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# Business Cycle Indicators and Composite Indexes

## International Workshop on Leading Indicators for Short Term Economic Analysis in Andalusia

Seville

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# Overview:

- What is The Conference Board and what does it do?
- Economic indicator programs
- U.S. and global business cycle indicators program
- Real time indicators: timeliness and evaluating the indicators in real time
- Business Cycles in the Euro Area and leading indicators

# Economic Indicators at The Conference Board

- Long tradition of economic measurement work
- Wide-range of indicators
  - ◆ Consumer Confidence Index<sup>®</sup>
  - ◆ The Conference Board Leading Economic Index<sup>™</sup>
  - ◆ Help-wanted: print and online
  - ◆ Business confidence
  - ◆ Employment Trends Index (ETI)<sup>™</sup>
  - ◆ Total Economy Database: Productivity and per capita income levels and growth rates globally

# U.S. Business Cycle Indicators Program

- Transfer from BEA 1996
- Advisory board
- Evaluation and updating composite indicators, 1996
- “Real” time analytic and production goals
- Introduction of statistical imputation
- Introduction of indexes for 10 countries and regions
- [www.conference-board.org/economics/bci](http://www.conference-board.org/economics/bci)

# Global Business Cycle Indicators

- Modeled after U.S. system of *monthly* indicators
- Economic theory informs selection of indicators, but country specific features influence choice
- Objectivity, consistency, and reliability
- Composite indexes bring cycles and turning points into focus
- Used in defining business cycles and anticipating turning points in business cycles
- Help in forecasting and economic outlook

# Producing Global Indicators

- Monthly releases for each country follow pre-announced release schedules
- Data revisions incorporated only for last six months of data
- Annual benchmark revisions bring history of indexes up to date with revisions in the history of indicator series
- Occasional comprehensive revisions

# A Synopsis of Selected Business Cycle Theories

Type of Theory	Main Factors		Most sensitive Processes	Are Cycles Linked to Growth?	Special Features	Authors & Dates
	Originating	Responsive				
<i>I. Some Largely Endogenous Theories</i>						
Monetary disequilibrium	Unstable flow of money (bank credit)	Interest rate changes; cycles of inflation and deflation	Investment in traders inventories	No	Cycles tend to be periodic under the gold standard	Hawtrey 1913 - 37
Monetary overinvestment	Unstable supply of bank credit	Discrepancy between the natural and money interest rates	Capital investment, production processes	No or weakly	Real vertical maladjustments result from monetary disequilibria	Hayek 1931 - 39
Cyclical real growth	Burst of innovation contested by imitators	Credit financing; excesses of speculation and misjudgement	Business capital investment booms and readjustments in contractions	Yes	Simultaneous interacting long, intermediate, and short cycles	Schumpeter 1912 - 39
<i>II. Some Theories with Major Exogenous and Stochastic Elements</i>						
Impulse and propagation in a real model	Undefined erratic shocks and discontinuous Schumpeterian innovations	Investment accelerator, lags in output of capital goods, money demand and imperfectly elastic supply	Capital-goods production, but the system as a whole is damped (dynamically stable)	Yes (through innovations)	Random shocks or innovations bunched in expansions needed to maintain oscillations	Frisch 1933
The original monetarist theory	Sequential shocks: high monetary growth rates followed by low rates, etc.	Relative prices and asset yields, then spending flows	Both consumption and investment react to monetary changes	No	Monetary policies destabilize the private sector	Friedman and Schwartz 1963a, 1963b
Market clearing with rational expectations and incomplete information	Random monetary shocks causing price-level variations	General price changes misperceived for relative price changes; intertemporal substitution of labor and leisure	Prompt and strong reactions to perceived changes in relative prices or real rates of return on the supply side	No	Flexible prices and wages clear markets continuously; money and price surprises cause fluctuations in output and investment	Lucas 1977
A disequilibrium theory of investment and financial instability (largely endogenous)	Unstable expected profits drive business investment, which generates fluctuations in realized profits	Money created by bank lending to business; short-term financing of long-term investment	Relative prices of capital assets set in financial markets under uncertainty about future returns, costs of capital, and cash flows	Yes	Long expansions produce over-confidence, unsound financing practices, a growing debt burden and illiquidity...sources of contractions and crises	Minsky 1982

# Typical leads and lags among major economic indicators

Leading	Roughly Coincident	Lagging
<b><i>I. Investment in Fixed Capital and Inventories</i></b>		
New building permits; housing starts; residential fixed investment	Production of business equip.	Backlog of capital appropriations, mfg.*
New business formation	Machinery and equip. sales*	Business expenditures for new plant and equip.*
New capital appropriations, mfg.*; contracts and orders for plant and equip.		Mfg. and trade inventories
Change in business inventories		
<b><i>II. Consumption, Trade, Orders, and Deliveries</i></b>		
New orders for consumer goods and materials	Production of consumer goods	
Change in unfilled orders, durable goods*	Mfg. and trade sales	
Vendor performance (speed of deliveries)		
Index of consumer sentiment		
<b><i>III. Employment, Production, and Income</i></b>		
Average workweek; overtime hours (mfg.)	Nonagricultural employment	Average duration of unemployment
Accession rate; layoff rate (mfg.)	Unemployment rate	Long-term unemployment
New unemployment insurance claims	GNP; personal income	
Productivity (output per hour)	Industrial production, total	
Rate of capacity utilization (mfg. mtl.)		
<b><i>IV. Prices, Costs, and Profits</i></b>		
Bond Prices*		Unit labor costs
Stock prices*		Labor share in national income
Sensitive materials prices*		
Profit margins		
Total corporate profits; net cash flows		
<b><i>V. Money, Credit, and Interest</i></b>		
Monetary growth rates*	Velocity of money	Short-term interest rates*
Change in liquid assets*		Bond yields*
Change in consumer credit*		Consumer credit outstanding*
Total private borrowing*		Commercial and industrial loans outstanding
Real money supply		

Note: Series marked \* are nominal terms. All other series are in real terms or related indexes and ratio numbers.

Abbreviations: mfg. = manufacturing; mtl. = materials; equip. = equipment





# Coincident Economic Index (CEI) helps define business cycles;

# Leading Economic Index (LEI) helps predict turning points in the business cycle.

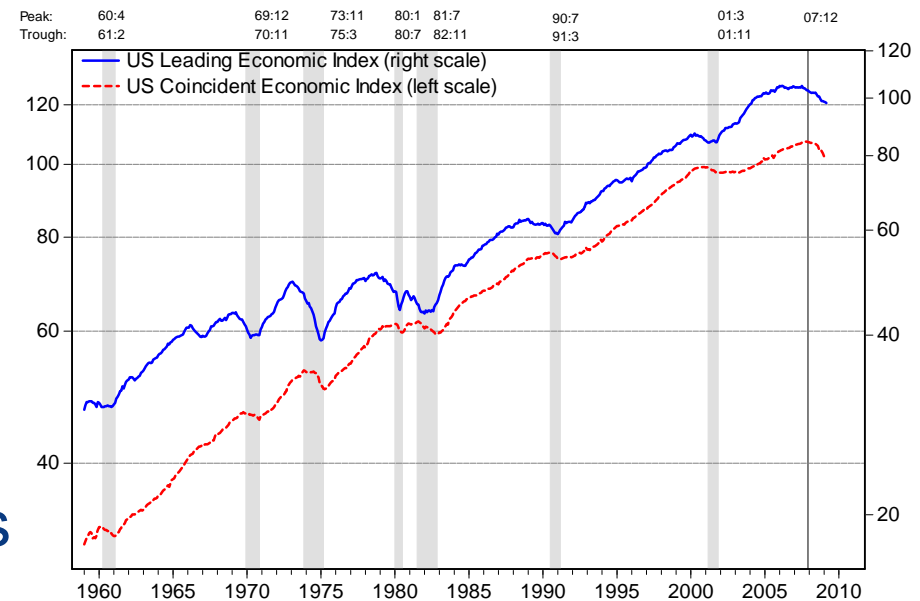
## Coincident Indicators:

Employment

Personal Income

Manufacturing and Trade Sales

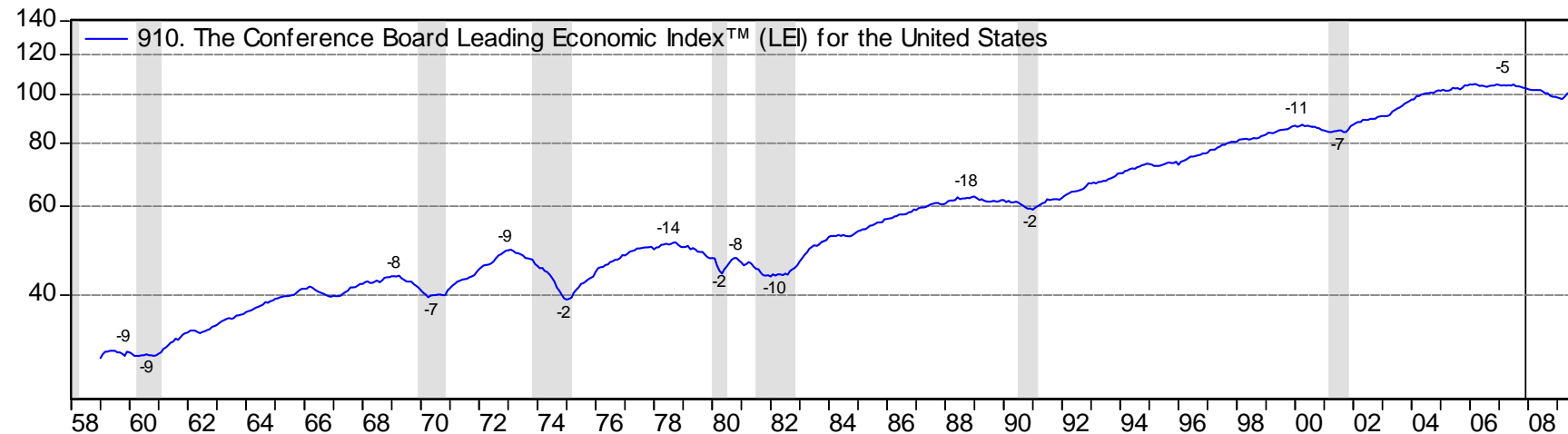
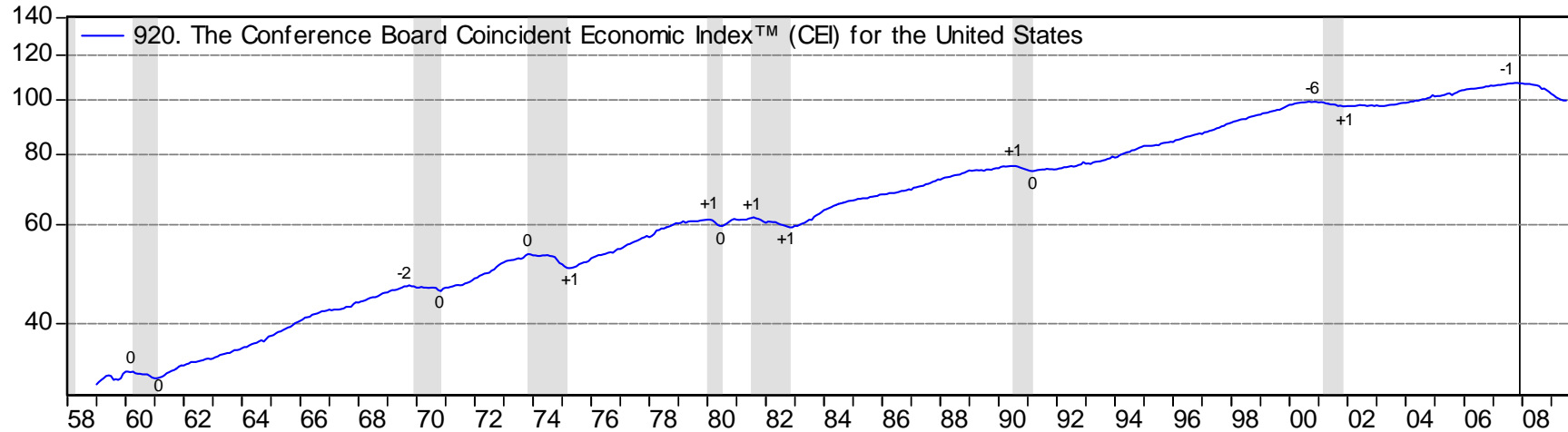
Industrial Production



