
The Global Economy

Business Cycle Properties

Roadmap

- Exam review
- Business cycles
 - What are they?
 - Terminology
 - What do they look like?
 - What makes a good indicator?
- Forecasting
 - Using indicators

Summary Statistics

Mean	83.1
Standard Dev.	9.2
Median	84.0
Top 10%	93
Top 35%	87

Question 6

- Opportunity cost of producing a car in US is (in tons of wheat): $\frac{1}{12} * 9 = 0.75$
- Opportunity cost of producing a car in Canada is (in tons of wheat): $\frac{1}{6} * 3 = 0.5$
- So Canada exports cars if the price of a car (P_c) is such that $0.5 < P_c < 0.75$. If $P_c = 0.8$, no country wishes to import cars.

Question 9 Part e

- This was a hard question
 - The answer needs to be argued in terms of borrowing and lending, as the hint implied. Fast growth implies a high return on investment that is relatively attractive to foreign investors. Typically, this implies a deficit on net exports.
 - “They grew a lot, so they would have exported a lot” is not a great answer. Why? We are interested in *net* exports, not only exports.

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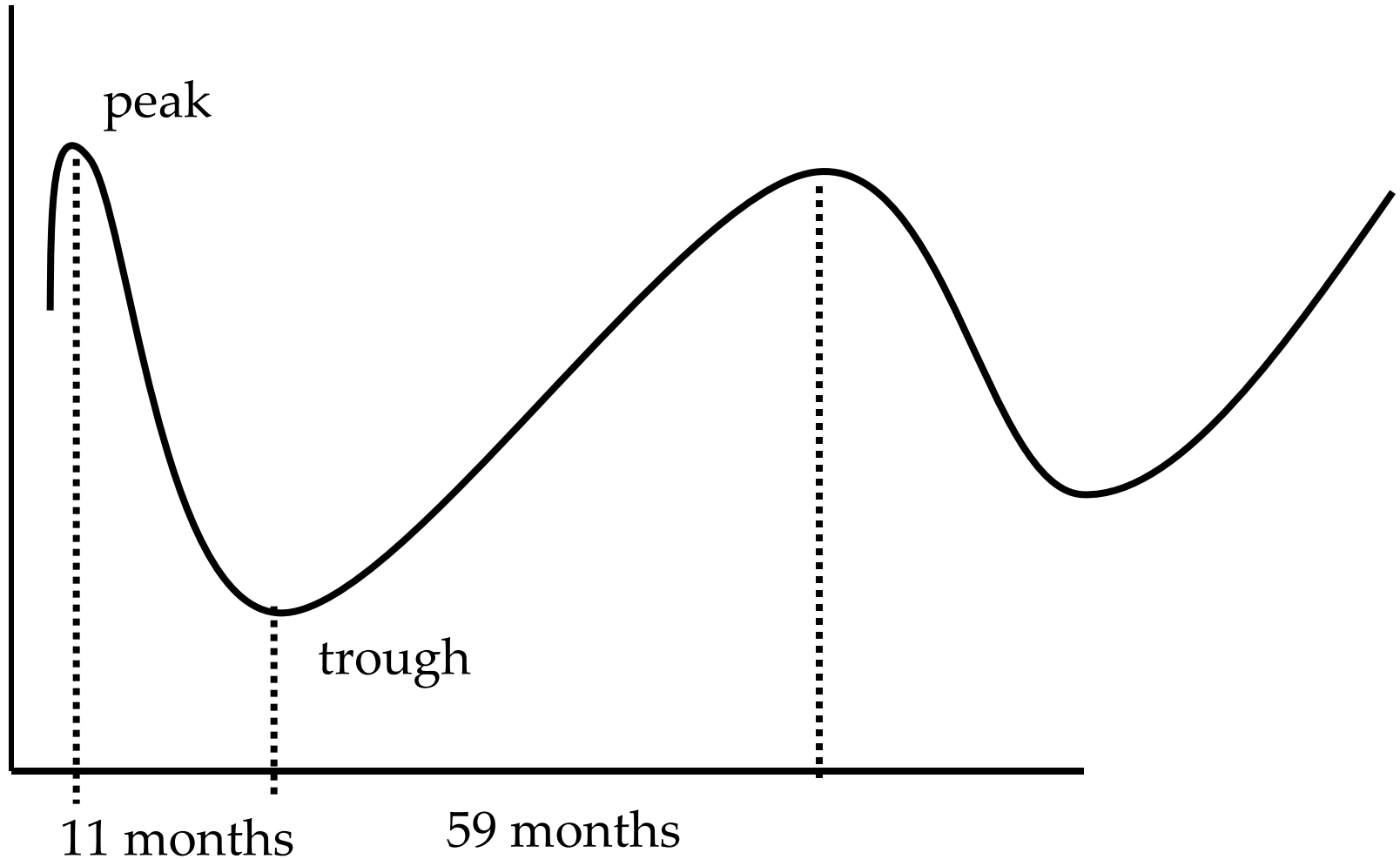
Business Cycles: Why people care

- How is business cycle analysis used?
 - Production, employment, investment, and pricing decisions
 - How would a boom affect each of these?
 - Does it depend on what you are producing?
 - Asset management decisions
 - Is a boom good or bad for equity? Bonds?

What is a business cycle?

- Definitions
 - Short-term economic fluctuations (“high frequency”)
 - Arthur Burns and Wesley Mitchell: “Business cycles are a type of fluctuation found in the aggregate economic activity of nations.... A **cycle consists of expansions occurring at about the same time in many economic activities, followed by similarly general recessions**, contractions and revivals which merge into the expansion phases of the next cycle.”
 - The “official” cycle dates
http://www.nber.org/cycles/recessions_faq.html
- Business cycles are recurrent, but not periodic

Business cycle terminology



US business cycles

Duration in months

Average	Contraction (Peak to Trough)	Expansion (Trough to Peak)	Cycle (Trough from Previous Trough)	Cycle (Peak from Previous Peak)
1854-2009 (33 cycles)	16	42	56	55
1854-1919 (16 cycles)	22	27	48	49
1919-45 (6 cycles)	18	35	53	53
1945-2009 (11 cycles)	11	59	73	66
Great Recession (2007-09)	18	73	91	81

