HOW DID LEADING INDICATOR FORECASTS DO DURING THE 2001 RECESSION?

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1. Introduction

The recession that began in March, 2001 differed in many ways from other recessions of the past three decades. The twin recessions of the early 1980s occurred when the Federal Reserve Board, under Chairman Paul Volker, acted decisively to halt the steady rise of inflation over the 1970s, despite the substantial employment and output cost to the economy. Although monetary tightening had reduced the growth rate of real activity in 1989, the proximate cause of the recession of 1990 was a sharp fall in consumption, a response by consumers to the uncertainty raised by Iraq's invasion of Kuwait and the associated spike in oil prices (Blanchard (1993)). In contrast, the recession of 2001 started not in the corridors of the Federal Reserve Board, but in the boardrooms of corporate America as businesses sharply cut back on expenditures, most notably investment associated with information technology, in turn leading to declines in manufacturing output and in the overall stock market.

Because it differed so from its recent predecessors, the recession of 2001 provides a particularly interesting experiment in which to examine the forecasting performance of various leading economic indicators. In this article, we take a look at how a wide range of leading economic indicators did during this episode. Did these leading economic indicators predict a slowdown of growth? Was that slowdown large enough to suggest that a recession was imminent? Were the leading indicators that were useful in earlier recessions useful in this recession, and why or why not?

We begin our analysis by examining how professional forecasters – specifically, the forecasters in the Survey of Professional Forecasters conducted by the Federal Reserve Bank of Philadelphia – did during this episode. As we show in Section 2, these forecasters were taken by surprise: even as late as the fourth quarter of 2000, when industrial production was already declining, the median SPF forecaster was predicting strong economic growth throughout 2000.

With the SPF results as a benchmark, Section 3 turns to the performance of individual leading indicators before and during the 2001 recession. Generally speaking, we find that the performance of specific indicators was different than during previous recessions. Some indicators, in particular the so-called term spread (the difference between long-term and short-term interest rates on government debt) and stock returns, provided some warning of a slowdown in economic growth, although the predicted growth was still positive and these indicators fell short of providing a signal of an upcoming recession. Other, previously reliable leading indicators, such as housing starts and new claims for unemployment insurance, provided little or no indication of the slowdown.

In practice, individual leading indicators are not used in isolation; as Mitchell and Burns (1938) emphasized when they developed the system of leading economic indicators, their signals should be interpreted collectively. Accordingly, Section 4 looks at the performance of pooled forecasts based on the individual leading indicator forecasts from Section 3, and finds encouraging results. Section 5 concludes.

2. Forecasting the 2001 Recession: How Did the Pros Do?

This section begins with a brief quantitative review of the 2001 recession. We then turn to professional forecasts during this episode, as measured in real time by the Philadelphia Fed's quarterly Survey of Professional Forecasters.

2.1 A Brief Reprise of the 2001 Recession

Figure 1 presents monthly values of the four coincident indicators that constitute The Conference Board's Index of Coincident Indicators: employment in nonagricultural businesses, industrial production, real personal income less transfers, and real manufacturing and trade sales.[1] These four series are also the primary series that the NBER Business Cycle Dating Committee uses to establish its business cycle chronology (Hall (2002)). The percentage growth rates of these series, expressed at an annual rate, are plotted in Figure 2. In addition, Figure 2 presents the percentage growth of real GDP (at an annual rate); because GDP is measured quarterly and the time scale of Figure 2 is monthly, in Figure 2 the same growth rate of real GDP is attributed to each month in the quarter, accounting for the "steps" in this plot.

Figures 1 and 2 reveal that the economic slowdown began with a decline in industrial production, which peaked in June 2000. Manufacturing and trade sales fell during the first quarter of 2001, but employment did not peak until March 2001, the official NBER cyclical peak. Real personal income reached a cyclical peak in November 2000 and declined by 1.5% over the next twelve months. This relatively small decline in

personal income reflected the unusual fact that productivity growth remained strong through this recession. Based on the most recently available data, real GDP fell during the first three quarters of 2001, with a substantial decline of 1.6% (at an annual rate) in the second quarter.

The economy gained substantial strength in the final quarter of 2001 and throughout 2002, and the monthly indicators all were growing by December 2001. Thus, based on the currently available evidence, the recession appears to have ended in the fourth quarter of 2002. As this article is being written, however, the NBER has not announced a cyclical trough, that is, a formal end to the recession.

2.2 Professional Forecasts During 2000 and 2001

In the second month of every quarter, the Research Department of the Federal Reserve Bank of Philadelphia surveys a large number of professional forecasters – in the first quarter of 2000, 36 forecasters or forecasting groups participated – and asks them a variety of questions concerning their short-term forecasts for the U.S. economy. Here, we focus on two sets of forecasts: the forecast of the growth rate of real GDP, by quarter, and the probability that the forecasters assign to the event that GDP growth will be negative in a given quarter.

The average growth forecasts – that is, the forecast of real GDP growth, by quarter, averaged across the respondents to the SPF – are summarized in Table 1 for late 2000 and 2001. The first two columns of Table 1 report the quarter being forecast and the actual growth rate of real GDP, based on the most recently available data as of this

[1] For additional information on The Conference Board's coincident and leading indexes,

writing. The remaining columns report the average SPF growth forecasts, where the column date is the quarter in which the forecast is made for the quarter of the relevant row. For example, in the fourth quarter of 2000, real GDP actually grew by 1.1% (at an annual rate), based on the most recently available data, but the average SPF forecast for 2000Q4 GDP growth, recorded in the SPF survey taken in 2000Q1, was 2.9%. Because the Bureau of Economic Analysis does not release GDP estimates until the quarter is over, forecasters do not know GDP growth for the current quarter, and in the 2000Q4 survey the average SPF forecast of 2000Q4 real GDP growth was 3.2%.