Note: Shaded areas represent recessions as determined by the NBER Business Cycle Dating Committee.

# CEI and LEI for the United States

Dec. '07



Source: Business Cycle Indicators



# Data needs and timeliness issues

- Historical data required for selection and construction of indexes
- Monthly, seasonally adjusted, and deflated
- Timely data required for real time monitoring
- Dealing with publication lags

# New procedure uses available data more efficiently

	Old March release:	New March release:
	January (t-2)	February (t-1)
Average Weekly Hours, Mfg.	<b>Yes</b>	<b>Yes</b>
Initial Claims, Unemp. Insurance (Inverted)	<b>Yes</b>	<b>Yes</b>
Manufacturers' new orders, consumer goods & materials*	<b>Yes</b>	<b>No</b>
Suppliers' Deliveries Index	<b>Yes</b>	<b>Yes</b>
Manufacturers' new orders, nondefense capital goods*	<b>Yes</b>	<b>No</b>
Building Permits, Private Housing	<b>Yes</b>	<b>Yes</b>
Stock Prices, 500 Common Stocks	<b>Yes</b>	<b>Yes</b>
Money Supply, M2 in 2000 Dollars*	<b>Yes</b>	<b>No</b>
Interest rate spread	<b>Yes</b>	<b>Yes</b>
Index of Consumer Expectations	<b>Yes</b>	<b>Yes</b>

# Dealing with publication lags

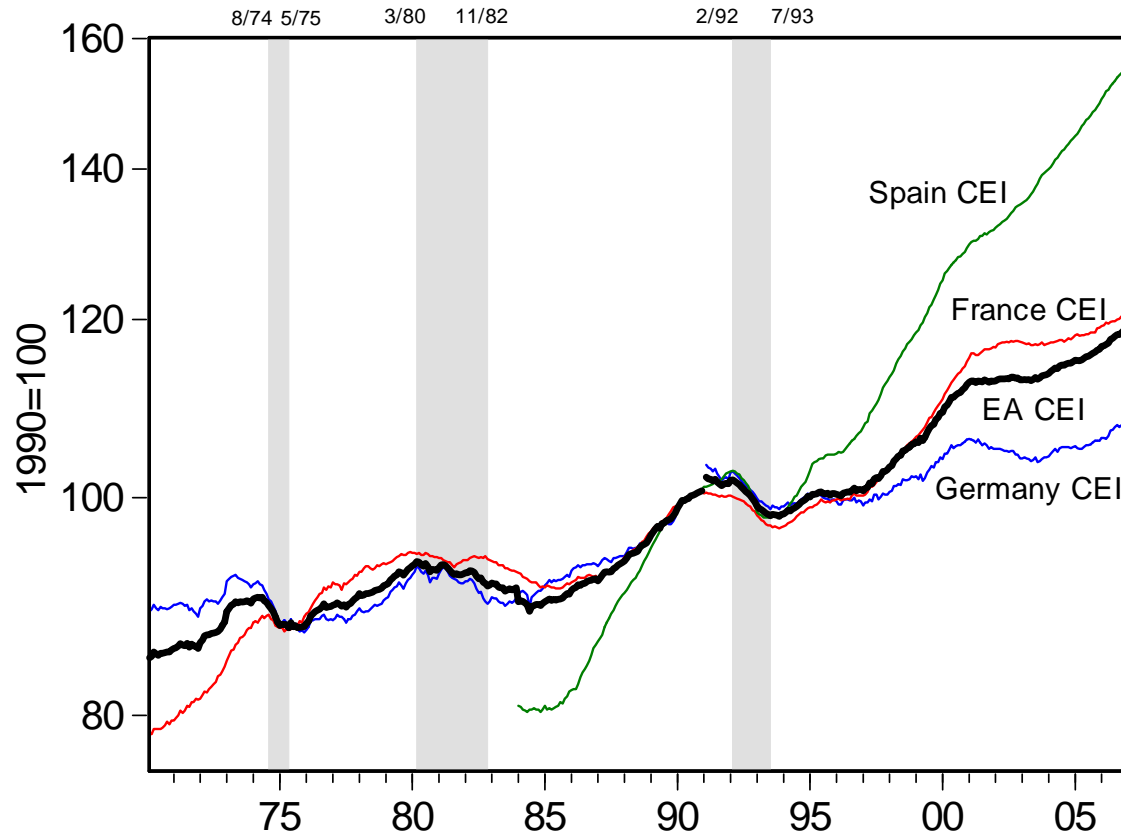
- New procedure uses available data more efficiently
- Combines forecasts and actual observations
- U.S. LEI released *at least two weeks earlier*
- Procedure makes monthly indexes possible outside U.S
- Euro Area LEI schedule can be made similar to the U.S. LEI schedule
- But, not possible elsewhere due to lack of timely high frequency data

# Business Cycles in the Euro Area and Leading Indicators

# Potential LEI components for the Euro Area

Indicator:	Source:	Beginning Date:
Economic Sentiment Index	European Commission	1985
Index of Housing Permits Granted (sq. meters)	Eurostat	1995
Index of Capital Goods New Orders	Eurostat	1996
Eurostoxx stock price index	Dow Jones	1987
Real M2	ECB	1980
German 10 Year bond yield – 3 mo. Fidor yield	Bundesbank	Jan. 1965
10 Year ECB benchmark bond - 3M Euribor Rate	ECB	Jan. 1994
10 Year ECB benchmark bond - ECB Minimum Bid rate	ECB	Jul. 2000
Manufacturing Purchasing Managers' Index, PMI	Markit	1998
Business Expectations for Services	Markit	1998
HWWA Commodities Price Index	HWWI	1978
Index of Euro Area exports	Eurostat	1995
Oil Imports of the Euro Area	Eurostat	1990
Real M3	ECB	1970

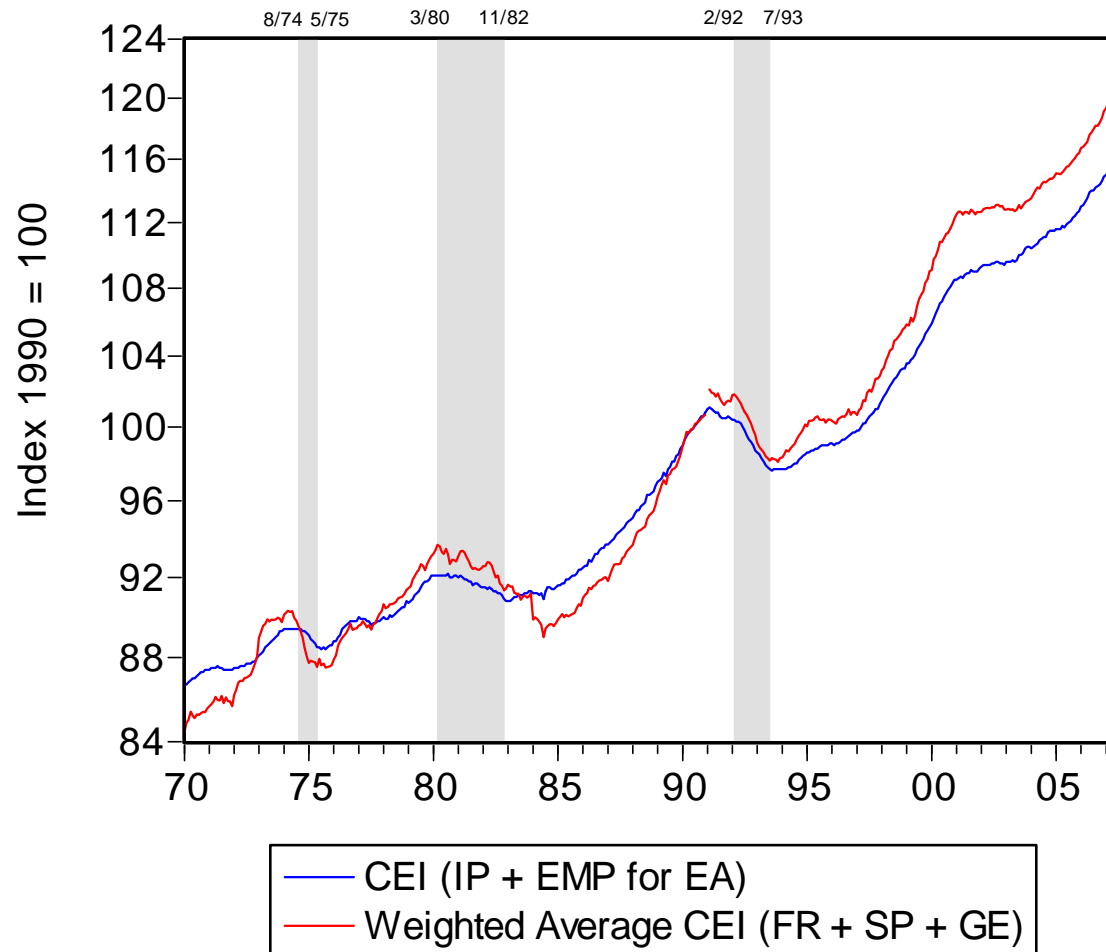
# Coincident indexes for France, Germany, Spain and the Euro Area (1970-2006)



Note: Shaded areas represent B.C. Recessions as determined by TCB based on CEI+GDP for Euro Area  
 Euro Area CEI is a weighted average of Spain, France and Germany CEI



# Comparison of Euro Area CEI with a weighted average of CEIs for France, Germany and Spain



Note: Index of weighted average of FR, GE and SP CEI is based on GDP shares in 2000.