The Great Depression is still great

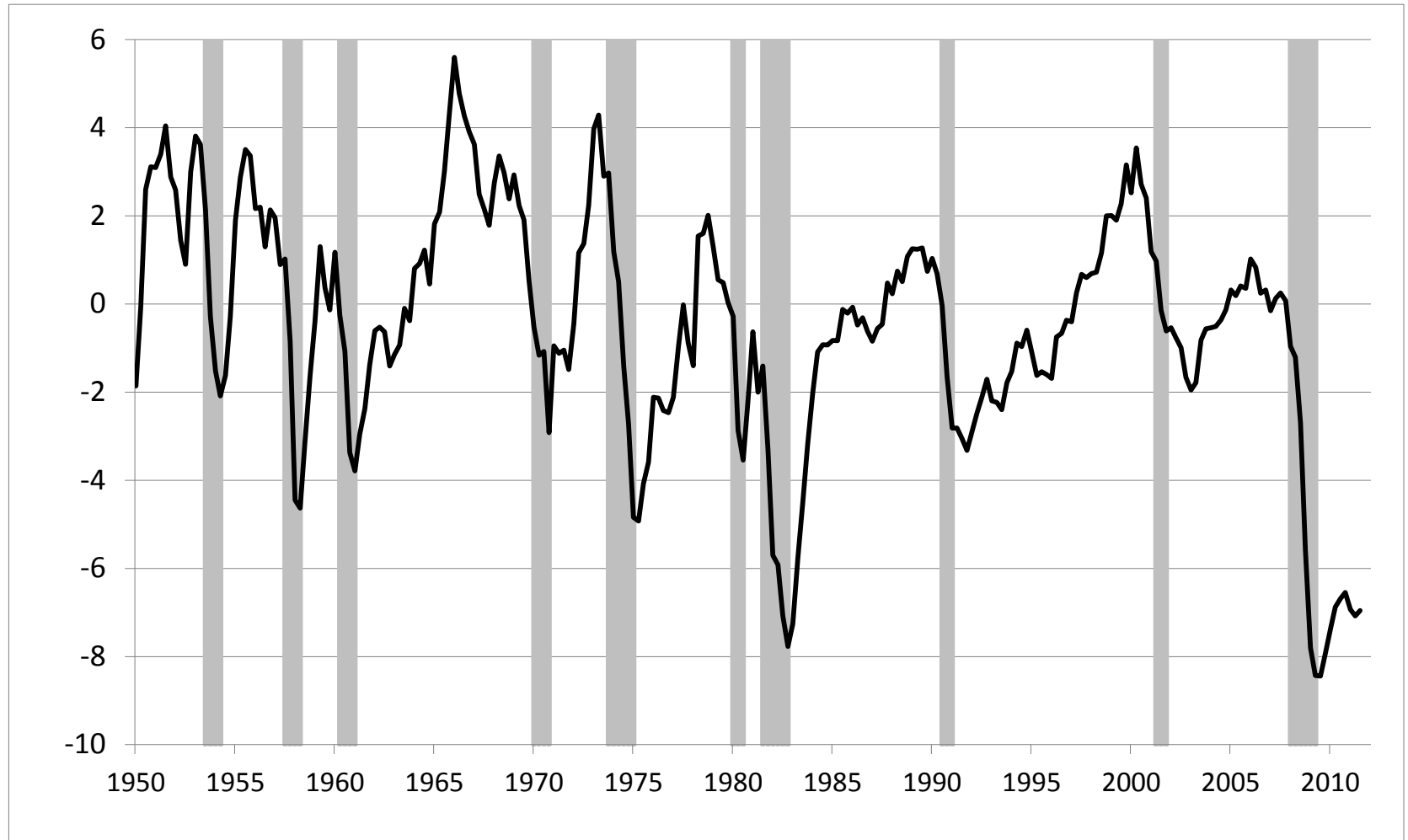
	How Long?		How Deep?		Unemployment rate	
	Duration in months	Real GDP	Ind. Prod	Employment	High	Change
Great Depression (1933)	43	-33%	-53%	-32%	25%	22%
Major depressions (1921, 1938)	16	-13	-32	-11	16	10
Sharp recessions (1924, 1949, 1954, 1958, 1975, 1982)	13	-3	-12	-4	8	4
Mild recessions (1927, 1945, 1961, 1970, 1980, 1991, 2001)	9	-2	-7	-2	6	3
Great Recession (2009)	18	-5	-15	-5	10	5

Sources: BEA, BLS, Citi, FRB, and Geoffrey Moore.

Describing data

- A variable is **procyclical** if it moves up and down with GDP, **countercyclical** if it moves in the opposite direction
- A variable **leads** GDP if its ups and downs precede those in GDP, **lags** if its movements come after
- We'll develop a way to sort out leads and lags

Output Gap

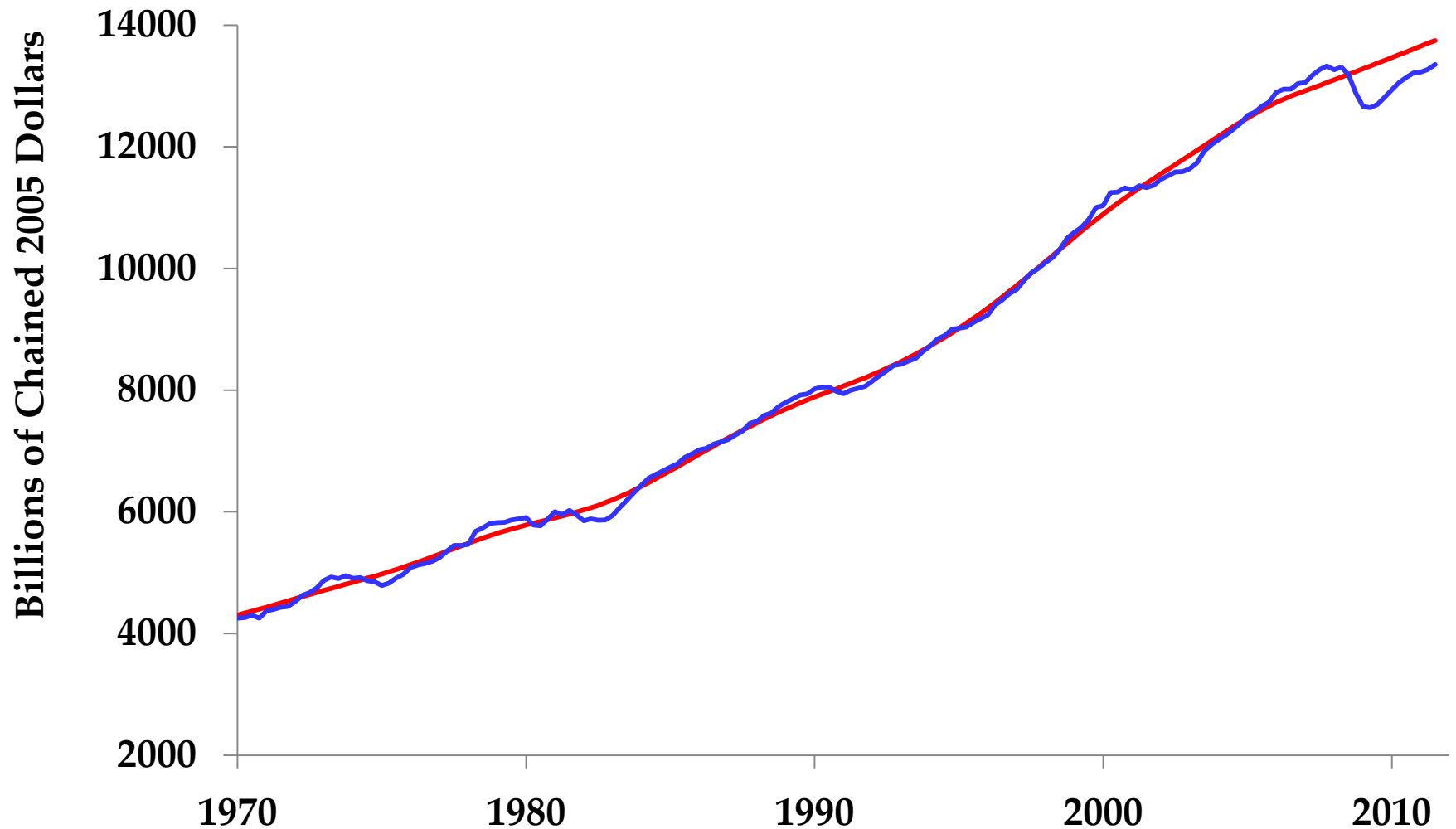


Sources: BEA and CBO. Note: Shaded areas denote NBER recessions.