An examination of the one quarter ahead forecasts (for example, the 2000Q3 forecast of 2000Q4 growth) and the current quarter forecasts (the 2000Q4 forecast of 2000Q4 growth) reveals that the SPF forecasters failed to predict the sharp declines in real GDP, even as they were occurring. The average one quarter ahead forecast of 2001Q1 growth was 3.3%, whereas GDP actually fell by 0.6%; the one quarter ahead forecast of 2001Q2 growth was 2.2%, but GDP fell by 1.6%; and the one quarter ahead forecast of 2001Q3 growth was 2.0%, while GDP fell by 0.3%. Throughout this episode, this average forecast was substantially too optimistic about near-term economic growth. Only in the fourth quarter of 2001 did the forecasters begin to forecast ongoing weakness – in part in reaction to the events of September 11 – but, as it happened, in that quarter GDP was already recovering.

The SPF forecasters are also asked the probability that real GDP will fall, by quarter, and Table 2 reports the average of these probabilities across the SPF forecasters. In the fourth quarter of 2000, the forecasters saw only a 11% chance of that GDP growth

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see www.tcb-indicators.org.

in the first quarter of 2001 would be negative, consistent with their optimistic growth forecast of 3.3% for that quarter; in fact, GDP growth *was* negative, falling by 0.6%. Throughout the first three quarters of 2001, the current-quarter predicted probabilities of negative growth hovered around one-third, even though growth was in fact negative in each of those quarters. When, in the fourth quarter of 2001, the SPF forecasters finally were sure that growth would be negative – the consensus probability of negative growth was 82% - the economy in fact grew by a strong 2.7%. Evidently, this recession was a challenging time for professional forecasters.

3. Forecasts Based on Individual Leading Indicators

Perhaps one reason for these difficulties was the different nature of the 2001 recession and its predecessors over the past three decades. If so, this difference would also be reflected in the performance of leading indicators over this episode. In this section, we examine the performance of forecasts based on individual leading indicators during the 2001 recession. We begin by discussing the methods used to construct these forecasts, then turn to graphical and quantitative analyses of these forecasts.

3.1 Construction of Leading Indicator Forecasts

The leading indicator forecasts were computed by regressing future output growth over 2 or 4 quarters against current and past values of output growth and the candidate leading indicator. Specifically, let $Y_t = \Delta \ln Q_t$, where Q_t is the level of output (either the level of real GDP or the Index of Industrial Production), and let X_t be a candidate

predictor (e.g. the term spread). Let Y_{t+h}^h denote output growth over the next *h* quarters, expressed at an annual rate, that is, let $Y_{t+h}^h = (400/h)\ln(Q_{t+h}/Q_t)$. The forecasts of Y_{t+h}^h are made using the *h*-step ahead regression model,

$$Y_{t+h}^h = \alpha + \sum_{i=0}^{p-1} \beta_i X_{t-i} + \sum_{i=0}^{q-1} \gamma_i Y_{t-i} + u_{t+h}^h, \quad (1)$$

where u_{t+1}^h is an error term and $\alpha, \beta_0, \ldots, \beta_{p-1}, \gamma_0, \ldots, \gamma_{q-1}$ are unknown regression coefficients. Forecasts are computed for 2- and 4-quarter horizons ($h = 2$ and 4).

To simulate real-time forecasting, the coefficients of Equation (1) were estimated only using data prior to the forecast date. For example, for a forecast made using data through the fourth quarter of 2000, we estimate (1) using only data available through the fourth quarter of 2000. Moreover, the number of lags of *X* and *Y* included in (1), that is, *p* and *q*, were also estimated using data only available through the date of the forecast; specifically, *p* and *q* were selected using the Akaike Information Criterion (AIC), with $1 \le p \le 4$ and $0 \le q \le 4$. Restricting the estimation to data available through the forecast date – in this example, 2000Q4 – prevents the forecasts from being misleadingly accurate by using future data, and also helps to identify shifts in the forecasting relation during the period that matters for forecasting, the end of the sample. This approach, in which all estimation and model selection is done only using data prior to the forecast date, is commonly called pseudo out-of-sample forecasting; for an introduction to pseudo out-of-sample forecasting methods and examples, see Stock and Watson (2003, Section 12.7).

As a benchmark, we computed a multistep autoregressive (AR) forecast, in which (1) is estimated with no X_t predictor and the lag length is chosen using the AIC ($0 \le q \le 4$). As an additional benchmark, we computed a recursive random walk forecast, in which $\hat{Y}^h_{t+h|t} = h\hat{\mu}_t$, where $\hat{\mu}_t$ is the sample average of ΔY_s, $s = 1,\ldots, t$. Like the leading indicator forecasts, these benchmark forecasts were computed following the pseudo out-of-sample methodology.[2]

3.2 Graphical Analysis

Figure 3 plots the time path of twelve leading indicators from 1986:I through 2002:III, along with actual two-quarter real GDP growth and its forecast based on that indicator. For each series in Figure 3, the solid lines are the actual two-quarter GDP growth (thick line) and its indicator-based forecast (thin line), where the dates correspond to the date of the forecast (so the value plotted for the first quarter of 2001 is the forecasted and actual growth of GDP over the second and third quarters, at an annual rate). The dashed line is the historical values of the indicator itself (the value of the indicator plotted in the first quarter of 2001 is its actual value at that date). The scale for the solid lines is given on the right axis and the scale for the dashed line is given on the left axis.