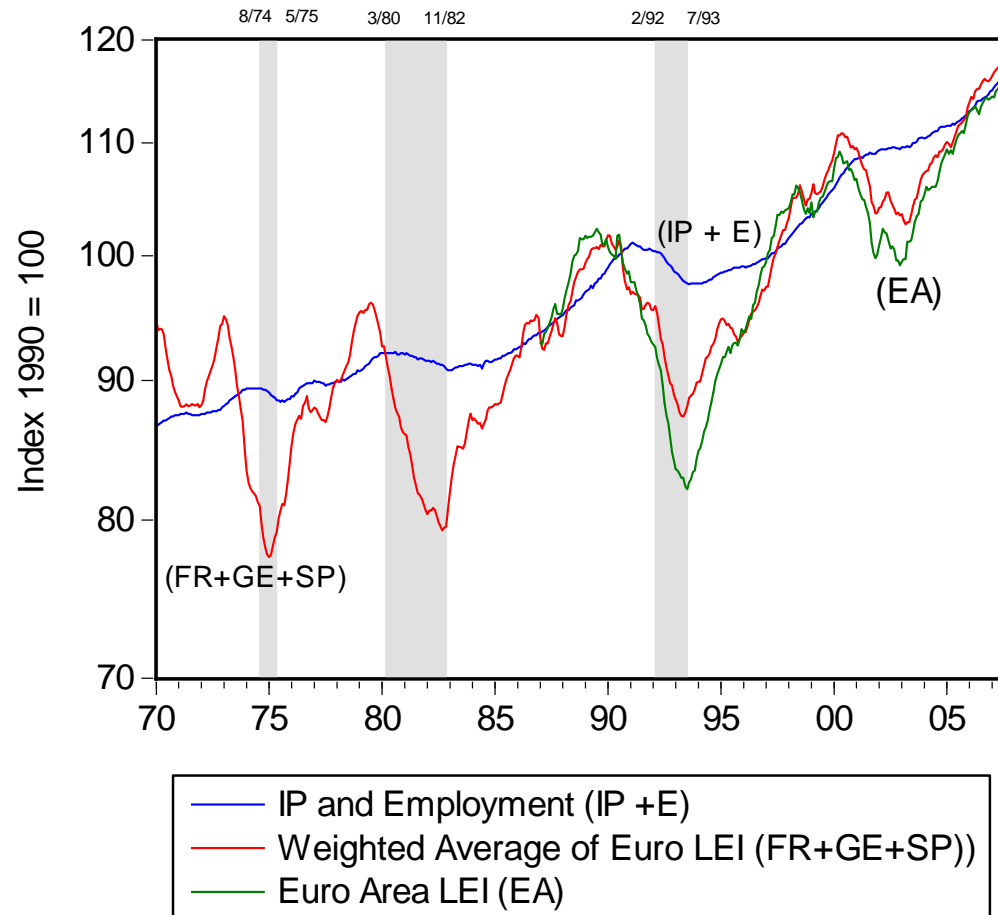
# Alternative Business Cycle Chronologies (1970 - 2007)

Line	Business Cycle	TCB Indicators Approach	CEPR Quarterly	OECD Approaches	FHM-AWM	BDH-2001
1	Peak	August 1974	Q3 1974 (0)	Aug. 1974 (0)	Aug. 1974 (0)	n.a.
2	Trough	May 1975	Q1 1975 (-3)	May 1975 (0)	Feb. 1975 (-3)	n.a.
3	Peak	March 1980	Q1 1980 (-1)	n.m.	Feb. 1980 (-1)	Feb 1980 (-1)
4	Trough	November 1982	Q3 1982 (0)	n.m.	Feb. 1981 (-21)	Oct. 1980 (-25)
5	Peak	February 1992	Q1 1992 (0)	Feb. 1992 (0)	Feb. 1992 (0)	May 1992 (+3)
6	Trough	July 1993	Q3 1993 (+1)	Feb. 1993 (-5)	Feb. 1993 (-5)	May 1993 (-2)

# Components of the LEI for the Euro Area

Indicator:	Source:	Beginning Date:
Economic Sentiment Index	European Commission	1985 -
Index of Housing Permits Granted (sq. meters)	Eurostat	1995 -
Index of Capital Goods New Orders	Eurostat	1996 -
Eurostoxx stock price index	Dow Jones	1987 -
Real M2	ECB	1980 -
10 Year ECB benchmark bond - ECB Minimum Bid rate	ECB	Jul. 2000 -
Manufacturing Purchasing Managers' Index, PMI	Markit	1998 -
Business Expectations for Services	Markit	1998 -

# Comparison of coincident index (IP + E), Euro Area LEI and Weighted Average of LEIs for France, Germany and Spain (1970-2007)



# Cyclical Timing for Euro LEI and Composite LEI

Turning Points for Euro Area Business Cycles (Only those 1970-2005)	LEI Standard Eight Components Since 1987	Composite LEI France, Spain, Germany Since 1970
<b>Timing at Business Cycle Peaks</b>		
Aug-74	NA	-19
Feb-80	NA	-8
Feb-92	-31	-25
Extra Turns	2	3
Missed Turns	0	0
Mean	-31.00	-17.33
Median	-31.00	-19.00
St. Deviation	17.90	8.62
<b>Timing at Business Cycle Troughs</b>		
May-75	NA	-4
Nov-82	NA	-2
Jul-93	0	-2
Extra Turns	2	4
Missed Turns	0	0
Mean	0.00	-2.67
Median	0.00	-2.00
St. Deviation	0.00	1.15
<b>Combined Statistics</b>		
Mean	-15.50	-10.00
Median	-15.50	-6.00
St. Deviation	12.66	9.74

NA: Data not available for index at the time of Euro Area peak or trough

NM: Peaks and troughs for index did not occur at or near time of the Euro Area peak or trough

# Evaluating the LEI in real time

Table 4: Pseudo Vintages of the Coincident Index (I), 2002 – 2007\*

Vintage: Date	January '02	February '02	March '02	April '02 – September '07	October '07	November '07	December '07
	_1 (1)	_2 (2)	_3 (3)	_4 - _69 (4)	_70 (5)	_71 (6)	_72 (7)
Jan-87	93.7	93.7	93.7	...	93.7	93.7	93.7
Feb-87	93.8	93.8	93.8	...	93.8	93.8	93.8
Mar-87	93.9	93.9	93.9	...	93.9	93.9	93.9
...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...
Oct-01	109.7	109.6	109.6	...	...	...	...
Nov-01	109.8	109.7	109.7	...	...	...	...
Dec-01	110.0	109.8	109.8	...	...	...	...
Jan-02	110.1	109.8	109.9	...	...	...	...
Feb-02	---	109.9	110.0	...	...	...	...
Mar-02	---	---	110.1	...	...	...	...
Apr-02	---	---	---	...	...	...	...
May-02	---	---	---	...	...	...	...
...	---	---	---	...	...	...	...
...	---	---	---	...	...	...	...
Jul-07	---	---	---	...	117.9	117.9	117.9
Aug-07	---	---	---	...	118.2	118.1	118.1
Sep-07	---	---	---	...	118.2	118.1	118.1
Oct-07	---	---	---	...	118.4	118.3	118.3
Nov-07	---	---	---	...	---	118.4	118.3
Dec-07	---	---	---	...	---	---	118.5

\* Each consecutive column adds one more month's observation. The first pseudo vintage (Jan. '02 vintage) contains data from Jan. '87 to Jan. '02. The next pseudo vintage (in the second column) contains data through February 2002, and so on, until December 2007 (the last column). Hence, there are 72 pseudo vintages of component data in our dataset, each vintage starting in January 1987. In the table "..." denotes skipped rows and columns, and "---" denotes data unavailable to the real time forecaster beyond the end of the sample. By construction, the histories of each pseudo vintage for and LEI are almost identical except for the last few months where data gaps in components have been filled in by forecasts.

# How well does the new procedure work?

- More timely LEI adds forecast value
- But, historical versus real time differences are small and random for similar forecast periods
- Timelier procedure improves forecast ability in out-of-sample tests
- Compared to an autoregressive benchmark:
  - ◆ Out-of-sample forecast improvement of up to 12 % with the more timely U.S. LEI (McGuckin, Ozyildirim, and Zarnowitz, 2007)
  - ◆ Up to 8 % out-of-sample forecast improvement with the more timely Euro Area LEI (Ozyildirim, Schaitkin, and Zarnowitz, 2009)

# Reductions in Root Mean Squared Error

Table 5

Percent Improvements in Forecasting Performance when Alternative Models Are Used instead of Benchmark Models (2002-2007)

Number of Lags	Deviation from Trend		Six-Month Log Differences	
	MAD	RMSE	MAD	RMSE
(1)	(2)	(3)	(4)	(5)
<b>One-Month Ahead Forecasts</b>				
Fixed (6)	-4.647	-4.067	-1.929	-1.454
AIC	-4.569	-3.879	-1.929	-1.454
SIC	-3.552	-2.885	-1.929	-1.454
<b>Three-Month Ahead Forecasts</b>				
Fixed (6)	-8.367	-8.089	-5.079	-4.223
AIC	-7.820	-7.577	-3.718	-3.473
SIC	-8.077	-7.874	-3.673	-3.638
<b>Six-Month Ahead Forecasts</b>				
Fixed (6)	-15.963	-17.178	-4.389	-4.110
AIC	-14.548	-15.948	0.122	0.210
SIC	-12.616	-13.726	1.134	0.620

Notes: \*Benchmark model denotes autoregression with CEI lags on the right-hand side.