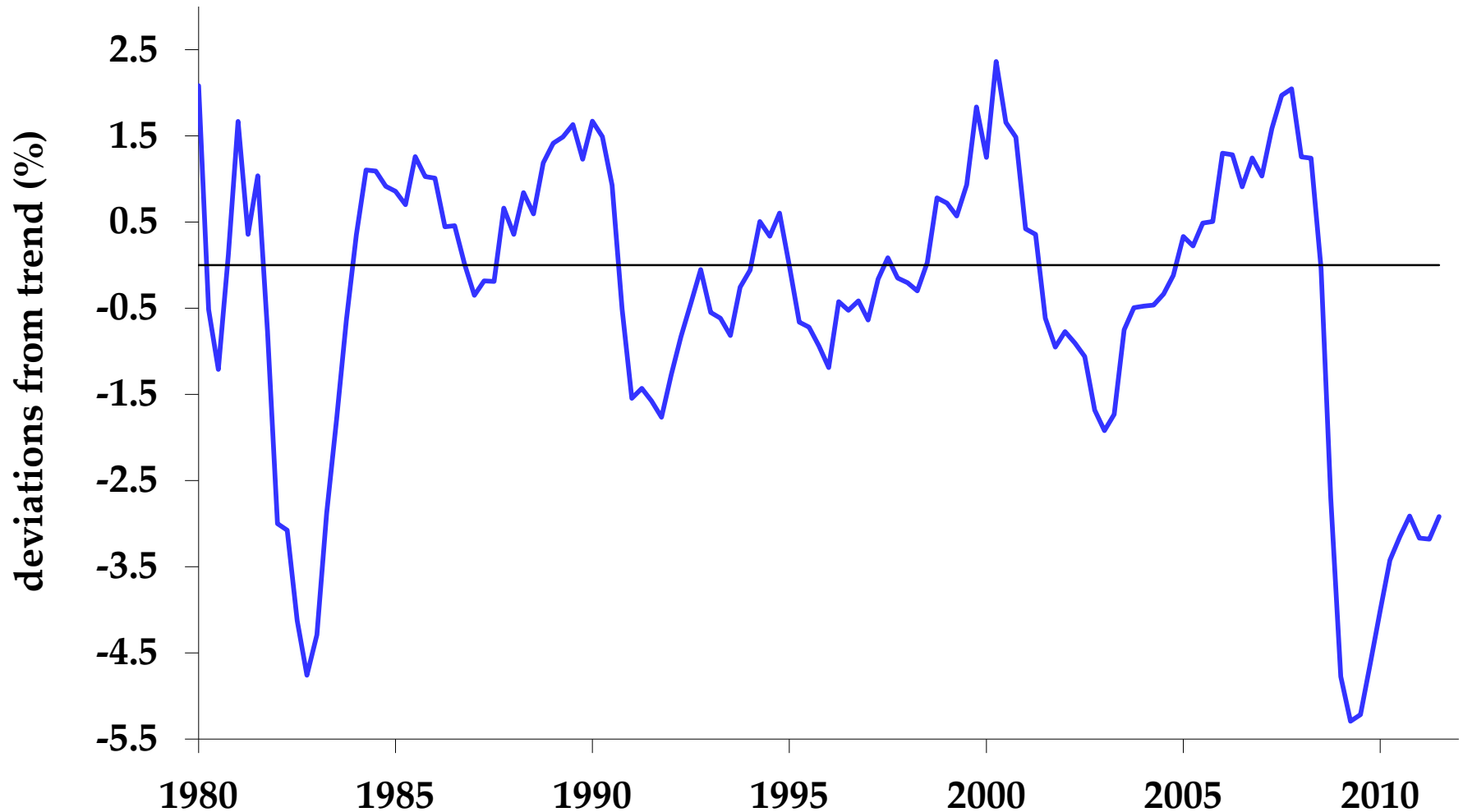
Correlation

- Correlation: the degree to which two indicators vary together
- Correlation index ρ where $-1 \leq \rho \leq 1$
- If $\rho = 1$, we say that two indicators are perfectly correlated.
- If $\rho = -1$, we say that two indicators are perfectly negatively correlated.
- If $\rho = 0$, the indicators are not correlated.

