TO A SHOCK TO CRBRAW: SIX-VARIABLE VAR



in the second period is very similar in the multivariate and bivariate cases. Comparing the multivariate results across the periods (the lower two panels in Figures 6A and 6B) shows that the average response is actually a bit larger in the second period, though the difference is not significant. However, taken by itself, the average response of CPI to a CRB shock in the lower-right panel of Figure 6A is more than two standard deviations above zero for a horizon of more than a year. The comparable horizon for CRBRAW shocks in Figure 6B is about nine months. Again, the results relating to the commodity price indexes are not sensitive to their ordering in the VAR models.

The results, then, indicate that the information content in shocks to commodity prices about future inflation in the second period did not overlap significantly with other macroeconomic variables. The shocks to commodity prices that conveyed information about future inflation in the second period were more idiosyncratic than in the first period. These differences in the information content of shocks to commodity prices in the two periods could account for the results in the previous section showing the commodity indexes were relatively robust stand-alone indicators in the 1970s and early 1980s, but not in more recent years. This could be because idiosyncratic shocks to commodity prices (those associated with a positive response in overall prices) tend to affect the relevant commodity prices more than overall prices, while more general economic shocks could have a more balanced long-run impact on commodity prices and overall prices. This appears to have been the case in the sample period covering the 1970s and early 1980s. For that period, shocks to the commodity price indexes led to larger responses of those indexes relative to the responses of CPI than did shocks to either NUR or FX.

Pinning down the reasons for the difference in the information content of the commodity price indexes, however, is problematic. One explanation is that the mix of shocks changed.[15] It is possible, for example, that general economic shocks were more important relative to idiosyncratic commodity price shocks in the first period compared with the second. That is, while supply shocks may have had some role, commodity prices performed relatively well as stand-alone inflation indicators in the first period because the relatively high inflation rates ultimately reflected persistent aggregate demand shocks. Such a shift in the relative importance of shocks would be consistent with the relatively stable and low CPI inflation, the general decline in the relative price of commodities, and the relatively greater role of oil price shocks in explaining CPI inflation in the multivariate systems for the subperiod since the early 1980s.

A second explanation is that the changes in commodity price indexes have become less effective in conveying shocks generally. One possibility is that the role of commodities has changed. Bloomberg and Harris (1995), for example, point out that the role of commodities in total output has declined over time. In the case of supply shocks to a commodity or basket of commodities, this should mean that over time a given change in commodity prices would have a smaller impact on overall prices. This may have played some role in the change in the empirical relationship between commodity prices and inflation. However, it seems unlikely that it could account for an eightfold difference in the response of inflation to a shock to commodity prices in the first period compared with the second period as is found in the bivariate models. Moreover, the analysis above suggests that the response of CPI inflation to idiosyncratic shocks to the commodity is more likely to have been larger than smaller in recent years.

Another possibility relates to commodity prices signaling aggregate demand shocks. The argument is that over time commodities have been used less for hedging against inflation because of the availability of alternative financial instruments (Bloomberg and Harris). If so, this could reduce the demand for some durable commodities and contribute to the drift in the level of their prices relative to other prices. The implications for the short-run link are less straightforward, however. Prices of durable commodities still should respond to aggregate demand shocks, though possibly with less overshooting—that is, smaller initial commodity price movements for a given shock. However, if that were the case (and the ultimate response of overall inflation to a given aggregate demand shock were the same) we should find evidence of larger, not smaller, responses of inflation to shocks to commodity prices in the bivariate VARs in recent years compared to the more distant past.

A third general explanation is that the response of monetary policy to shocks to commodity prices has changed. The idea is that, if monetary policy were to respond to shocks to commodity prices to head off inflation, the observed relationship between commodity prices and inflation would be changed. Since the observation is that the link between commodity prices and inflation is weaker, the argument would have to be that monetary policy has responded more in recent years to offset the pending inflation. This raises two issues: Has monetary policy responded more to commodity prices, and, if so, how much has it affected the empirical relationship between the commodity price indexes and inflation?

15. Another explanation is that the relationship between CPI inflation and the other macroeconomic variables has been unstable.