Alternative model adds lags of LEI to the benchmark model.

The values in the table are  $100 \times (\text{RMSE from the benchmark model} / \text{the RMSE from the alternative model} - 1)$ .

Negative values indicate a reduction in forecast errors in the alternative model and an improvement in forecast performance.



# Reductions in Root Mean Squared Error are Statistically Significant

Table 6

Forecasting CEI with LEI: Summary of test statistics in forecast performance comparisons of the Benchmark and Alternative Models (2002-07)					
Number of Lags	Deviation from Trend		Six Month Log-differences		
	DM Statistic	CCS Statistic	DM Statistic	CCS Statistic	
(1)	(2)	(3)	(4)	(5)	
<b>One-Month Ahead Forecasts</b>					
Fixed (6)	2.975 <b>(0.001)</b>	45.637 <b>(0.000)</b>	1.621 <i>(0.052)</i>	21.851 <b>(0.001)</b>	
AIC	3.251 <b>(0.001)</b>	39.227 <b>(0.000)</b>	1.621 <i>(0.052)</i>	21.851 <b>(0.001)</b>	
SIC	3.051 <b>(0.001)</b>	2.128 <i>(0.145)</i>	1.621 <i>(0.052)</i>	21.851 <b>(0.001)</b>	
<b>Three-Month Ahead Forecasts</b>					
Fixed (6)	2.989 <b>(0.001)</b>	24.751 <b>(0.000)</b>	2.294 <b>(0.011)</b>	7.195 <i>(0.066)</i>	
AIC	2.900 <b>(0.002)</b>	48.128 <b>(0.000)</b>	1.950 <b>(0.026)</b>	16.243 <b>(0.023)</b>	
SIC	2.908 <b>(0.002)</b>	47.843 <b>(0.000)</b>	2.076 <b>(0.019)</b>	16.844 <b>(0.018)</b>	
<b>Six-Month Ahead Forecasts</b>					
Fixed (6)	2.640 <b>(0.004)</b>	37.097 <b>(0.000)</b>	1.952 <b>(0.025)</b>	9.669 <i>(0.139)</i>	
AIC	2.628 <b>(0.004)</b>	41.975 <b>(0.000)</b>	-0.194 <i>(0.423)</i>	16.621 <b>(0.020)</b>	
SIC	2.414 <b>(0.008)</b>	37.203 <b>(0.000)</b>	-0.775 <i>(0.219)</i>	21.239 <b>(0.002)</b>	

Notes: \*Benchmark model denotes autoregression with CEI lags on the right-hand side.

Alternative model adds lags of LEI to the benchmark model.

Bolded values under the test statistics in parentheses are p-values signifying that the null hypothesis (that the benchmark and alternative models have equal predictive ability) can be rejected at 5% level of significance.

Values under test statistics in *italics* indicate that the null hypothesis can be rejected at the 10% level of significance.



# Discussion

- Timelier procedure generates forecast gains
- Procedure makes monthly indexes possible outside U.S.
- LEI is a useful tool for predicting and assessing business cycles in real time

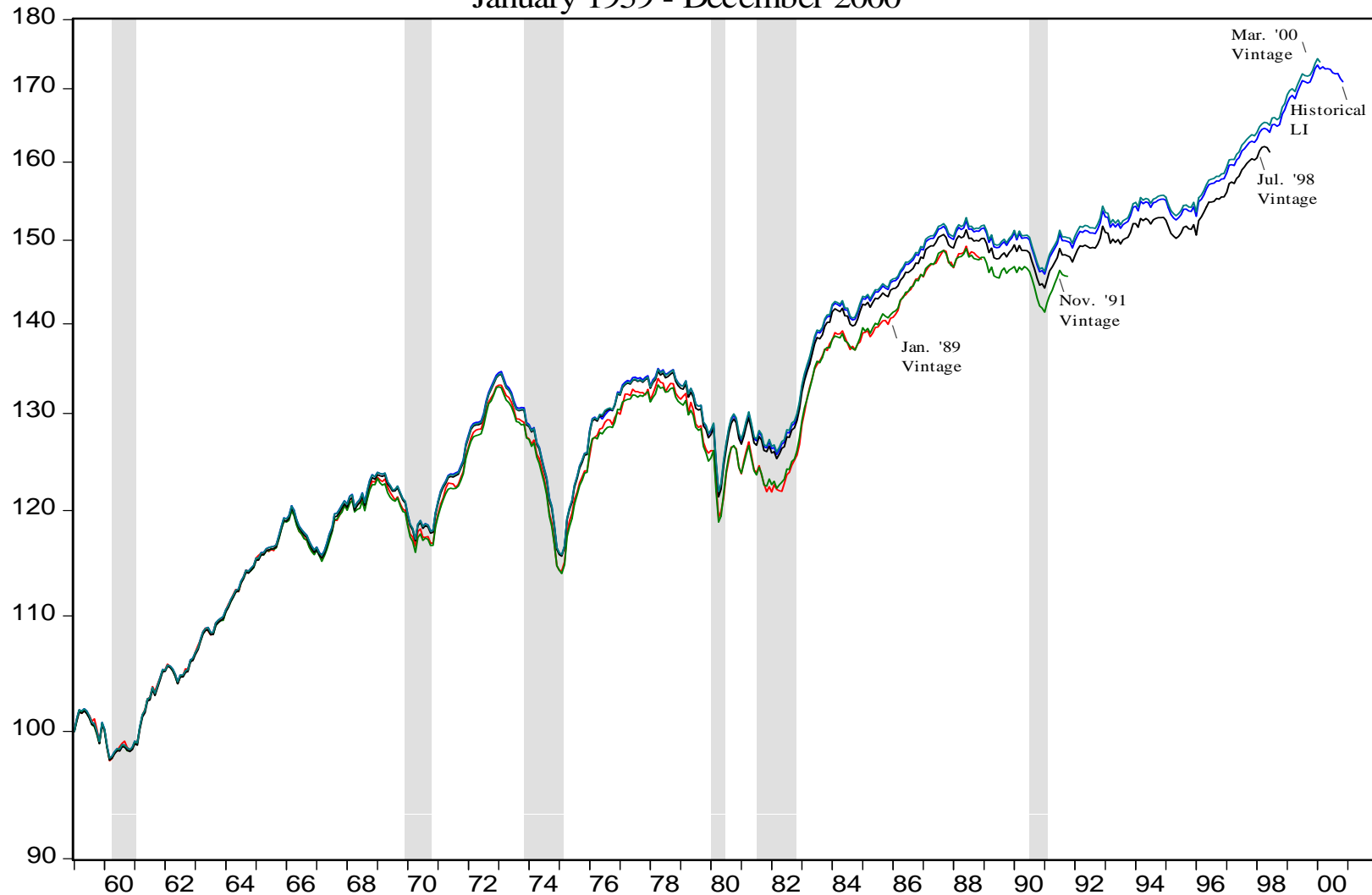
# Appendix

# Real-Time Out-of-Sample Tests

- Successive LEI vintages are different because of
  - Data revisions
  - Changes in composition of LEI
- Composition-constant versions of the LEI vintages necessary for measuring gain from timeliness
- True real-time tests use “as-published” data (composition-changing)
- Pseudo real-time tests use a rolling window through the sample

# Historical and Selected Vintages of LEI

Chart 1: Historical LI (as of January 2001) and Selected Vintages of the New Leading Index  
January 1959 - December 2000





# Out-of-sample Forecasting with the LEI

$$\text{EQ (1)} \quad \Delta_j CI_t = \beta_0 + \sum_{i=1}^k \beta_i \Delta_j CI_{t-i} + \varepsilon_t$$

$$\text{EQ (2)} \quad \Delta_j CI_t = \beta_0 + \sum_{i=1}^k \beta_i \Delta_j CI_{t-i} + \sum_{i=1}^k \delta_i \Delta_j LI_{t-i} + \varepsilon_t$$

$CI_t$  = Coincident Index

$LI_t$  = Leading Index

$\Delta_j$  = Growth rate over j months



**Table 3**  
**Out-of Sample Forecasts of Growth in the Current Conditions Index, U.S. Jan. 1989- Sep.2002:**  
**Contribution of Autoregression and the Leading Index**

Line	Span of Months over which Growth Rate is Calculated (j)	Number of Lags of Growth Rates of CCI, LI (1 to k)	Mean Square Errors (MSE) for Model with Lagged Terms in			
			CCI only	CCI and LI <sup>h</sup> (historical index)	CCI and LI <sup>old</sup> (real-time, old index)	CCI and LI <sup>new</sup> (real-time, more timely index)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
<b>One Month Ahead Forecasts</b>						
1	1	1	0.863	0.873 <sup>x</sup>	0.877 <sup>x</sup>	0.863
2	1	3	0.747	0.732	0.752 <sup>x</sup>	0.739
3	1	6	0.764	0.719	0.733	0.729
4	1	9	0.770	0.713	0.723	0.719
5	3	1	1.044	1.022	1.063 <sup>x</sup>	1.061 <sup>x</sup>
6	3	3	1.090	1.074	1.104 <sup>x</sup>	1.102 <sup>x</sup>
7	→ 3	6	→ 0.953	→ 0.904	→ 0.939	→ 0.940
8	3	9	0.949	0.882	0.907	0.905
9	6	1	1.207	1.099	1.133	1.121
10	6	3	1.299	1.180	1.202	1.193
11	6	6	1.351	1.235	1.282	1.271
12	6	9	0.929	0.850	0.879	0.867
13	9	1	1.500	1.333	1.361	1.356
14	9	3	1.543	1.369	1.386	1.381
15	9	6	1.566	1.397	1.388	1.392
16	9	9	1.574	1.369	1.339	1.337





# Average MSEs of Out of Sample Forecasts of Log Changes in the U.S. Real GDP, All 16 Models: A Summary: 1989 Q1 – 2002 Q3