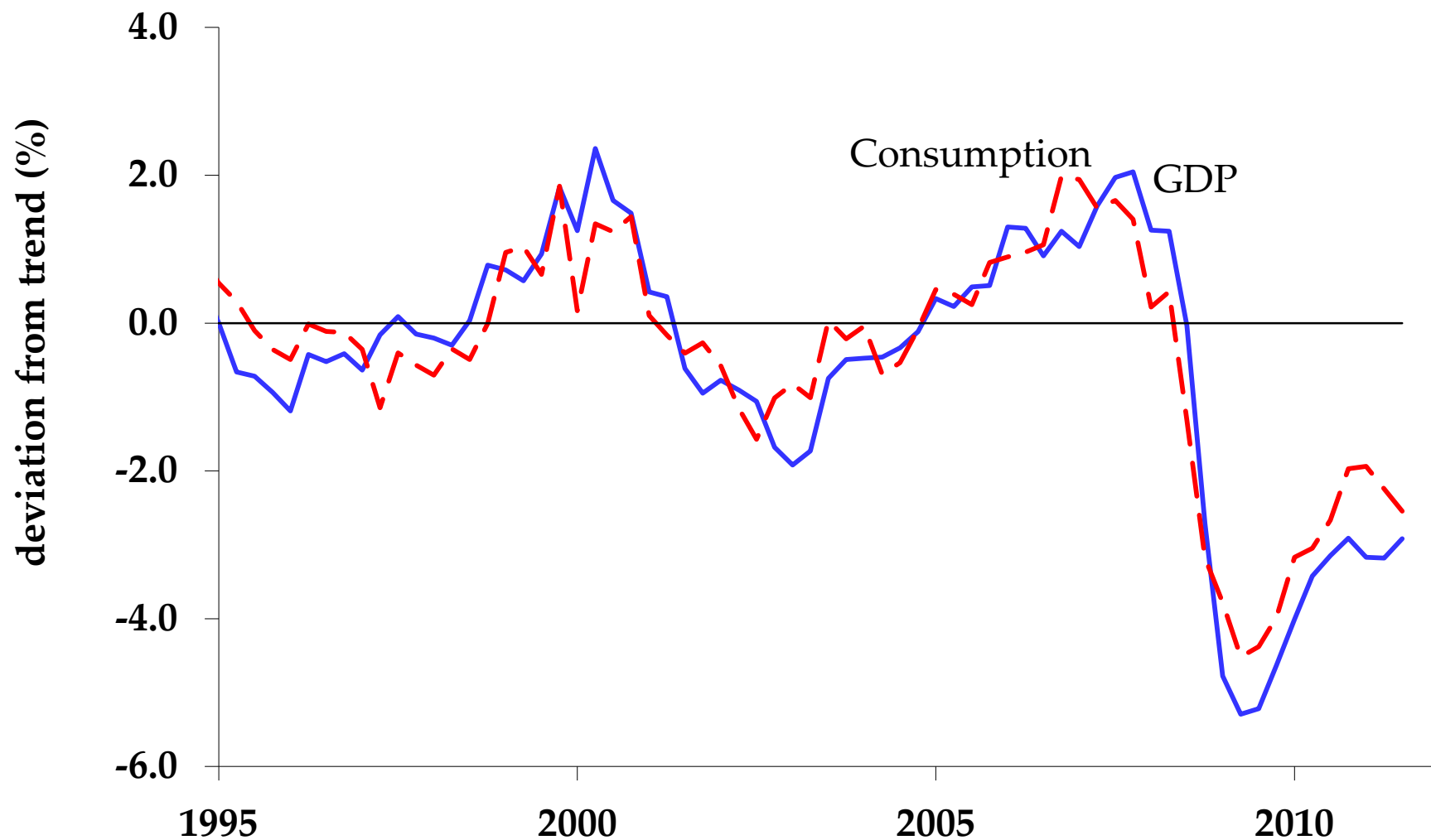
Gross domestic product



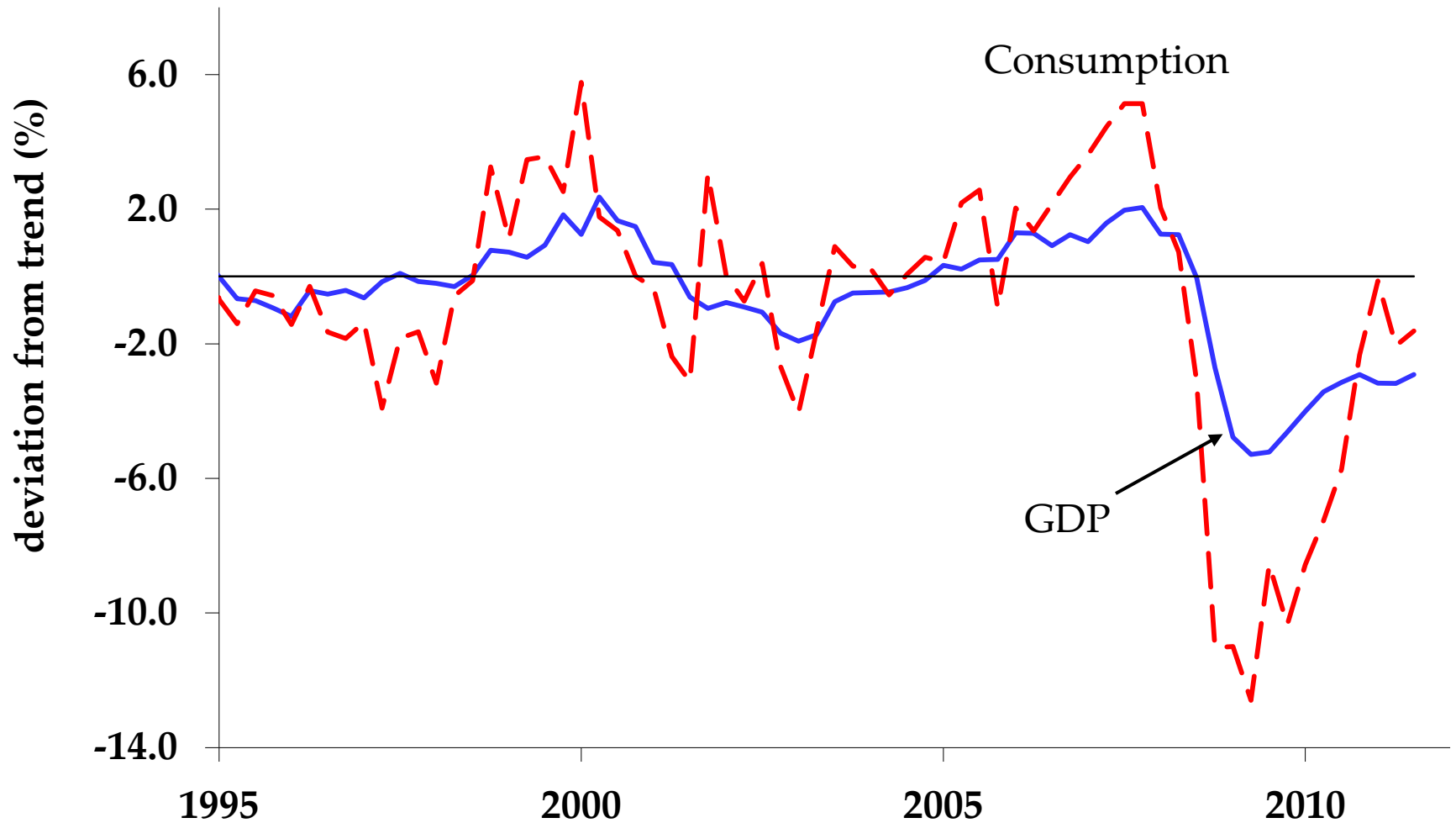
Deviations from trend GDP



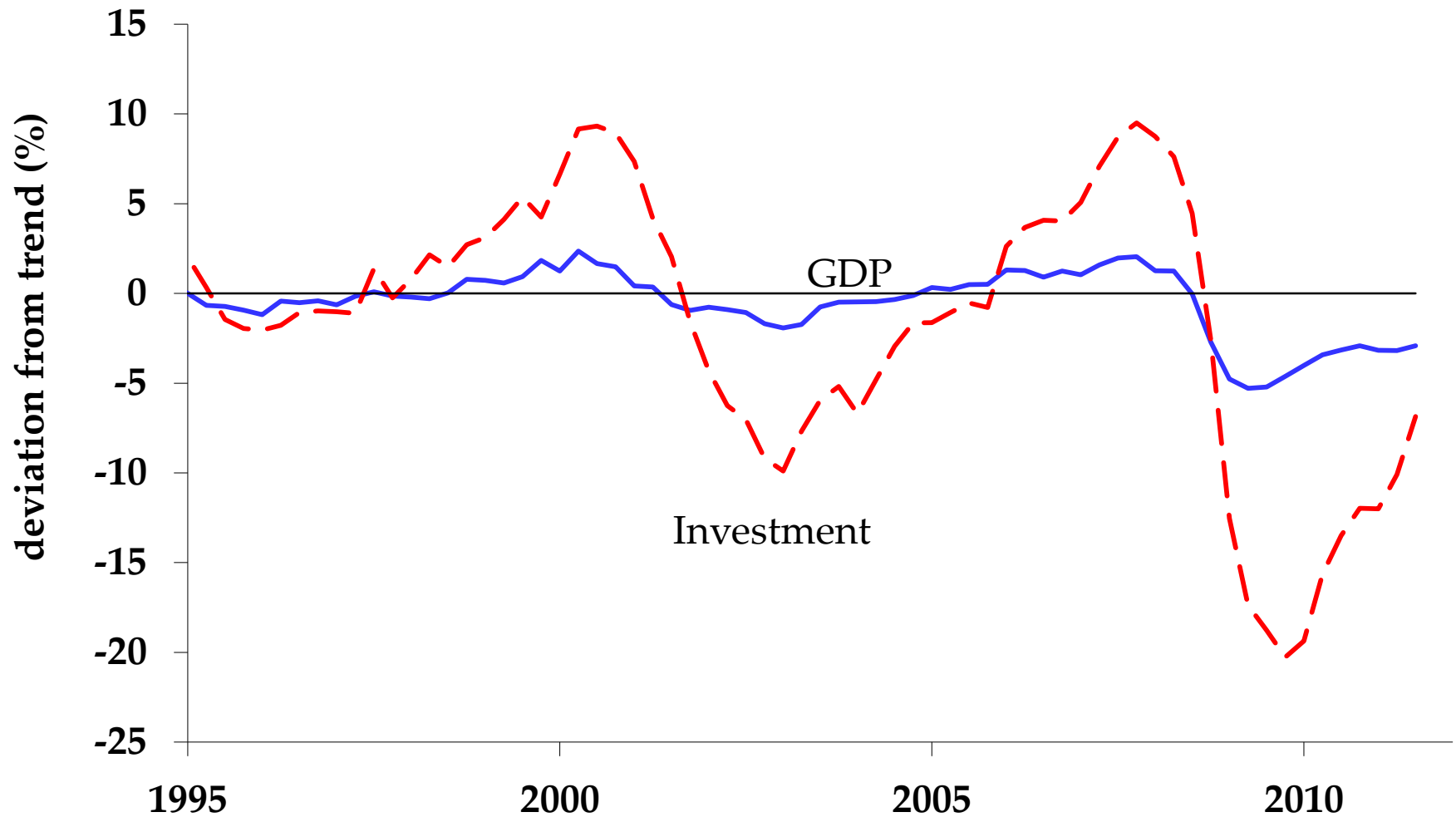
Nondurables consumption