[2] One way that this methodology does *not* simulate real-time forecasting is that we use the most recently available data to make the forecasts, rather than the data that were actually available in real time. For many of the leading indicators, such as interest rates and consumer expectations, the data are not revised, so this is not an issue. For others, such as GDP, revisions can be large, and because our simulated real-time forecasts use GDP growth as a predictor in Equation (1), their performance in this exercise could appear better than it might have in real time, when preliminary values of GDP would be used.

In order of presentation, the leading indicators in Figure 3 are a measure of the term spread (the ten year Treasury bond rate minus the federal funds rate); the federal funds rate; the paper-bill spread (the 3-month commercial paper rate minus the Treasury bill rate; the high yield "junk" bond spread (the difference between the yield on high-yield securities[3] and the Aaa corporate bond yield, a spread similar to that suggested by Gertler and Lown (2000)); stock prices (the S&P500); the real price of oil; new claims for unemployment insurance; housing starts (building permits); the University of Michigan index of consumer expectations; industrial production of business equipment; new orders for capital goods; and real M2.

Inspection of these plots reveals that some of these indicators moved in advance of the economic contraction, but others did not. The term spread provided a clear signal that the economy was slowing: the long government rate was less than the federal funds rate from June, 2000 through March, 2001. The decline in the stock market through the second half of 2000 also presaged further declines in the economy. New claims for unemployment insurance rose sharply over 2000 signaling a slowdown in economic activity. Other series, particular series related to consumer spending, were strong throughout the first quarters of the recession: housing starts fell sharply during the 1990 recession but remained strong through 2000. The consumer expectation series remained above 100 throughout 2000 reflecting overall positive consumer expectations. Although new capital goods orders dropped off sharply, that decline was contemporaneous with the decline in GDP, and in this sense new capital goods orders did not forecast the onset of the recession. The paper-bill spread provided no signal of the recession: although it

[3] Merrill Lynch, US High Yield: Master II Index.

moved up briefly in October, 1998, October, 1999, and June, 2000, the spread was small and declining from August, 2000 through the end of 2001, and the forecast of output growth based on the paper-bill spread remained steady and strong. In contrast, the junk bond spread rose sharply in 1998, plateaued, then rose again in 2000. The junk bond spread correctly predicted a substantial slowing in the growth rate of output during 2001, however it incorrectly predicted a slowdown during 1998. Finally, real M2, an element of The Conference Board's Index of Leading Indicators, performed particularly poorly; the strong growth of the money supply before and during this recession led to output forecasts that were far too optimistic.

3.3 Quantitative Analysis of Forecast Errors

To learn more about which leading indicators performed well over this recession, we compared the mean squared forecast error of the leading-indicator based forecasts during the recession to the errors of the benchmark AR forecast.

Relative mean squared forecast error. The relative mean squared forecast error (MSFE) compare the performance of a candidate forecast (forecast *i*) to a benchmark forecast, where both are computed using the pseudo out-of-sample methodology. Specifically, let $\hat{Y}^h_{i,t+h|t}$ denote the pseudo out-of-sample forecast of Y^h_{t+h}, computed using data through time *t*, based on the i^{th} individual indicator. Let $\hat{Y}^h_{0,t+h|t}$ denote the corresponding benchmark forecast made using the autoregression. Then the relative mean squared forecast error (MSFE) of the candidate forecast, relative to the benchmark forecast, is

$$\text{Relative MSFE} = \frac{\sum_{t=T_1}^{T_2-h}(Y_{t+h}^h - \hat{Y}_{i,t+h|t}^h)^2}{\sum_{t=T_1}^{T_2-h}(Y_{t+h}^h - \hat{Y}_{0,t+h|t}^h)^2}, \quad (2)$$

where T_1 and T_2–h are respectively the first and last dates over which the pseudo out-of-sample forecast is computed. For this analysis, we set T_1 to 1999Q1 and T_2 to 2002Q3. If the relative MSFE of the candidate forecast is less than one, then the forecast based on that leading indicator outperformed the AR benchmark during the period just before and during the 2001 recession.[4]

Empirical results. The relative MSFEs for 37 leading indicators are presented in the final four columns of Table 3 for 2- and 4-quarter ahead forecasts of GDP growth and IP growth, where the indicator and its transformation appears in the first two columns.

The mixed forecasting picture observed in Figure 3 is reflected in the MSFEs in Table 1. The relative MSFEs show that some predictors – the term spread, short-term interest rates, the junk bond spread, stock prices and new claims for unemployment insurance – produced substantial improvements over the benchmark AR forecast. For example, the mean squared forecast error of the four-quarter ahead forecast of GDP based on either measure of the term spread was one-third less than the AR benchmark. The two-quarter ahead forecast of real GDP growth based on unemployment insurance claims had a MSFE 63% of the AR benchmark, another striking success.

[4] When the orders p and q in (1) are fixed, standard errors for the relative MSFE can be computed as described by Clark and McCracken (2001). Here, however, p and q are selected in pseudo out-of-sample fashion by AIC.