(1)	(2)	(3)	(4)	(5)	(6)
<b><u>Lagged Variables Used in the Regression Model</u></b>					
Line	Forecast Horizon (Number of Months Ahead)	RGDP Only	RGDP and Historical LEI	RGDP and OLD Real Time LEI	RGDP and NEW Real Time LEI
1	One Quarter	3.972	3.607	3.873	3.766
2	Two Quarters	8.101	6.996	7.351	7.087
3	Three Quarters	12.226	10.826	10.984	10.720
<b><u>MSE Ratio to Autoregressive Model</u></b>					
4	One Quarter	1.000	0.91	0.98	0.95
5	Two Quarters	1.000	0.86	0.91	0.87
6	Three Quarters	1.000	0.89	0.90	0.88
<b><u>Percent of models with smaller MSEs than the autoregressive model</u></b>					
7	One Quarter	-	87.50	43.75	50.0
8	Two Quarters	-	100	100	100
9	Three Quarters	-	100	100	100



# Average MSEs of Out of Sample Forecasts of Log Changes in the U.S. Current Conditions Index, All 16 Models: A Summary: January 1989- August 2002

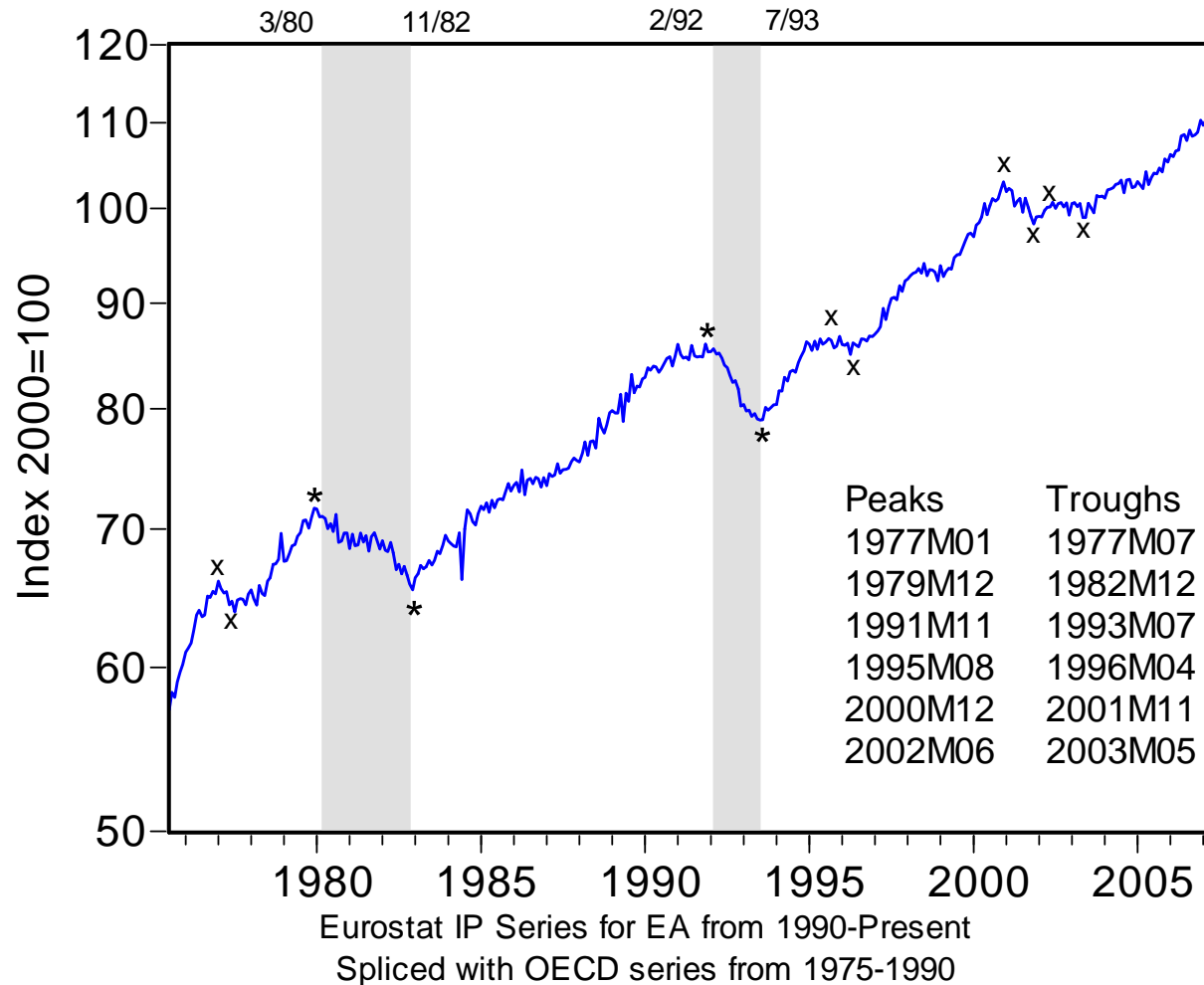
(1)	(2)	(3)	(4)	(5)	(6)
		<u>Lagged Variables Used in the Regression Model</u>			
		CCI only	CCI and LI <sup>h</sup>	CCI and LI <sup>new</sup>	CCI and LI <sup>old</sup> Different targets
Line					
1	One Month	1.134	1.047	1.061	1.067
2	Three Months	2.718	2.305	2.470	2.305
3	Six Months	5.711	4.980	5.225	5.083
		MSE Ratio to Autoregressive Model			
4	One Month	1.000	0.923	0.936	0.941
5	Three Months	1.000	0.848	0.909	0.848
6	Six Months	1.000	0.872	0.915	0.890
		Percent of models with smaller MSEs than the autoregressive model			
7	One Month	-	93.75	87.50	75.00
8	Three Months	-	93.75	62.50	56.25
9	Six Months	-	62.50	43.75	62.50



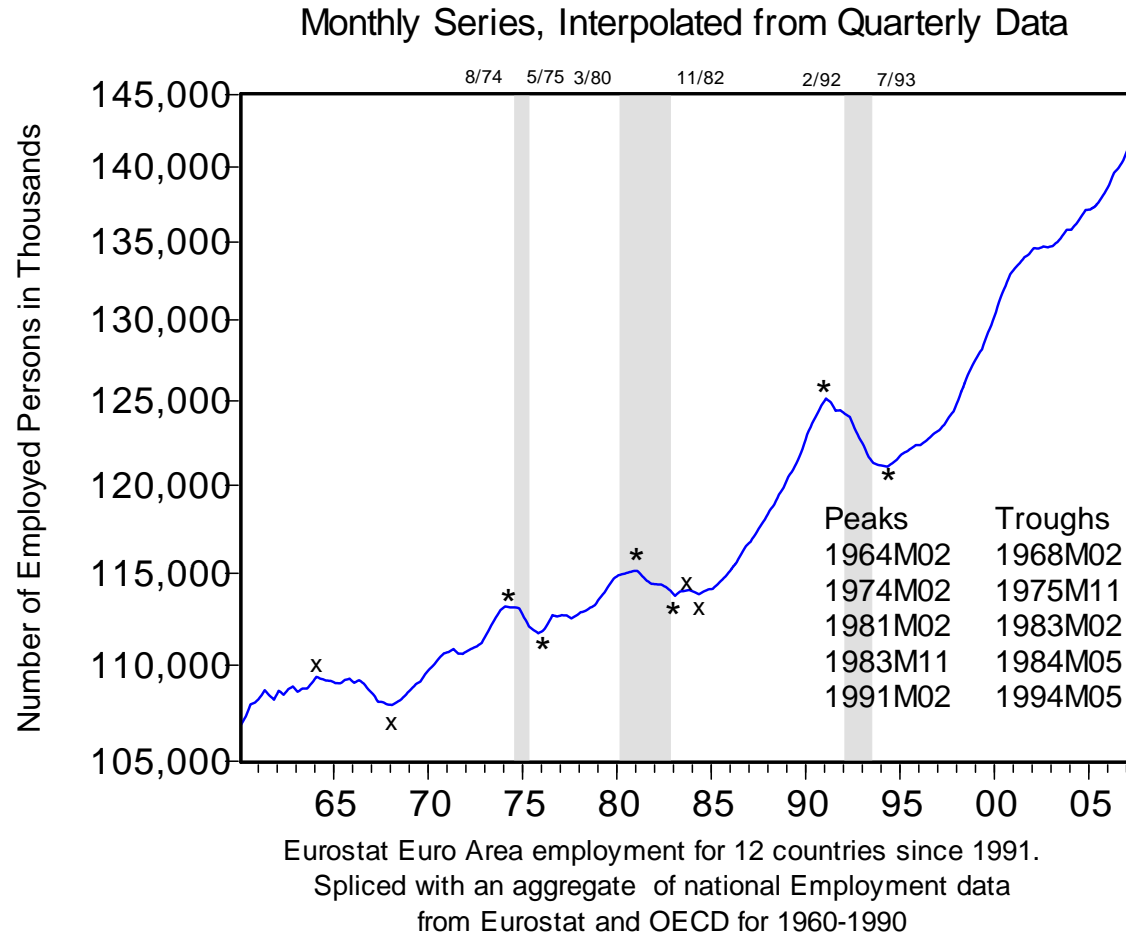
# Average MSEs of Out of Sample Forecasts of Log Changes in the U.S. Current Conditions Index, All 16 Models: A Summary: January 1989- August 2002

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<u>Lagged Variables Used in the Regression Model</u>							
CCI and LI <sup>old</sup>							
Line		CCI only	CCI and LI <sup>h</sup>	CCI and LI <sup>new</sup>	Different targets	Same Target	
						Direct Forecast	Two-step forecast
1	One Month	1.134	1.047	1.061	1.067	1.593	1.393
2	Three Months	2.718	2.305	2.470	2.305	3.249	3.901
3	Six Months	5.711	4.980	5.225	5.083	5.819	5.932
<u>MSE Ratio to Autoregressive Model</u>							
4	One Month	1.000	0.923	0.936	0.941	1.405	1.228
5	Three Months	1.000	0.848	0.909	0.848	1.185	1.435
6	Six Months	1.000	0.872	0.915	0.890	1.019	1.039
<u>Percent of models with smaller MSEs than the autoregressive model</u>							
7	One Month	-	93.75	87.50	75.00	-	-
8	Three Months	-	93.75	62.50	56.25	-	-
9	Six Months	-	62.50	43.75	62.50	-	-