Evidence regarding the monetary policy response can be gleaned from the federal funds rate equations in the multivariate VARs discussed above. These turn out to be inconclusive on whether the federal funds rate has been more responsive to changes in commodity prices in recent years. In Table 3 the results for the FF equations in the multivariate VARs indicate that the lagged values of the CRB terms are jointly significant in the second period but not the first period, and those for the CRBRAW terms are not jointly significant for either period. The variance decompositions for the forecast errors of FF differ noticeably for some variables in the two periods. The shares for NUR are smaller in the second period, while those for CPI are larger, suggesting monetary policy may have responded relatively more to movements in inflation. The share for the price of oil also is larger in the second period. However, the shares for non-oil commodity price indexes in the two periods are virtually unchanged. Finally in Figures 7A and 7B while the average responses of FF to shocks to commodity prices are larger in the second period than in the first, the difference generally is not statistically significant at the 5 percent level.

Even if monetary policy has responded more to commodity prices in recent years, the results in Figures 4 and 6 show that the inclusion of the federal funds interest rate did not fundamentally change the response of inflation to a given commodity price shock in the second period. That finding suggests that any difference in response of monetary policy to commodity prices is not the fundamental cause of their decline in usefulness as stand-alone indicators of inflation.

Recent inflation behavior

While the commodity price indexes may be poor stand-alone indicators of inflation, the results from the multivariate analysis indicate that they still may provide some information about future in inflation when considered in conjunction with other inflation indicators. That is, a shock to commodity prices still might be expected to have a positive, though modest, impact on inflation. In this section we look at whether the net rise in commodity prices from mid-1993 to mid-1995 provided any additional information about inflation.

To investigate this, the multivariate VAR that included the CRB was estimated for the period 1984 to 1993. Two forecasts were derived for the CPI for the period 1994–1995. The baseline forecast sets NUR, FX, OIL, and FF at their historical values and allows both CPI inflation and changes in the CRB to be forecasted dynamically. The second forecasts CPI inflation dynamically while setting the values for all the other variables to their historic values.

The implied forecasts for log level of the CPI along with the actual CPI are shown in Figure 8. The two forecasted series overpredict actual CPI by a large margin. By the end of 1995, the forecasts are about 5 percent above actual, and that spread is greater than two standard errors of the forecasts. This suggests that, at least relative to the model used

TABLE 3A

FF-EQUATION RESULTS
SIX-VARIABLE VAR: NUR, FX, OIL, CRB/CRBRAW, CPI, AND FF

SPECIFICATION	CRB		CRBRAW	
PERIOD	1973–1983	1984–1995	1973–1983	1984–1995
F-STAT: NUR (MSL)	1.43	0.85	1.47	0.51
	(.177)	(.598)	(.160)	(.904)
F-STAT: FX (MSL)	0.55	1.03	0.52	0.88
	(.871)	(.433)	(.895)	(.567)
F-STAT: OIL(MSL)	0.63	1.32	0.72	1.36
	(.803)	(.226)	(.727)	(.204)
F-STAT: CRB/CRBRAW (MSL)	0.77	1.91	1.91	0.95
	(.678)	(.048)	(.669)	(.507)
F-STAT: CPI (MSL)	1.45	1.18	1.15	1.06
	(.170)	(.317)	(.337)	(.408)
F-STAT: FF (MSL)	2.83	1.08	2.29	0.81
	(0.04)	(.393)	(.018)	(.638)
R^2	.29	.33	.29	.23

TABLE 3B

VARIANCE DECOMPOSITIONS: NUR, FX, OIL, CRB, CPI, FF; 1973–1983

FORECAST HORIZON	STANDARD ERROR	SHARE OF FORECAST ERRORS FOR FF DUE TO:					
		NUR	FX	OIL	CRB	CPI	FF
12 Months	.87153	20.1	5.8	5.2	7.7	2.3	58.9
24 Months	1.02324	17.5	9.3	5.7	10.8	4.1	52.6
36 Months	1.05454	17.2	9.6	6.6	10.9	4.3	51.4

TABLE 3C

VARIANCE DECOMPOSITIONS: NUR, FX, OIL, CRB, CPI, FF; 1984–1995

FORECAST HORIZON	STANDARD ERROR	SHARE OF FORECAST ERRORS FOR FF DUE TO:					
		NUR	FX	OIL	CRB	CPI	FF
12 Months	.25939	11.0	6.3	13.4	11.8	15.1	42.4
24 Months	.28163	11.2	7.7	12.6	10.6	19.3	38.6
36 Months	.28967	11.4	7.8	12.3	10.5	20.8	37.2