In contrast, forecasts based on consumer expectations, housing starts, long-term interest rates, oil prices, or the growth of monetary aggregates all performed worse – in some cases, much worse – than the benchmark autoregression. Overall, the results from Table 3 reinforce the graphical analysis based on Figure 3, and provide an impression of inconsistency across indicators, and for a given indicator inconsistency over time (e.g. the differing behavior of housing starts during the 1990 and 2001 recessions). This instability of forecasts based on individual leading indicators is consistent with other recent econometric evidence on the instability of forecast relations in the U.S. and other developed economies; see for example the review of forecasts with asset prices in Stock and Watson (2001).[5]

4. Combination Forecasts

The SPF forecasts examined in Tables 1 and 2 are the average of the forecasts by the individual survey respondents. Such pooling of forecasts aggregates the different information and models used by participating forecasters, and studies show that pooled, or combination, forecasts regularly improve upon the constituent individual forecasts (see Clemen (1989), Diebold and Lopez (1996), and Newbold and Harvey (2002)). Indeed, in

[5] The analysis here focuses on forecasts of growth rates. A complementary problem is forecasting whether the economy will be in a recession, that is, providing a probability that the economy will be in a recession in the near future. Filardo (2002) examines several probabilistic recession forecasting models. One of his findings is that the results of these models depend on whether final revisions or real-time data are used (the forecasts based on finally revised data are better). He finds that a probit model based on the term spread, the paper-bill spread, and stock returns provided advance warning of the 2001 recession, a result consistent with the relatively good performance of the term spread and stock returns in Table 3.

their original work on leading indicators, Mitchell and Burns (1938) emphasized the importance of looking at many indicators, because each provides a different perspective on current and future economic activity.

In this section, we pursue this line of reasoning and examine the performance during the 2001 recession of combination forecasts that pool the forecasts based on the individual leading indicators examined in Section 3. The literature on forecast combination has proposed many statistical methods for combining forecasts; two important early contributions to this literature are Bates and Granger (1969) and Granger and Ramanathan (1984). Here, we consider three simple methods for combining forecast: the simple average, the median, and a MSFE-weighted average based on recent performance.

The simple average combination forecast is simply the sample average of the forecasts in the panel. The median modifies this by computing the median of the panel of forecasts instead of the mean, which has the potential advantage of reducing the influence of "crazy" forecasts, or outliers; this is the method that was used to produce the SPF combination forecasts in Table 1.

The MSFE-weighted average forecast gives more weight to those forecasts that have been performing well in the recent past. Here, we implement this combination forecast by computing the forecast error for each of the constituent forecasts over the period from 1982:I through the date that the forecast is made (thereby following the pseudo out-of-sample methodology), then estimating the current mean squared forecast error as the discounted sum of past squared forecast errors, with a quarterly discount factor of 0.95. The weight received by any individual forecast in the weighted average is

inversely proportional to its discounted mean squared forecast error, so the leading indicators that have been performing best most recently receive the greatest weight.

The results are summarized in Table 4. The combination forecasts provide consistent modest improvements over the AR benchmark. During this episode, the simple mean performed better either the median or inverse MSFE-weighted combination forecasts.

Because real money has been an unreliable leading indicator of output for many years in many developed economies (Stock and Watson (2001)) – a characteristic that continued in the 2001 recession – it is also of interest to consider combination forecasts that exclude the monetary aggregates. Not surprisingly given the results in Table 3, the combination forecasts excluding money exhibit better performance than those that include the monetary aggregates.

Of course, the sample size is small and we should refrain from drawing strong conclusions from this one case study. Moreover, the improvements of the combination forecasts over the AR benchmark are less than the improvements shown by those individual indicators, like new claims for unemployment insurance, that were, in retrospect, most successful during this episode. Still, the performance of the simple combination forecasts results is encouraging.

5. Discussion and Conclusions

These results provide more evidence of the truth of the saying that every recession is different. While the decline of the stock market gave some advance warning of the

recession, this indicator was not reliable during previous episodes. While the term spread indicated an economic slowdown in 2001, it did not give an early signal in the 1990 recession. Building permits and consumer confidence, which declined sharply preceding and during the 1990 recession, maintained strength well into the 2001 recession. The varying performance of these indicators reflects the differences in the shocks and economic conditions prior to the 1990 and 2001 recessions. In retrospect, the performance of the various individual indicators is generally consistent with the view that this recession was a joint consequence of a sharp decline of the stock market (perhaps encouraged by a moderate monetary tightening) and an associated pronounced decline in business investment, especially in information technology. These shocks affected manufacturing and production, but diffused only slowly to general employment, incomes, and consumption. But without knowing these shocks in advance, it is unclear how a forecaster would have decided in 1999 which of the many promising leading indicators would perform well over the next few years and which would not.

The failure of individual indicators to perform consistently from one recession to the next, while frustrating, should not be surprising. After all, one of the reasons that Mitchell and Burns (1938) suggested looking at many indicators was that each measured a different feature of economic activity, which in turn can play different roles in different recessions. In light of the variable performance of individual indicators and the evident difficulty professional forecasters had during this episode, the results for the combination forecasts are encouraging and suggest that, taken together, leading economic indicators did provide some warning of the economic difficulties of 2001.