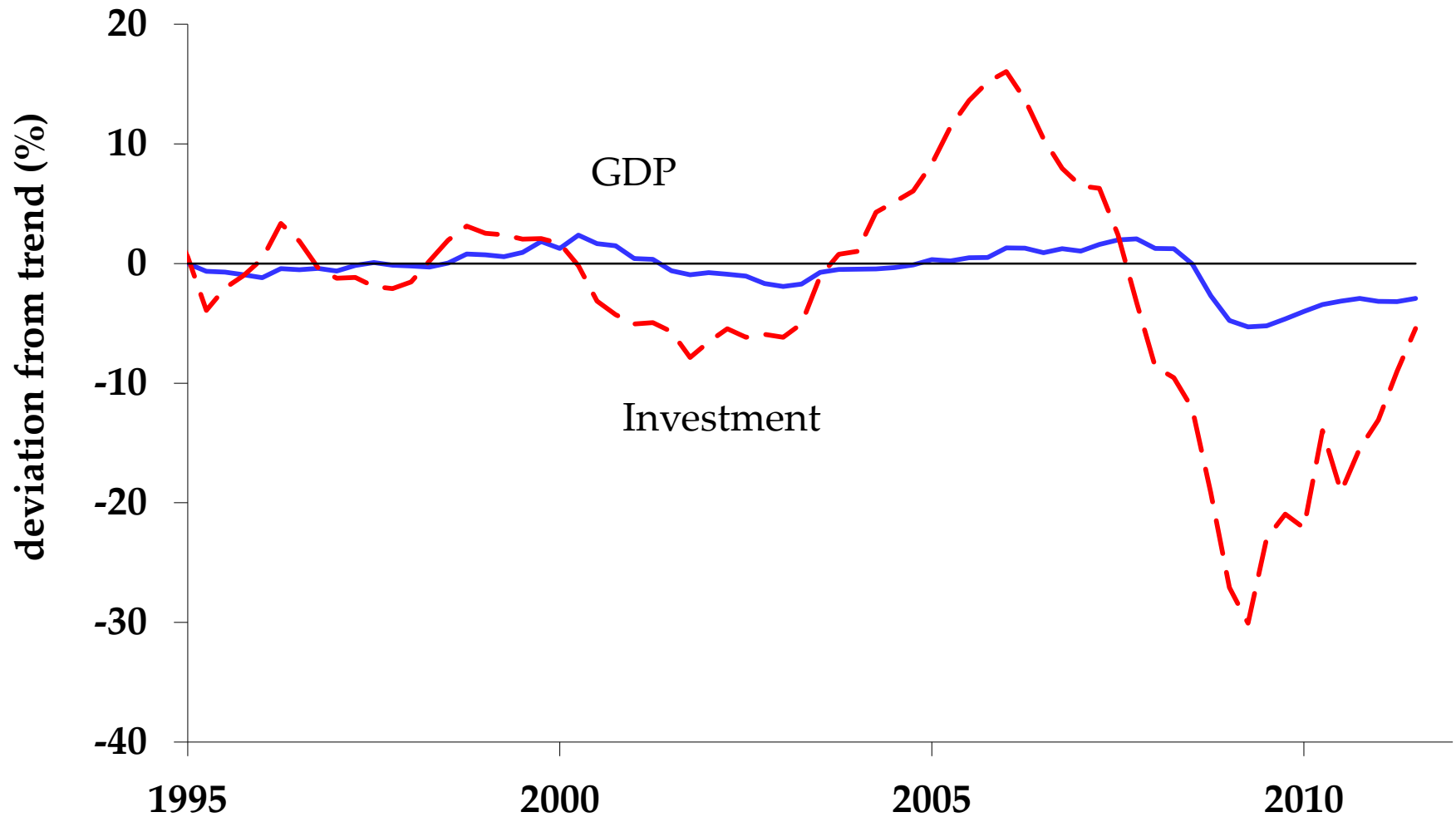
Durables consumption



Nonresidential investment



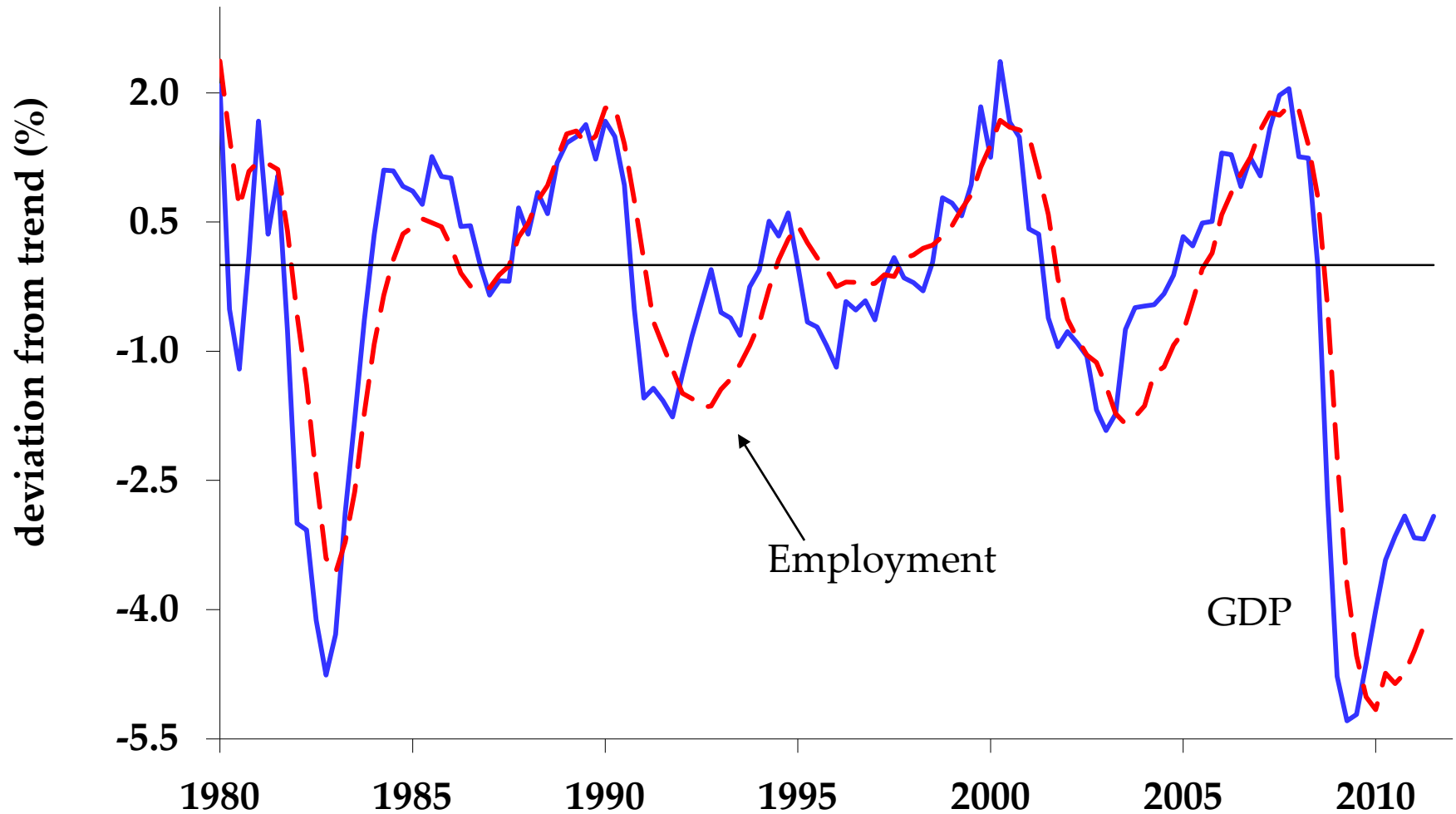
Residential investment



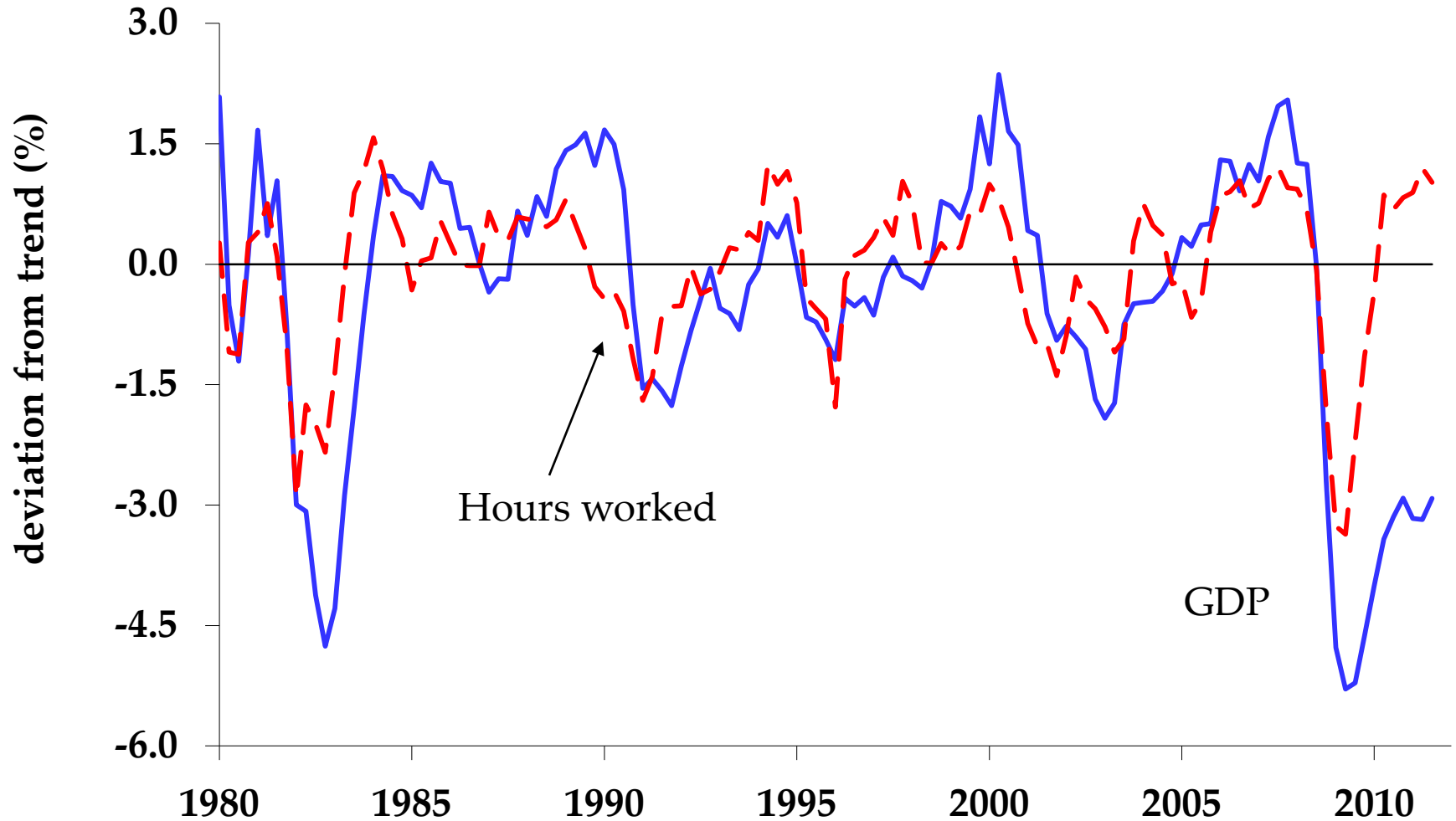
Summary: GDP components

	Std. deviations relative to GDP	Contemporaneous correlation with GDP
GDP	1.00	1.00
Cons. Durables	2.50	0.78
Cons. Nondurables	0.77	0.90
Nonresidential Investment	3.71	0.88
Residential Investment	5.86	0.74
Exports	2.74	0.67
Imports	7.65	0.10