TABLE 3D

VARIANCE DECOMPOSITIONS: NUR, FX, OIL, CRBRAW, CPI, FF; 1973–1983

FORECAST HORIZON	STANDARD ERROR	SHARE OF FORECAST ERRORS FOR FF DUE TO:					
		NUR	FX	OIL	CRBRAW	CPI	FF
12 Months	.88695	20.8	7.5	5.3	7.6	2.7	56.1
24 Months	1.02991	18.0	10.1	5.4	11.2	4.4	50.9
36 Months	1.05712	17.9	10.1	5.8	11.8	4.6	49.8

TABLE 3E

VARIANCE DECOMPOSITIONS: NUR, FX, OIL, CRBRAW, CPI, FF; 1984–1995

FORECAST HORIZON	STANDARD ERROR	SHARE OF FORECAST ERRORS FOR FF DUE TO:					
		NUR	FX	OIL	CRBRAW	CPI	FF
12 Months	.26673	9.2	5.1	11.5	12.0	16.2	46.0
24 Months	.28299	9.5	5.7	11.7	11.4	18.2	43.5
36 Months	.28849	10.0	5.9	11.4	11.3	18.8	42.6

FIGURE 7A

IMPULSE RESPONSE OF THE FEDERAL FUNDS RATE TO A SHOCK TO CRB: SIX-VARIABLE VAR

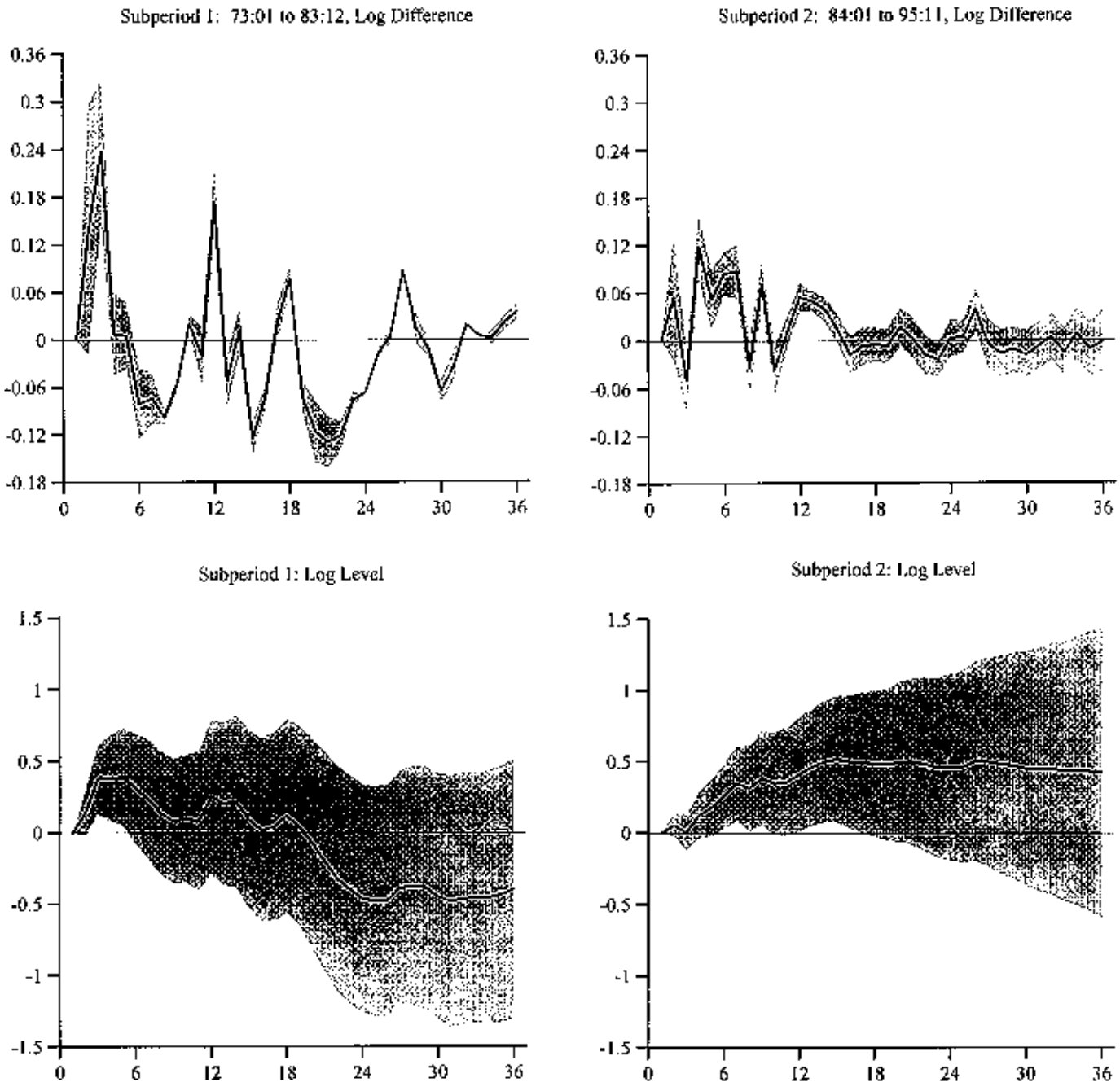


FIGURE 7B

IMPULSE RESPONSE OF THE FEDERAL FUNDS RATE TO A SHOCK TO CRBRAW: SIX-VARIABLE VAR

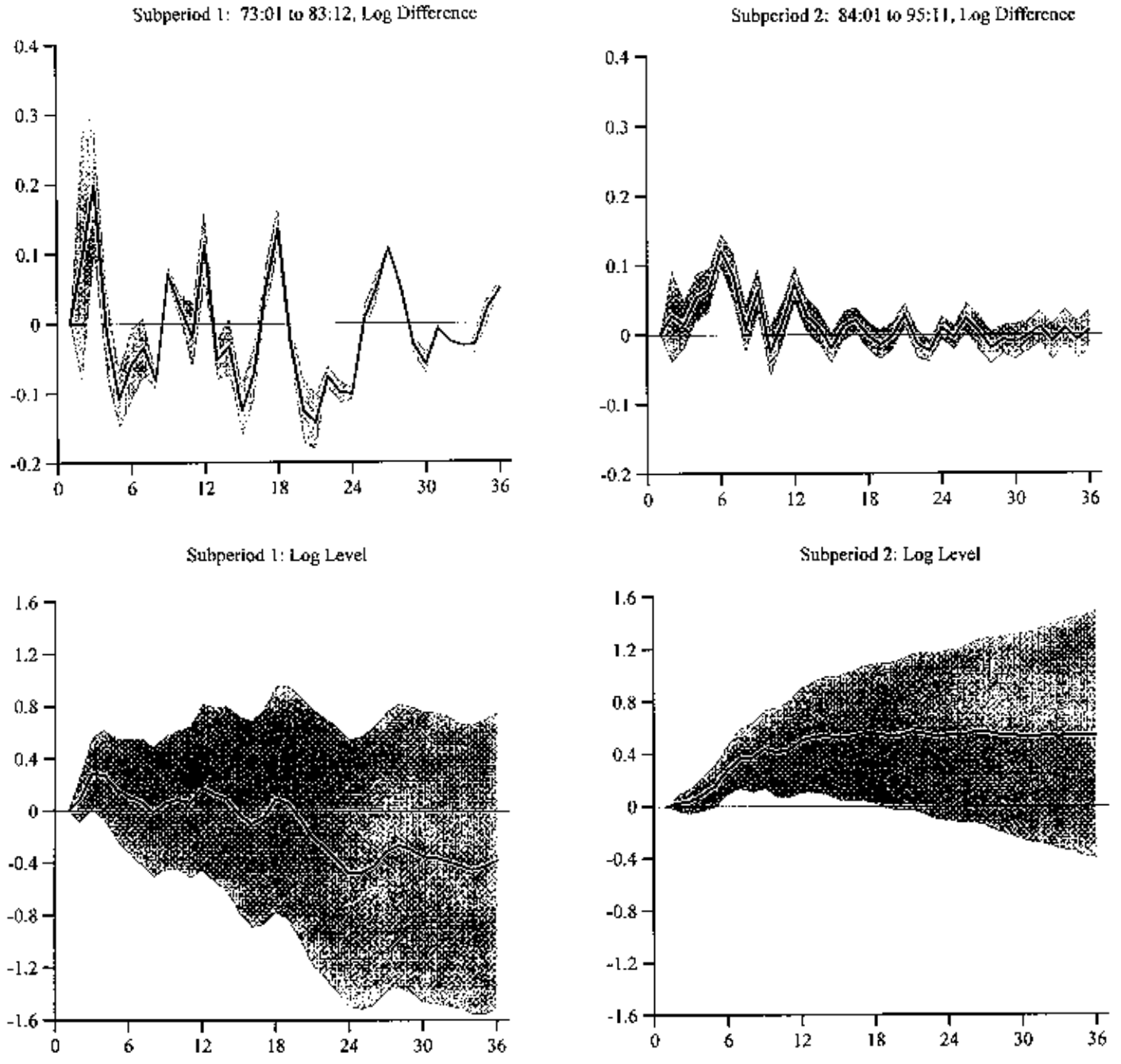
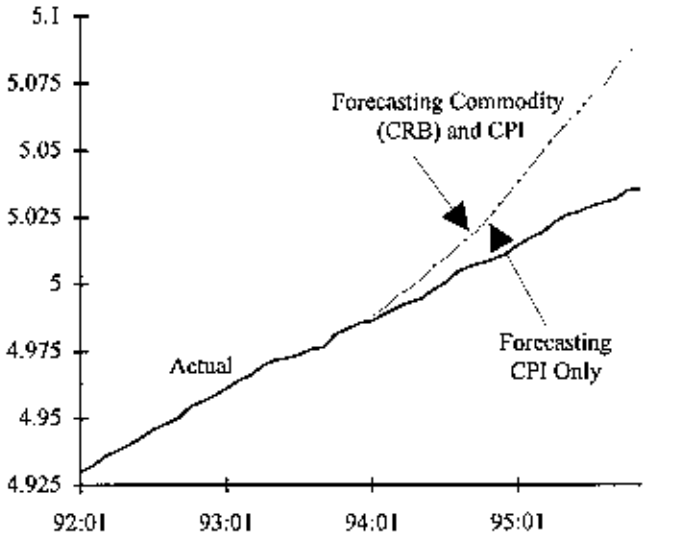