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Table 1. Median Forecasts of the Percentage Growth in Quarterly GDP from the Survey of Professional Forecasters

		Forecasts made in:							
		2000				2001			
Quarter	Actual growth	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
‘00Q4	1.1	2.9	3.1	3.2	3.2				
‘01Q1	-0.6	2.8	2.6	3.0	3.3	0.8			
‘01Q2	-1.6		2.9	2.7	3.2	2.2	1.2		
‘01Q3	-0.3			3.2	3.3	3.3	2.0	1.2	
‘01Q4	2.7				3.2	3.7	2.6	2.8	-1.9
‘02Q1	5.0					3.7	3.1	2.7	0.1
‘02Q2	1.3						3.6	3.0	2.4
‘02Q3	4.0							3.9	3.6

Notes: Entries are quarterly percentage growth rates of real GDP, at an annual rate. Actual GDP growth is from Dec. 20, 2002 GDP release by the Bureau of Economic Analysis. Forecasts are the median forecast from the Philadelphia Federal Reserve Bank’s Survey of Professional Forecasters (various issues; see www.phil.frb.org/econ/spf).

Table 2. Probabilities of a Quarterly Decline in Real GDP from the Survey of Professional Forecasters

		Forecasts made in:							
		2000				2001			
Quarter	Actual growth	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
‘00Q4	1.1	13%	9%	7%	4%				
‘01Q1	-0.6	17	15	13	11	37%			
‘01Q2	-1.6		18	16	17	32	32%		
‘01Q3	-0.3			17	19	23	29	35%	
‘01Q4	2.7				19	18	23	26	82%
‘02Q1	5.0					13	18	20	49
‘02Q2	1.3						13	16	27
‘02Q3	4.0							15	18

Forecast entries are the probability that real GDP growth will be negative, averaged across SPF forecasters. See the notes to Table 1.

Table 3. Relative MSFEs of Individual Indicator Forecasts of U.S. Output Growth, 1999:I – 2002:III

Predictor	Transformation	GDP		IP	
		h = 2	*h* = 4	*h* = 2	*h* = 4
		Root Mean Square Forecast Error			
Univariate Autoregression		2.06	2.03	4.34	4.92
Predictor		*MSFE Relative to Univariate AR Model*			
random walk	level	1.26	1.11	1.56	1.17
Interest Rates					
federal funds	Δ	1.01	0.71	0.97	0.78
90-day T-bill	Δ	1.01	0.76	1.02	0.88
1-year T-bond	Δ	1.17	0.96	1.22	1.06
5-year T-bond	Δ	1.37	1.24	1.38	1.23
10-year T-bond	Δ	1.36	1.26	1.21	1.23
Spreads					
term spread (10year – Fed. Funds)*	level	0.86	0.65	0.77	0.72
term spread (10 year – 90-day T-bill)	level	0.87	0.62	0.70	0.62
paper-bill spread (comm. paper – T-bill)	level	1.31	1.17	1.96	1.43
high yield spread (high yield – AAA corp)	level	0.76	0.65	0.67	0.58
Other Financial Variables					
exchange rate	Δln	0.85	0.87	0.85	0.80
stock prices*	Δln	0.83	0.93	0.64	0.71
Output					
real GDP	Δln			0.92	0.96
IP – total	Δln	0.98	1.01		
IP – products	Δln	1.03	0.99	1.03	0.96
IP – business equipment	Δln	1.00	1.01	1.05	1.06
IP – intermediate products	Δln	0.89	0.90	0.89	0.88
IP – materials	Δln	0.97	1.01	1.04	0.98
capacity utilization rate	level	0.91	1.01	0.85	1.03
Labor Market					
employment	Δln	0.96	1.00	0.96	0.99
unemployment rate	Δ	1.24	1.08	1.31	1.09
average weekly hours in manufacturing*	level	0.87	0.75	0.72	0.87
new claims for unemployment insurance*	Δln	0.75	0.84	0.74	0.81
Other Leading Indicators					
building permits*	Δln	1.30	1.07	1.52	1.14
vendor performance*	level	1.02	0.97	1.19	0.97
orders – consumer goods and materials*	Δln	0.77	0.83	0.81	0.83
orders – nondefense capital goods*	Δln	1.02	1.03	0.92	1.09
consumer expectations (Michigan)*	level	1.96	2.14	1.33	1.49
Prices and Wages					
GDP deflator	Δ^2ln	1.00	0.94	0.94	0.84
PCE deflator	Δ^2ln	1.01	1.05	0.99	0.99
PPI	Δ^2ln	1.01	1.02	0.96	0.99
earnings	Δ^2ln	1.00	1.01	0.89	0.98
real oil price	Δ^2ln	1.13	1.18	1.07	1.11
real commodity price	Δ^2ln	1.04	1.00	1.12	1.09

Money					
real M0	Δln	2.13	2.84	1.41	1.73
real M1	Δln	1.09	1.07	1.57	1.12
real M2*	Δln	2.06	1.82	2.13	1.94
real M3	Δln	1.81	2.23	2.05	2.15

Notes: The entry in the first line is the MSFE of the AR forecast, in percentage growth rates at an annual rate, and the final row gives the number of out-of-sample periods. The remaining entries are the MSFE of the forecast based on the individual indicator, relative to the MSFE of the benchmark AR forecast. The first forecast is made using data through 1999:I, the final forecast period ends at 2000:III. The second column provides the transformation applied to the leading indicator to make the forecast, for example, for the federal funds rate forecasts, X_t in (1) is the first difference of the federal funds rate. *Included in The Conference Board's Index of Leading Indicators.