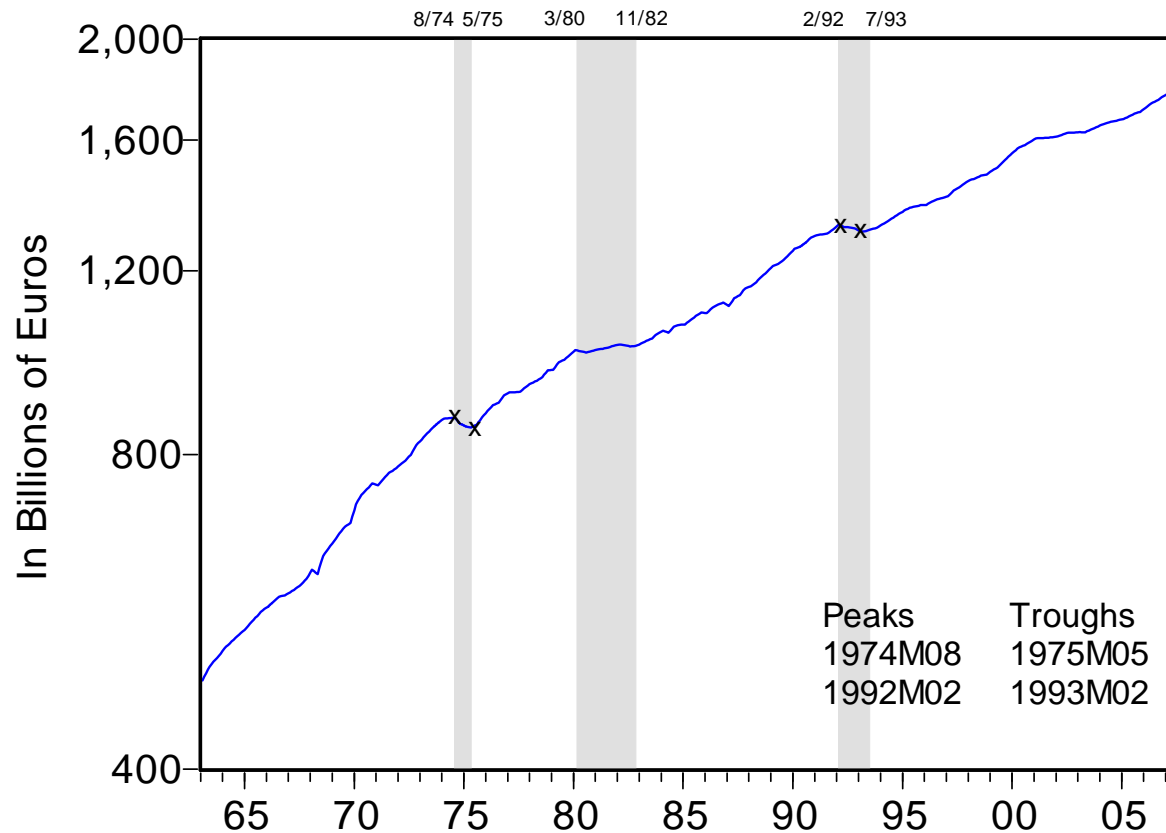
# Developing a Business Cycle Chronology for the Euro Area: Index of Industrial Production (1975-2007)



# Developing a Business Cycle Chronology for the Euro Area: Index of Employment (1960-2007)

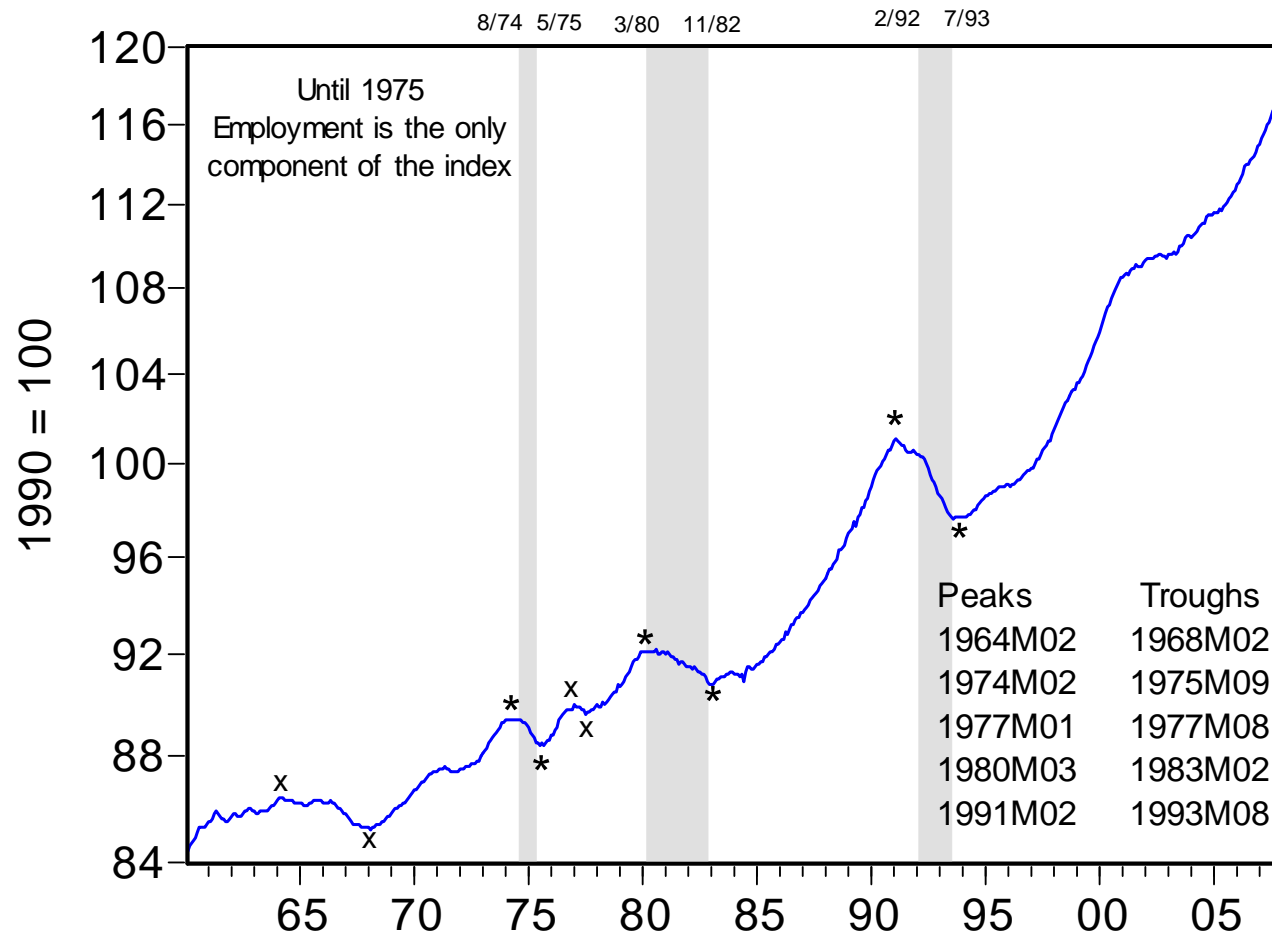


# Euro Area Real Gross Domestic Product, Seasonally Adjusted, Constant Prices, (1963-2007)



Eurostat data for the Euro Area 12 countries since 1995 spliced with country level data from OECD and Eurostat combined to form aggregate for Euro Area prior to 1995.

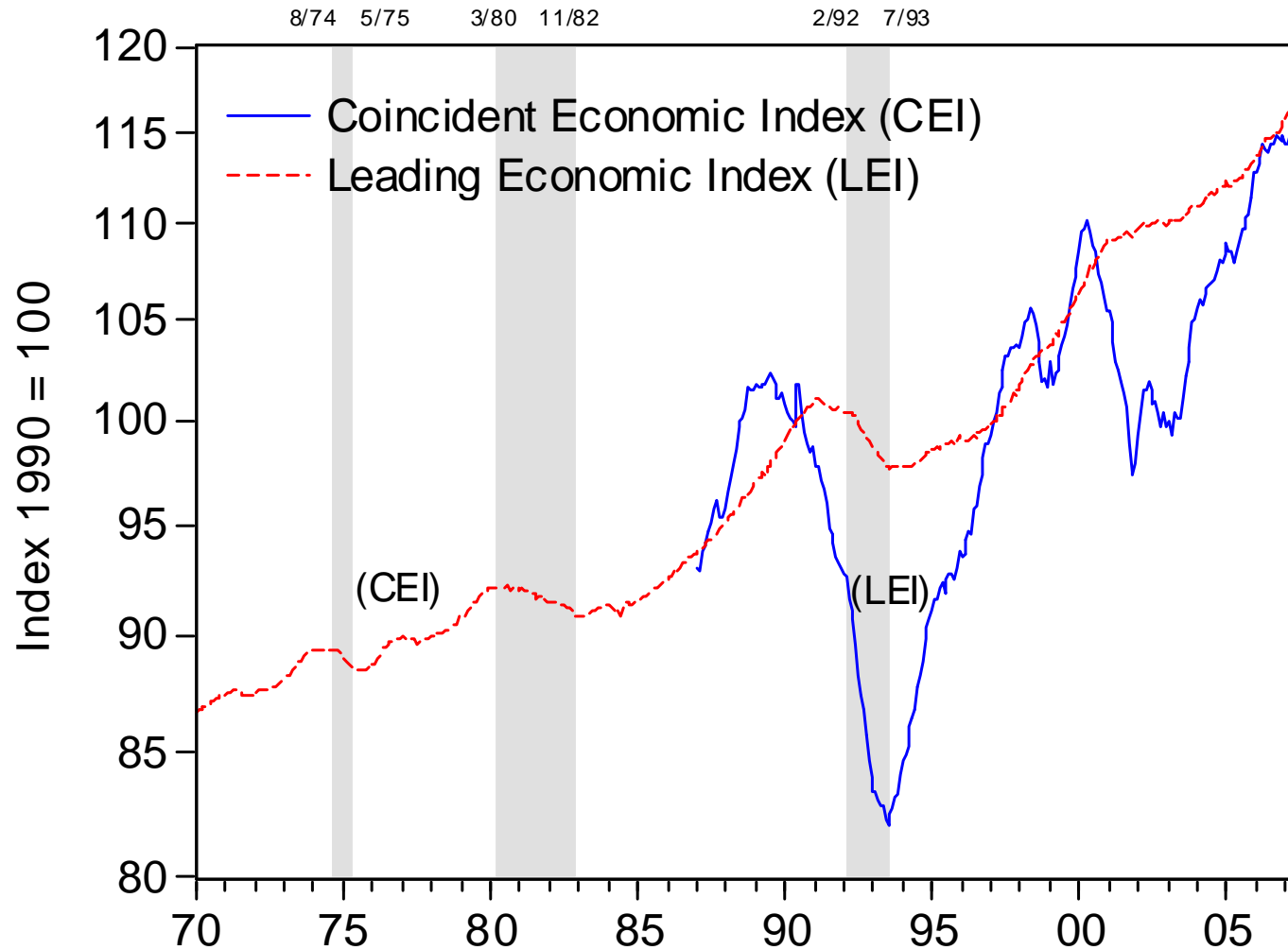
# Euro Area Composite Index of Industrial Production and Employment (1960-2007)