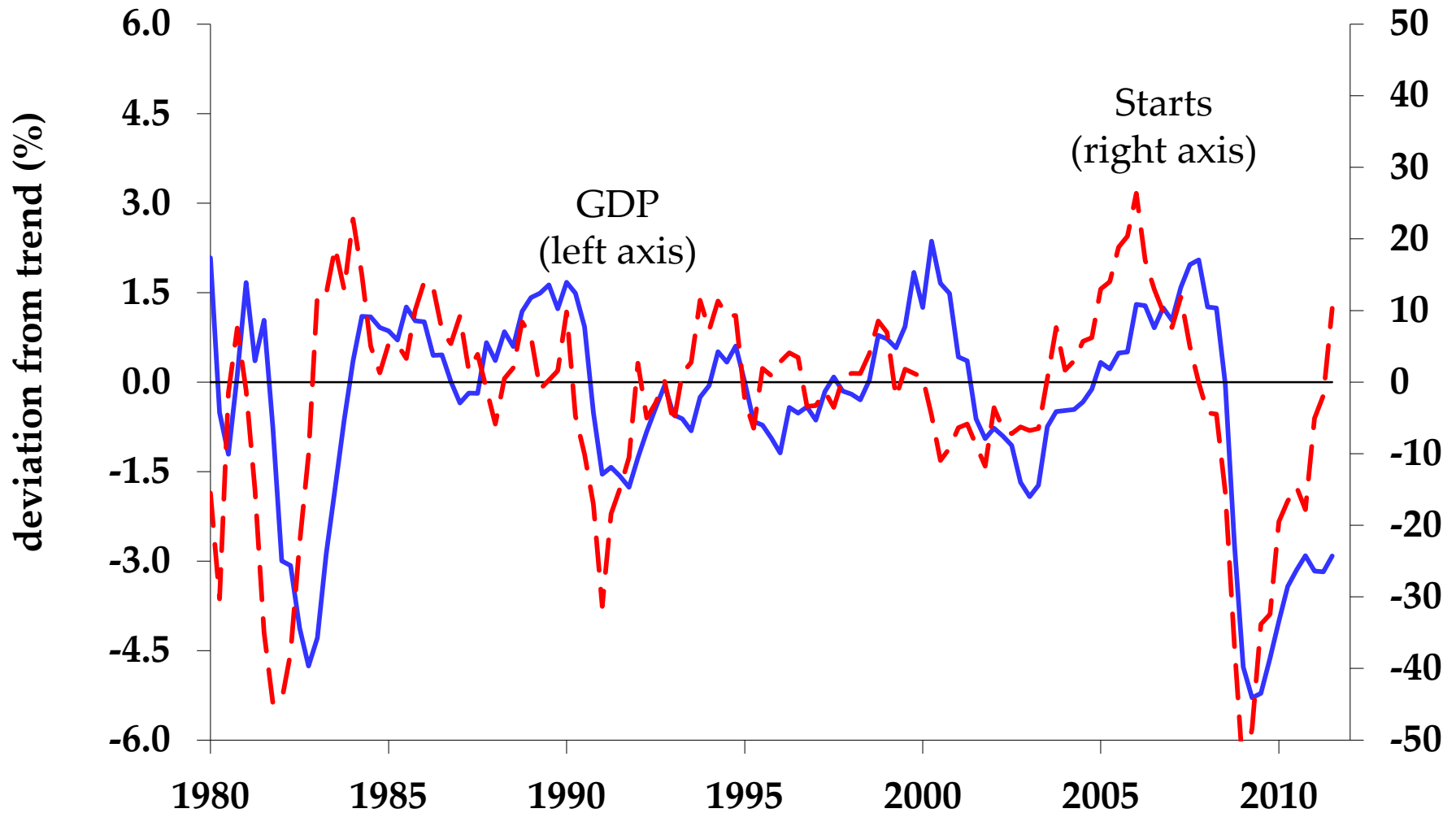
Nonfarm employment



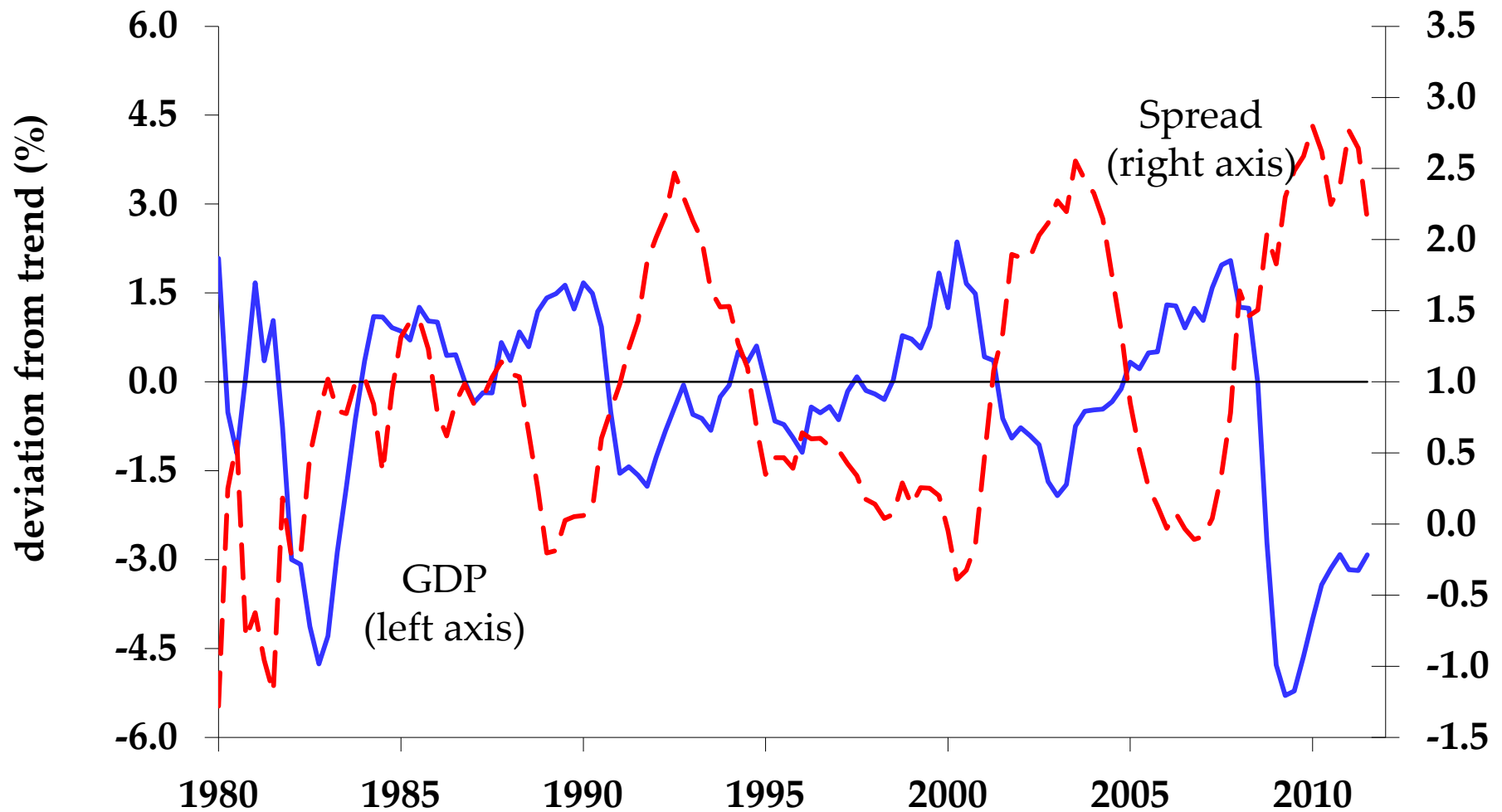
Hours worked per worker



Housing starts



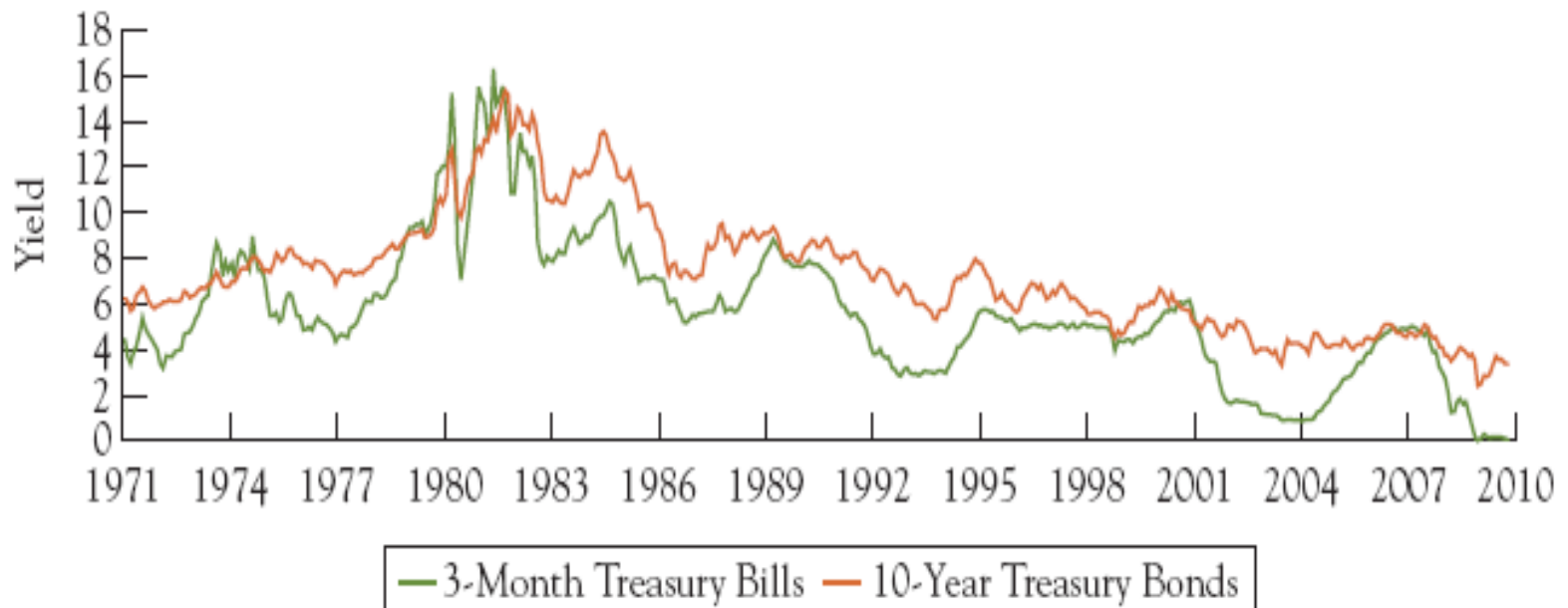
Yield spread



spread = 10 year rate minus 2 year rate

Term Structure of Interest Rates

Figure 7.3 The Term Structure of Treasury Interest Rates



The Expectations Hypothesis

Figure 7.5

The Expectations Hypothesis and Expectations of Future Short-term Interest Rates

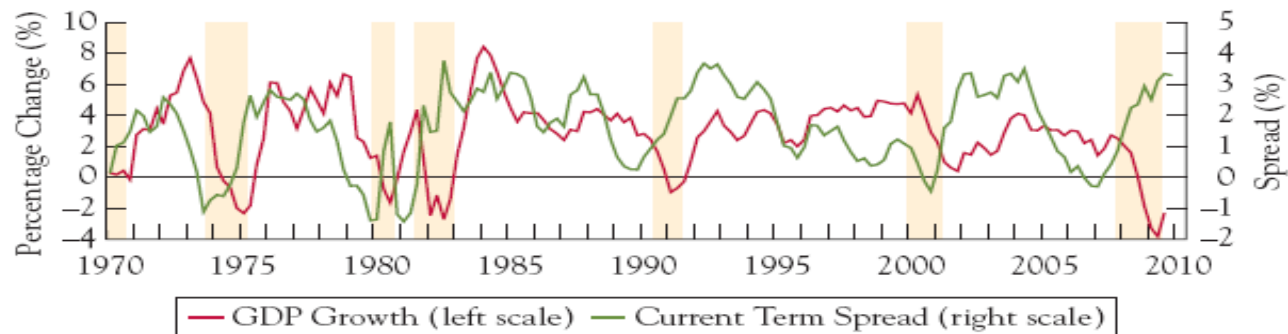


Term Structure of Interest Rates

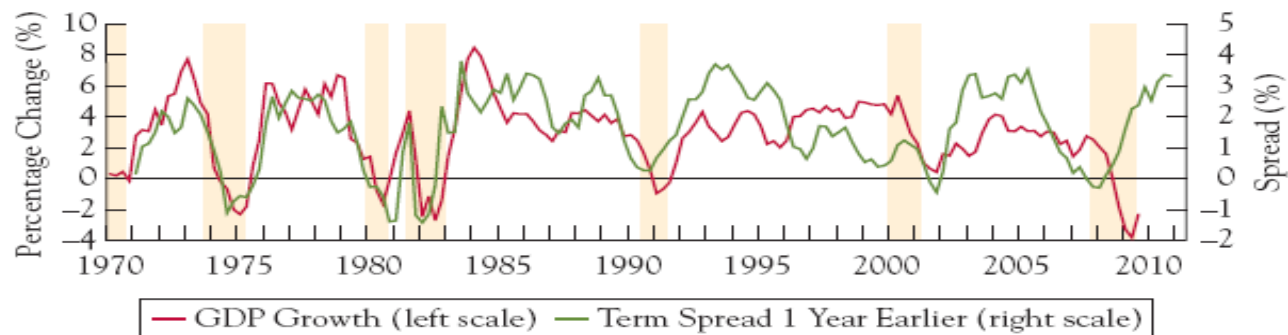
Figure 7.9

The Term Spread and GDP Growth

A. Current Term Spread and GDP Growth



B. GDP Growth with Term Spread 1 Year Earlier



Summary: other indicators

	Std. deviations relative to GDP	Contemporaneous correlation with GDP
GDP	1.00	1.00
Employment	1.01	0.87
Hours Worked	0.56	0.60
Yield Spread	0.55	-0.16
Housing Starts	8.69	0.53