Table 4. Relative MSFEs of Simple Combination Forecasts, 1999:I – 2002:III

Combination Forecast Method	GDP		IP	
	***h* = 2**	***h* = 4**	***h* = 2**	***h* = 4**
Based on all indicators:				
mean	0.95	0.94	0.95	0.95
median	0.96	0.95	0.97	0.95
inverse MSFE weights	0.97	0.98	0.95	0.96
***Excluding money*:**				
mean	0.94	0.91	0.91	0.92
median	0.96	0.94	0.92	0.94
inverse MSFE weights	0.96	0.95	0.93	0.94

Notes: Entries are the relative MSFEs of combination forecasts constructed using the full set of leading indicator forecasts in Table 3 (first three rows) and using the subset that excludes monetary aggregates (final three rows).

Figure 1
Coincident Indicators

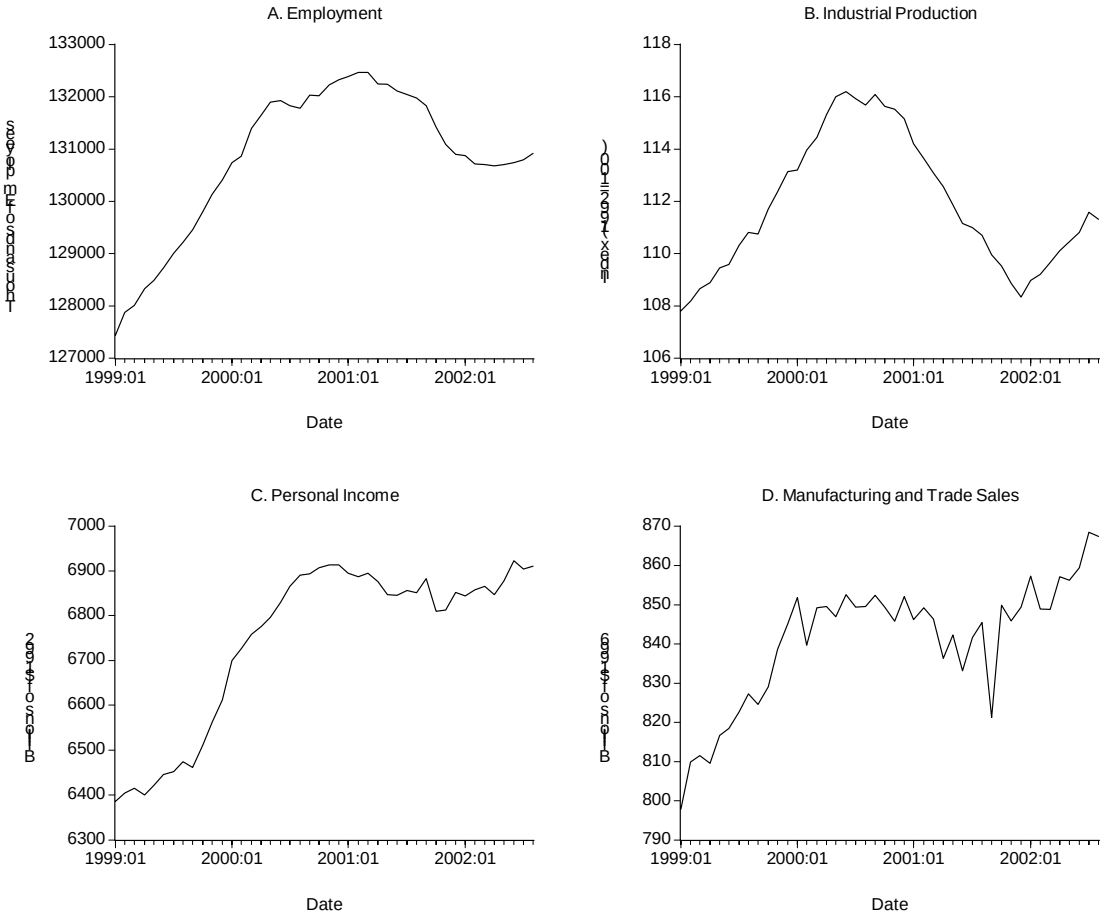


Figure 2
Concidient Indicators (Growth Rates, PAAR)