Sources, OECD, Eurostat, TCB

# Euro Area LEI and CEI (1970-2007)

Chart 2  
Comparison of Coincident Economic Index and Leading Economic Index  
1970-2007





# Cyclical Timing of Selected Coincident Indicators of Euro Area Economic Activity (1970-2007)

Line	1 Industrial Production OECD	2 Employment Eurostat	3 Industrial Production and Employment Combined	4 GDP Using AWM Eurostat	5 GDP Using BDH Eurostat	6 GDP Using BDH and PPP Eurostat	7 GDP OECD Single Country Eurostat Data	8 GDP OECD Single Country Eurostat Data	9 GDP 1995 ESA	10 Overall Composite Index (IP, Employment and Real GDP)
<b>Timing at Business Cycle Peaks</b>										
1 Aug-74	n.a.	-6	-7	0	0	-3	0	0	0	0
2 Feb-80	0	12	0	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	0
3 Feb-92	-1	-12	-13	0	0	0	0	0	0	0
4 Extra Turns	4	1	1	0	0	0	0	0	0	0
5 Missed Turns	0	0	0	1	1	1	1	1	1	0
6 Mean	-0.50	-2.00	-6.67	0.00	0.00	-1.50	0.00	0.00	0.00	0.00
7 Median	-0.50	-6.00	-7.00	0.00	0.00	-1.50	0.00	0.00	0.00	0.00
8 St. Deviation	0.58	12.49	6.51	0.00	0.00	1.73	0.00	0.00	0.00	0.00
<b>Timing at Business Cycle Troughs</b>										
9 May-75	n.a.	6	4	0	0	0	0	0	0	0
10 Nov-82	0	3	4	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	0
11 Jul-93	0	7	6	-5	-5	-5	-5	-5	-5	0
12 Extra Turns	4	1	1	0	0	0	0	0	0	0
13 Missed Turns	0	0	0	1	1	1	1	1	1	0
14 Mean	0.00	5.33	4.67	-2.50	-2.50	-2.50	-2.50	-2.50	-2.50	0.00
15 Median	0.00	6.00	4.00	-2.50	-2.50	-2.50	-2.50	-2.50	-2.50	0.00
16 St. Deviation	0.00	2.08	1.15	2.89	2.89	2.89	2.89	2.89	2.89	0.00
<b>Combined Statistics</b>										
17 Mean	-0.25	1.67	-1.00	-1.25	-1.25	-2.00	-1.25	-1.25	-1.25	0.00
18 Median	0.00	4.50	2.00	0.00	0.00	-1.50	0.00	0.00	0.00	0.00
19 St. Deviation	0.41	8.96	7.48	3.54	2.04	2.16	2.04	2.04	2.04	0.00

Note: Entries marked "-" denotes leads in months; entries unmarked denote lags in months; 0 represents coincidence. The entries in lines 4, 5, 12, and 13 are numbers of turning points; those in lines 6-8, 14-16, and 17-19 are summary statistics based on lines 1-3, 9-11, and the two sets combined, respectively, n.a. - not available (turn not covered by data). For the headings of the columns, see also Table 1. - Abbreviations: AWM (Area Wide Model), n.m. = not matched (missed turn).

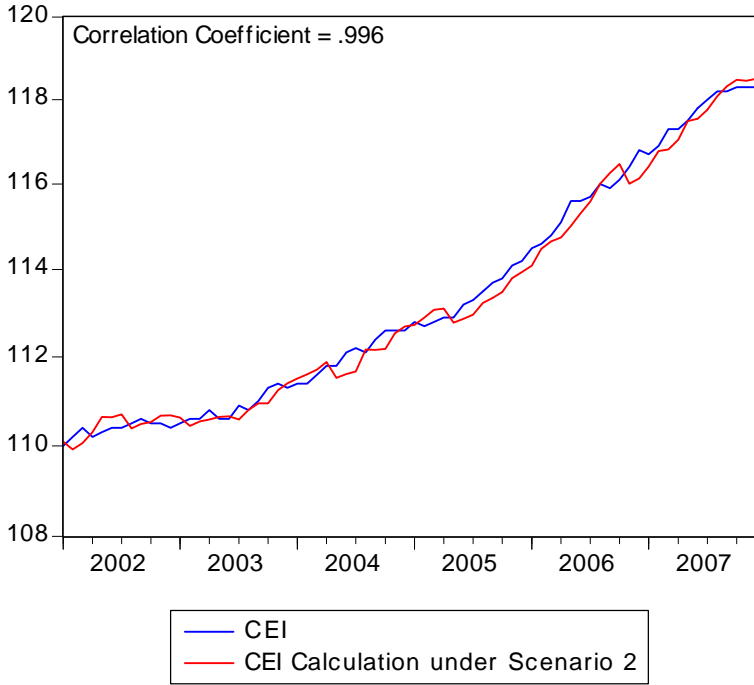
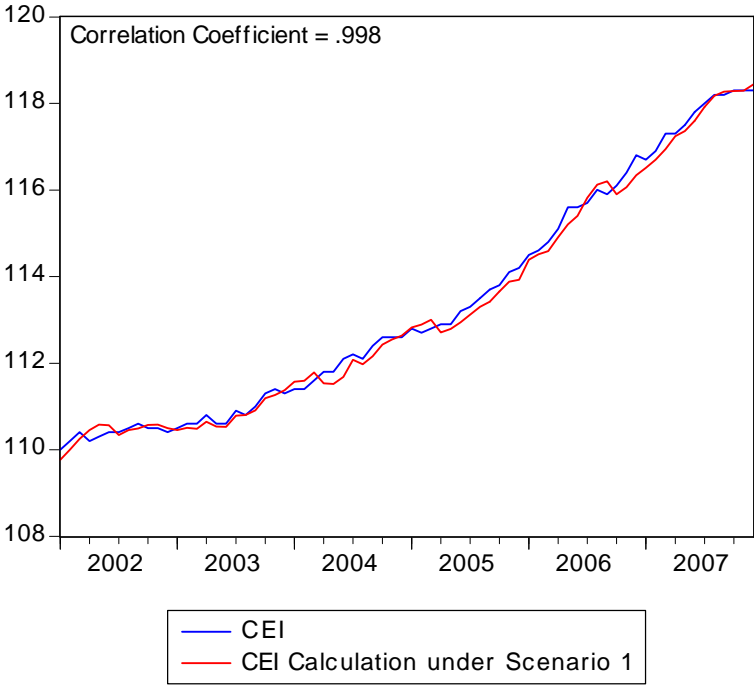


# Cyclical Timing for Selected LEI Components for the Euro Area (1970-2007)

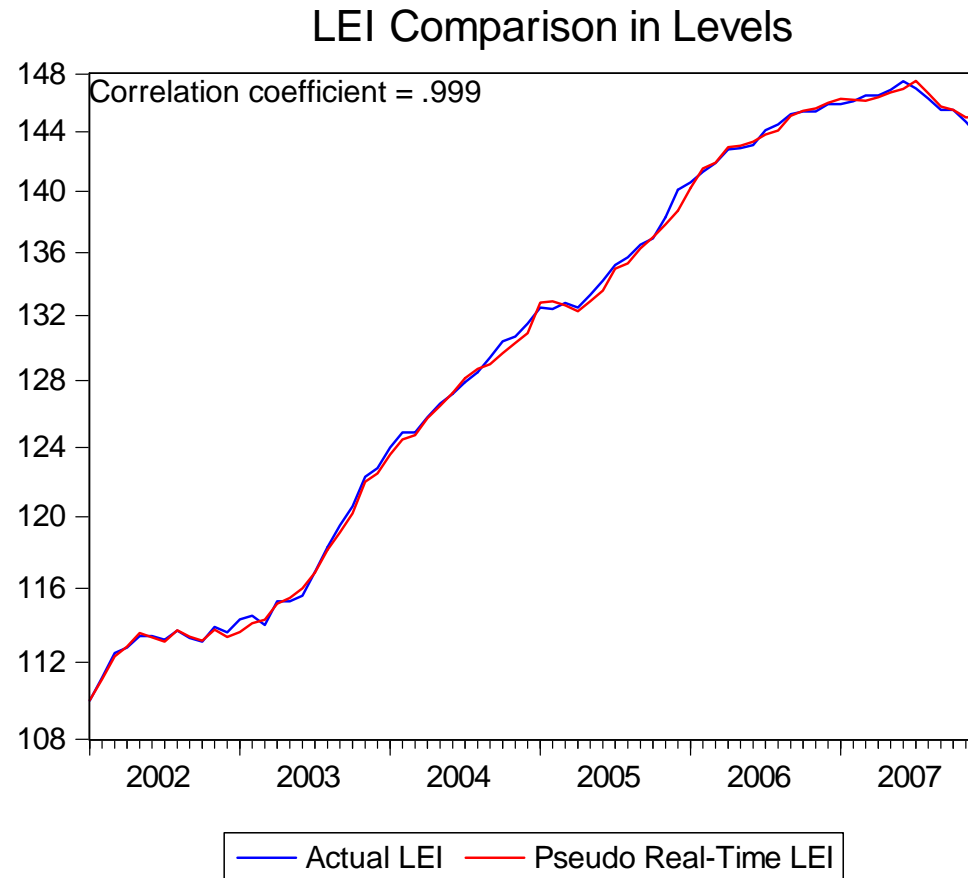
Turning Points for Euro Area Business Cycles (Only those 1970-2005)	Money Supply M2 Since 1980	Cumulative Yield Spread* GE YS, Euribor YS, ECB Minimum Bid YS Since 1987	Economic Sentiment Index European Commission Since 1985	Eurostoxx Dow Jones Since 1987	Residential Building Permits Eurostat Index Since 1995	New Orders for Capital Goods Eurostat Index Since 1996	PMI Index (Manufacturing) NTC Economics Since 1998	Business Expectations Index (Manufacturing) NTC Economics Since 1998
<b>Timing at Business Cycle Peaks</b>								
Aug-74	NA	NA	NA	NA	NA	NA	NA	NA
Feb-80	9	NA	NA	NA	NA	NA	NA	NA
Feb-92	NM	-15	-31	-20	NA	NA	NA	NA
Extra Turns	1	1	5	3	2	1	4	3
Missed Turns	1	0	0	0	0	0	0	0
Mean	9.00	-15.00	-31.00	-20.00	-	-	-	-
Median	9.00	-15.00	-31.00	-20.00	-	-	-	-
St. Deviation	5.20	8.66	17.90	11.55	0.00	0.00	0.00	0.00
<b>Timing at Business Cycle Troughs</b>								
May-75	NA	NA	NA	NA	NA	NA	NA	NA
Nov-82	-13	NA	NA	NA	NA	NA	NA	NA
Jul-93	NM	6	0	-30	NA	NA	NA	NA
Extra Turns	1	1	5	3	2	1	4	3
Missed Turns	1	0	0	0	0	0	0	0
Mean	-13.00	6.00	0.00	-30.00	-	-	-	-
Median	-13.00	6.00	0.00	-30.00	-	-	-	-
St. Deviation	7.51	3.46	0.00	17.32	0.00	0.00	0.00	0.00
<b>Combined Statistics</b>								
Mean	-2.00	-4.50	-15.50	-25.00	-	-	-	-
Median	-2.00	-4.50	-15.50	-25.00	-	-	-	-
St. Deviation	7.03	7.04	12.66	13.29	0.00	0.00	0.00	0.00