FIGURE 8

COMPARISON OF FORECASTS OF LOG CPI: SIX-VARIABLE VAR



in this study, inflation was lower than expected in the 1994–1995 period. The similarity of the two forecast series, however, indicates that shocks to commodity price indexes were relatively small and do not help explain the overprediction of inflation.

IV. CONCLUSION

The simple two-way relationship between CPI inflation and the commodity price indexes has changed significantly over time. The non-oil commodity prices were relatively strong and statistically robust leading indicators of overall inflation for a period covering the 1970s and early 1980s, but they have performed poorly in more recent years. As a result, using the past relationship between commodity prices and inflation to forecast inflation leads to a sizeable overprediction of inflation in recent years.

The deterioration in the role of non-oil commodity prices as stand-alone indicators of inflation appears to reflect a change in the extent to which the movement in the prices of these commodities reflected general economic shocks ultimately affecting overall inflation versus more idiosyncratic shocks to commodities. We find the non-oil commodity indexes performed relatively well as stand-alone indicators of inflation when the commodity prices conveyed the effects of factors affecting inflation that were reflected first in the tightness in labor markets and the foreign exchange rate of the dollar, while they performed poorly when they did not.

Pinpointing the reasons for the difference in the information content of commodity prices is problematic. Explanations such as the decline in the commodities' share in overall output, less use of commodities for inflation hedging, or offsetting response of monetary policy appear inadequate to account for the deterioration in empirical relationships between changes in commodity prices and overall inflation. Another possibility suggested in our analysis is a change in the mix of shocks affecting prices. Such a change occurring would be consistent with the relatively stable and low CPI inflation, the general decline in the relative price of commodities, and the more important role of oil price shocks in explaining inflation since the early 1980s.

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