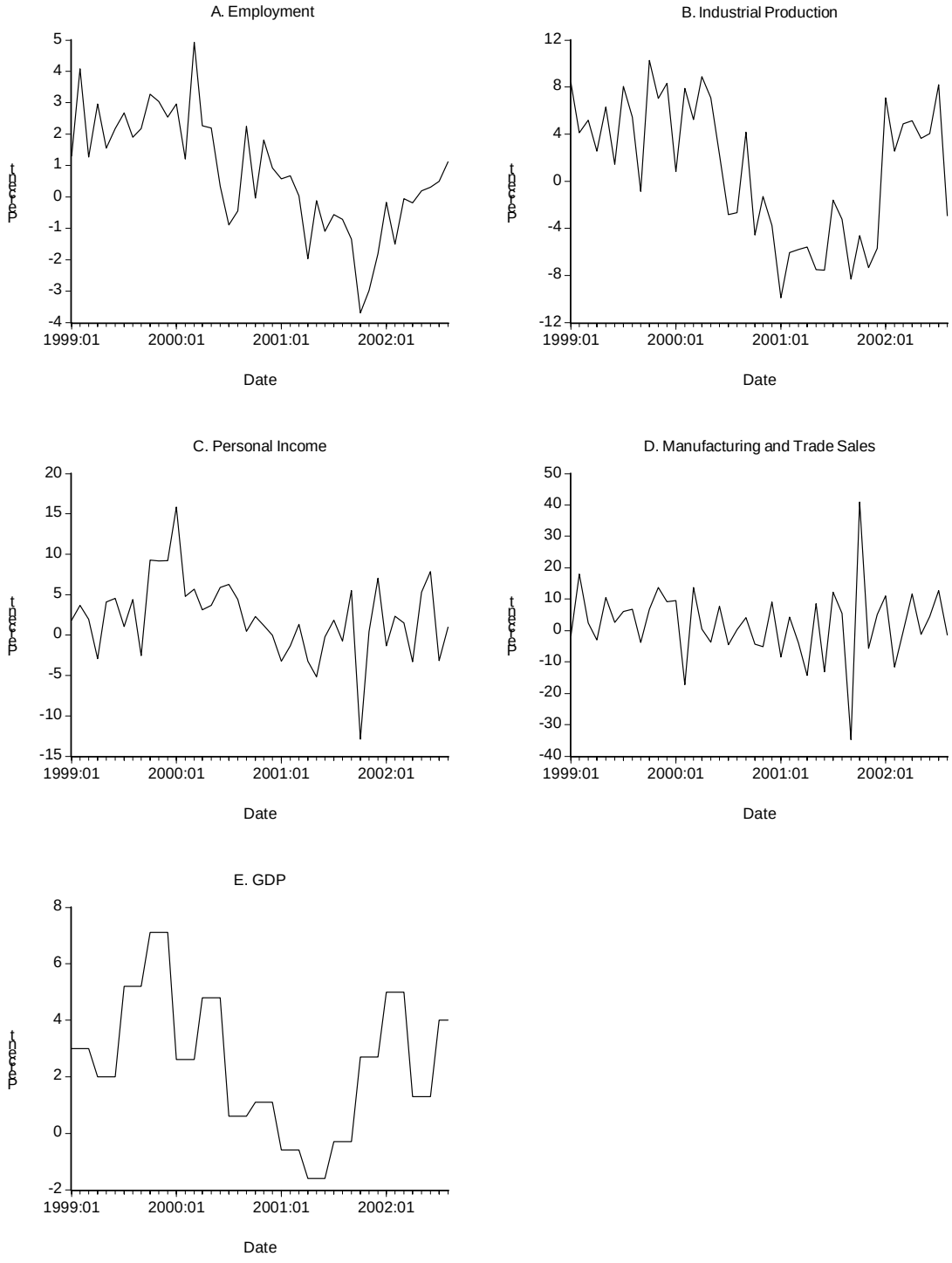
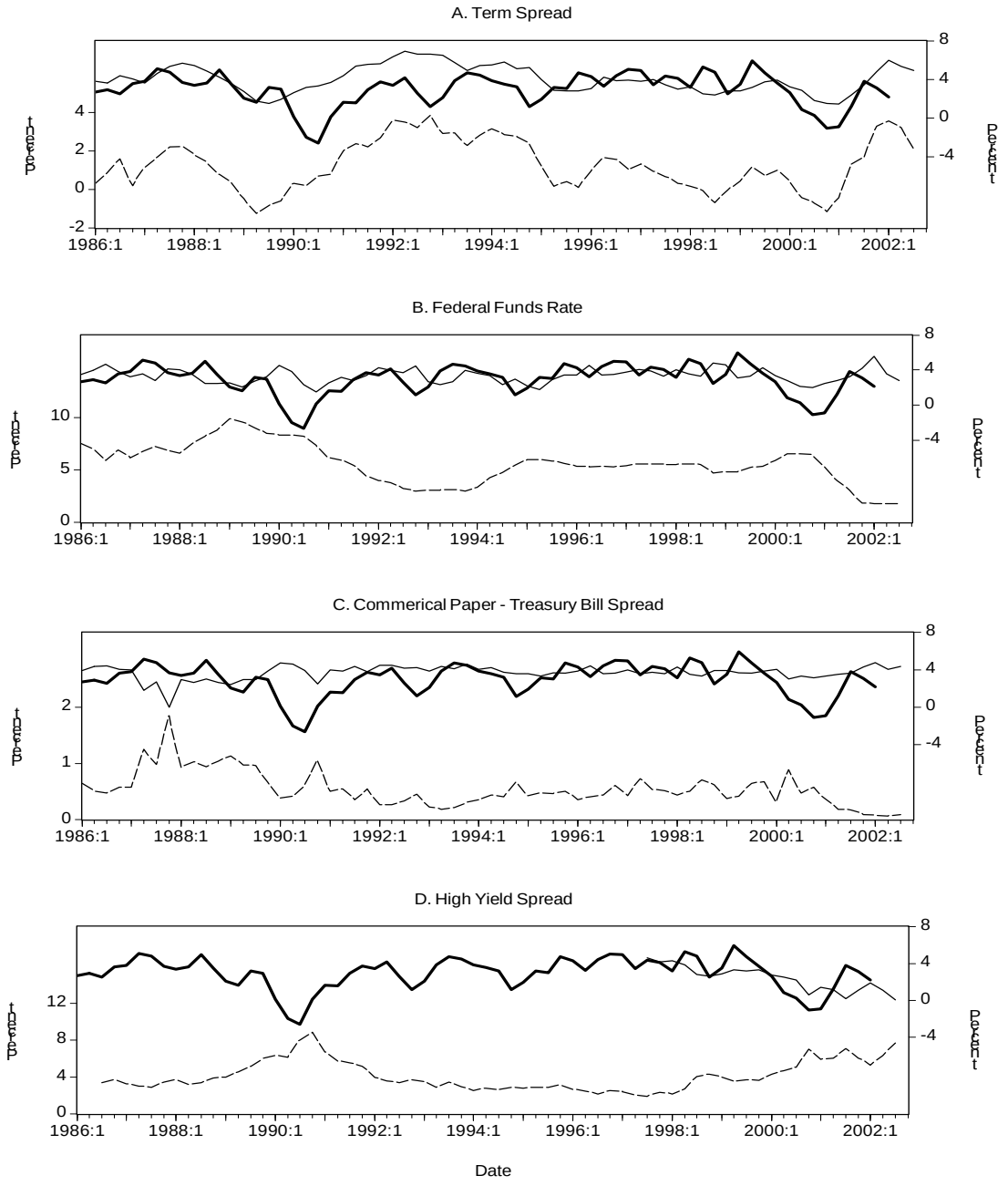