NA: Data not available for component at the time of Euro Area peak or trough  
 NM: Peaks and troughs for component did not occur at or near time of the Euro Area peak or trough  
 \*peaks and troughs found using combined version of yield spread cumulation.

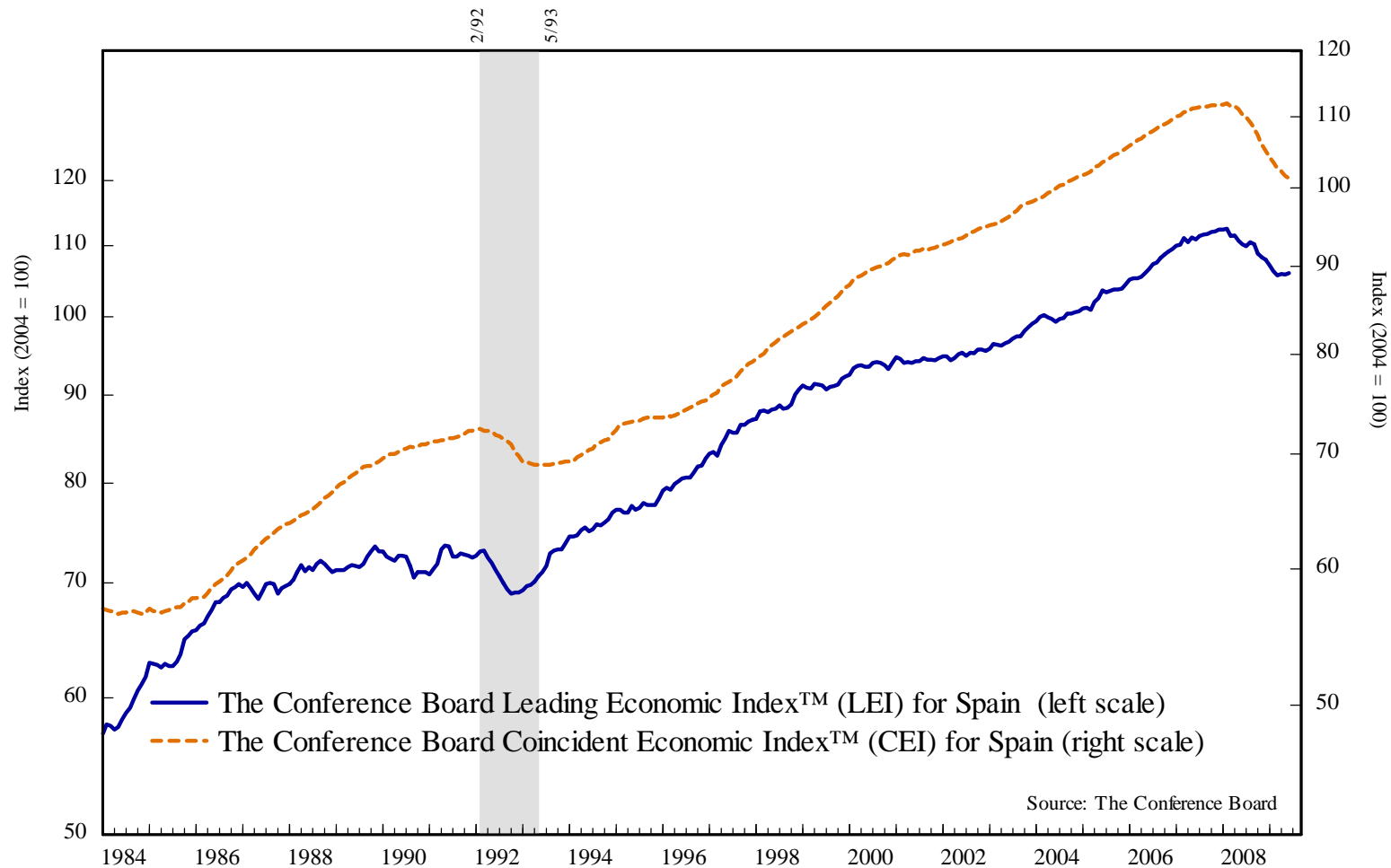
# Comparing Forecast Versions of CEI to the Actual



# Comparing Forecast Versions of LEI to the Actual

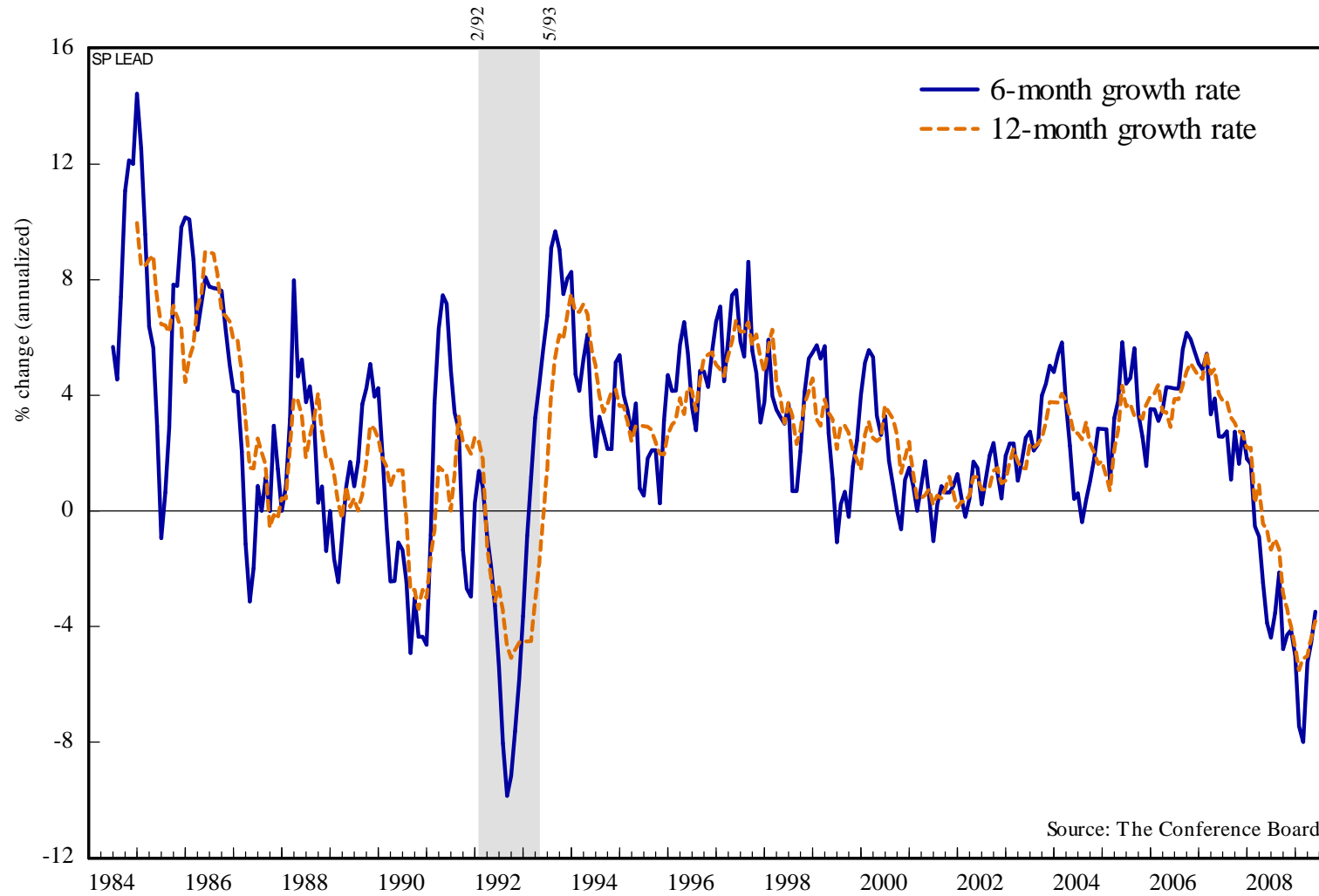


## Spain: Business Cycles, the Leading Economic Index (LEI), and the Coincident Economic Index (CEI)



Note: Shaded areas represent recessions in Spain

# Spain: LEI (1984 - Present)



Note: Shaded areas represent recessions in the Spain