Figure 3
Various Leading Indicators from 1986 to 2002,Two-Quarter Growth in Real GDP, and its Leading-Indicator Based Forecast



Note: The solid lines are the actual two-quarter GDP growth (thick line) and its indicator-based forecast (thin line), where the dates correspond to the date of the forecast . The dashed line is the historical values of the indicator itself . The scale for the solid lines is given on the right axis and the scale for the dashed line is given on the left axis.

Figure 3 (Continued)

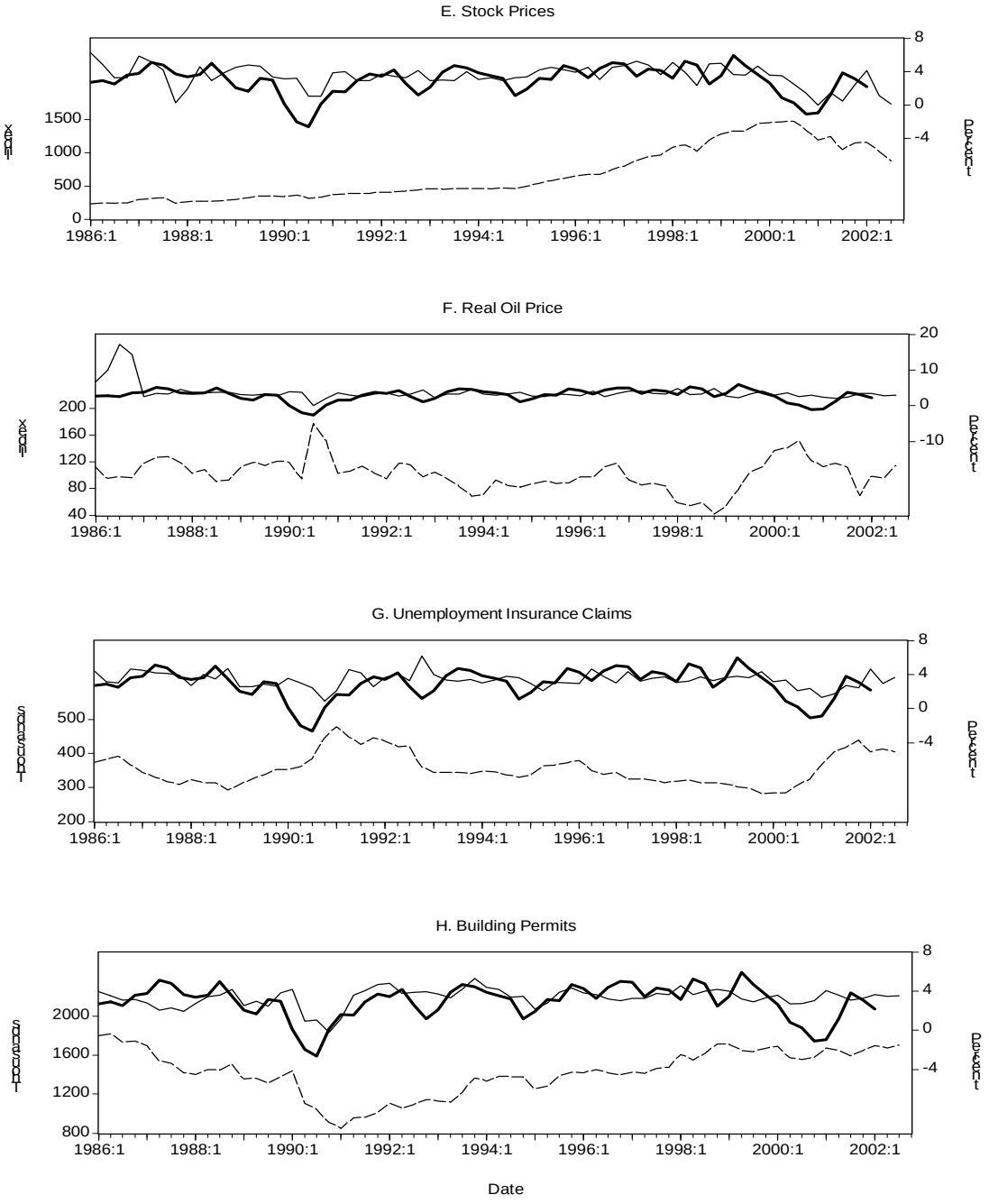


Figure 3 (Continued)