Identifying good indicators

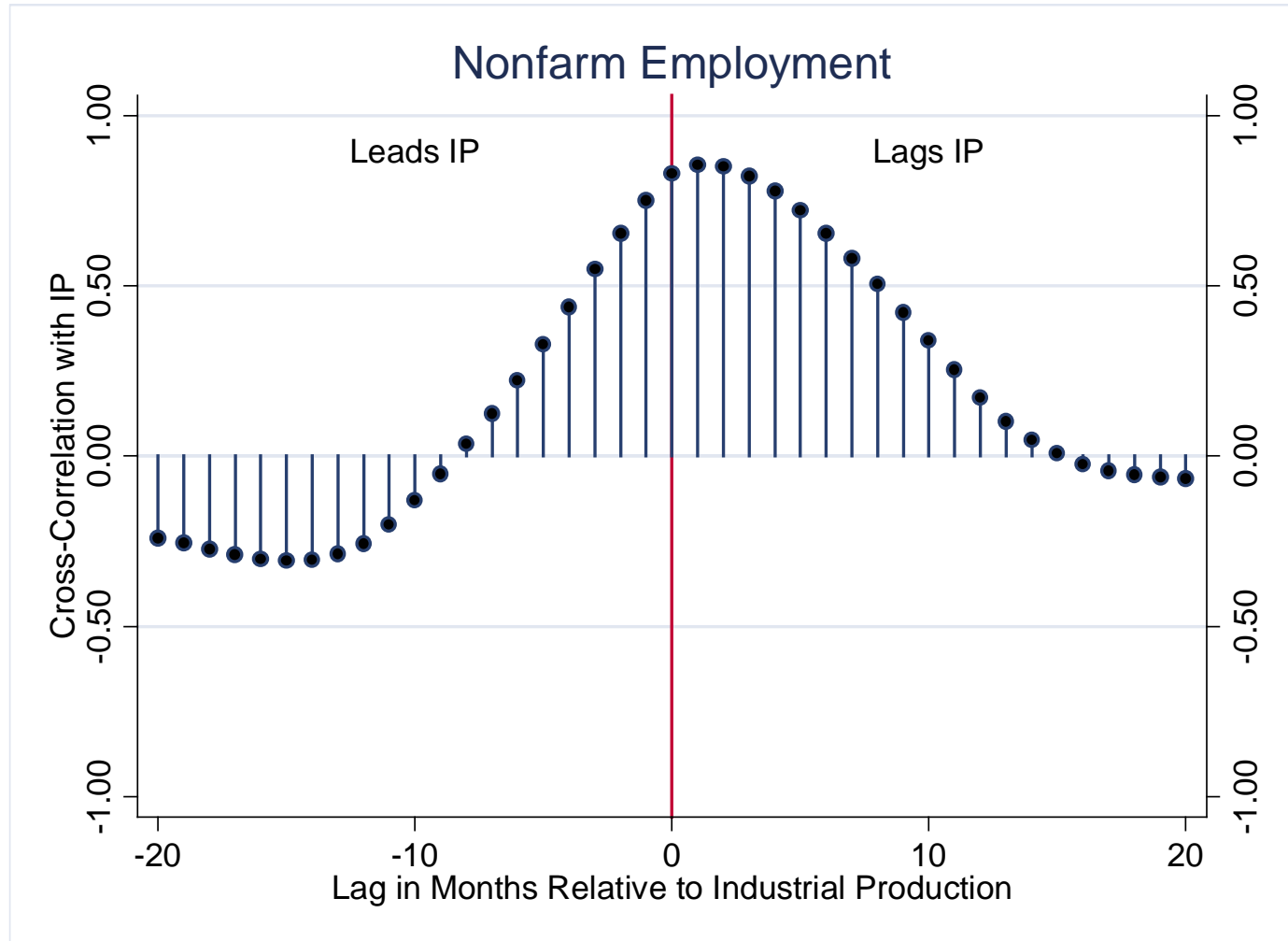
- How do you find good indicators?
 - Forecasting the future requires indicators that lead what you're forecasting
 - Ask friends, read reports, look at ccf (next!)
- Cross-correlation function (“ccf”)
 - Correlations between two variables at different times
$$\text{ccf}(k) = \text{corr}(x_t, y_{t-k})$$

[plot this against k]
 - If $k < 0$: x leads y [or y lags x]
 - If $k > 0$: x lags y [or y leads x]
 - Easier to analyze than growth rate plots

Cross correlation graphs

- Pictures: plot $\text{ccf}(k)$ against k
 - y = IP growth
 - x = indicator
 - Does indicator lead or lag IP growth?

Does employment lead or lag?



Contemporaneous correlation

Date	x(t)	y(t)
1	2.43	8.47
2	1.19	2.29
3	0.13	7.36
4	0.56	6.39
5	0.38	6.02
6	0.96	0.22
7	1.87	3.60

Reminder:

- $ccf(k) = \text{corr}[x(t), y(t-k)]$

For $k = 0$:

- $ccf(0) = \text{corr}[x(t), y(t)]$

Use data marked

- Red for x
- Blue for y

Lagging Indicator

Date	x(t)	y(t)
1	2.43	8.47
2	1.19	2.29
3	0.13	7.36
4	0.56	6.39
5	0.38	6.02
6	0.96	0.22
7	1.87	3.60

Reminder:

- $\text{ccf}(k) = \text{corr}[x(t), y(t-k)]$

For $k = +1$:

- $\text{ccf}(1) = \text{corr}[x(t), y(t-1)]$
- Means: x lags y

Use data marked

- Red for x
- Blue for y

Leading Indicator

Date	x(t)	y(t)
1	2.43	8.47
2	1.19	2.29
3	0.13	7.36
4	0.56	6.39
5	0.38	6.02
6	0.96	0.22
7	1.87	3.60

Reminder:

- $\text{ccf}(k) = \text{corr}[x(t), y(t-k)]$

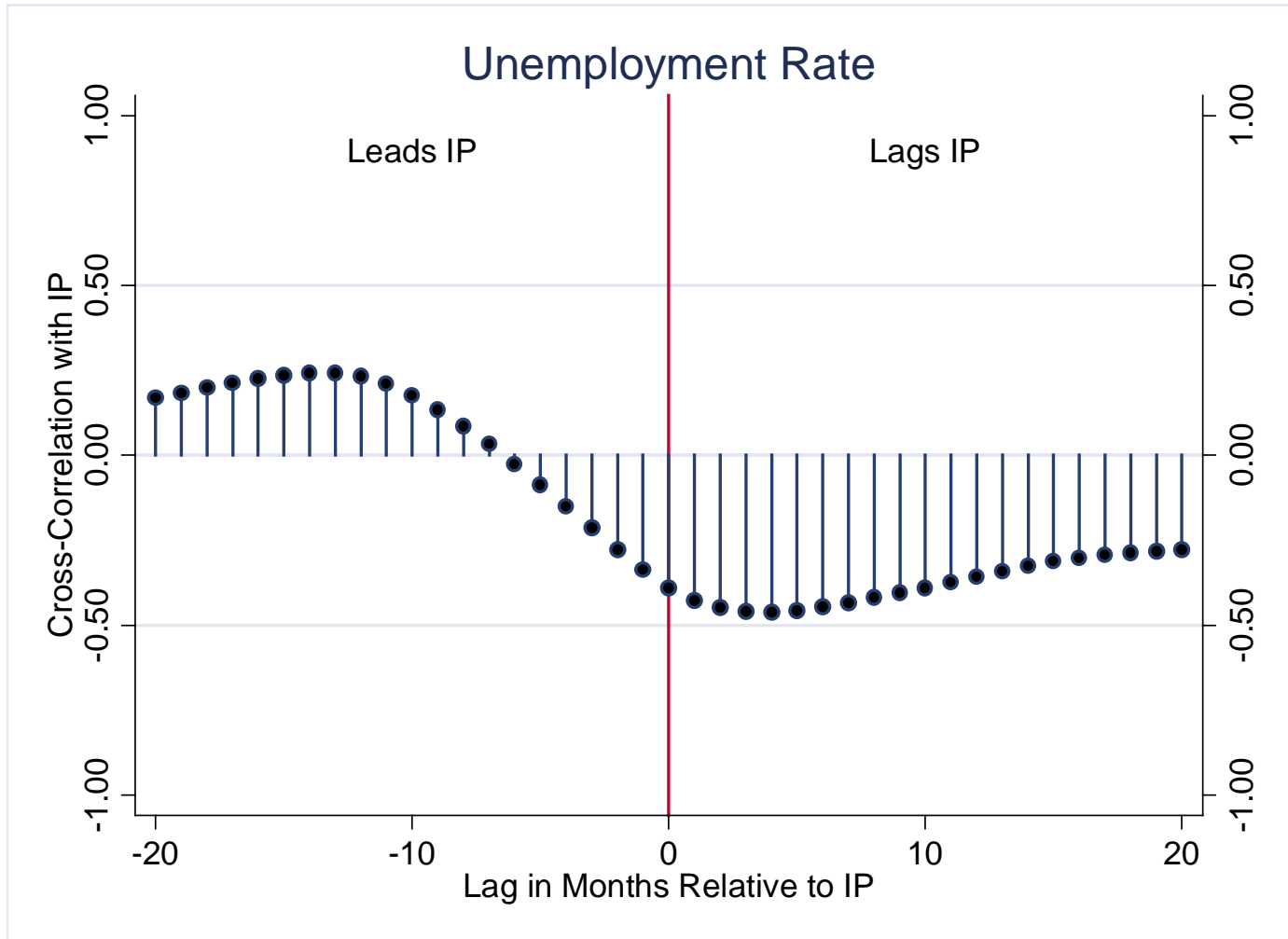
For $k = -1$:

- $\text{ccf}(1) = \text{corr}[x(t), y(t+1)]$
- Means: y lags x

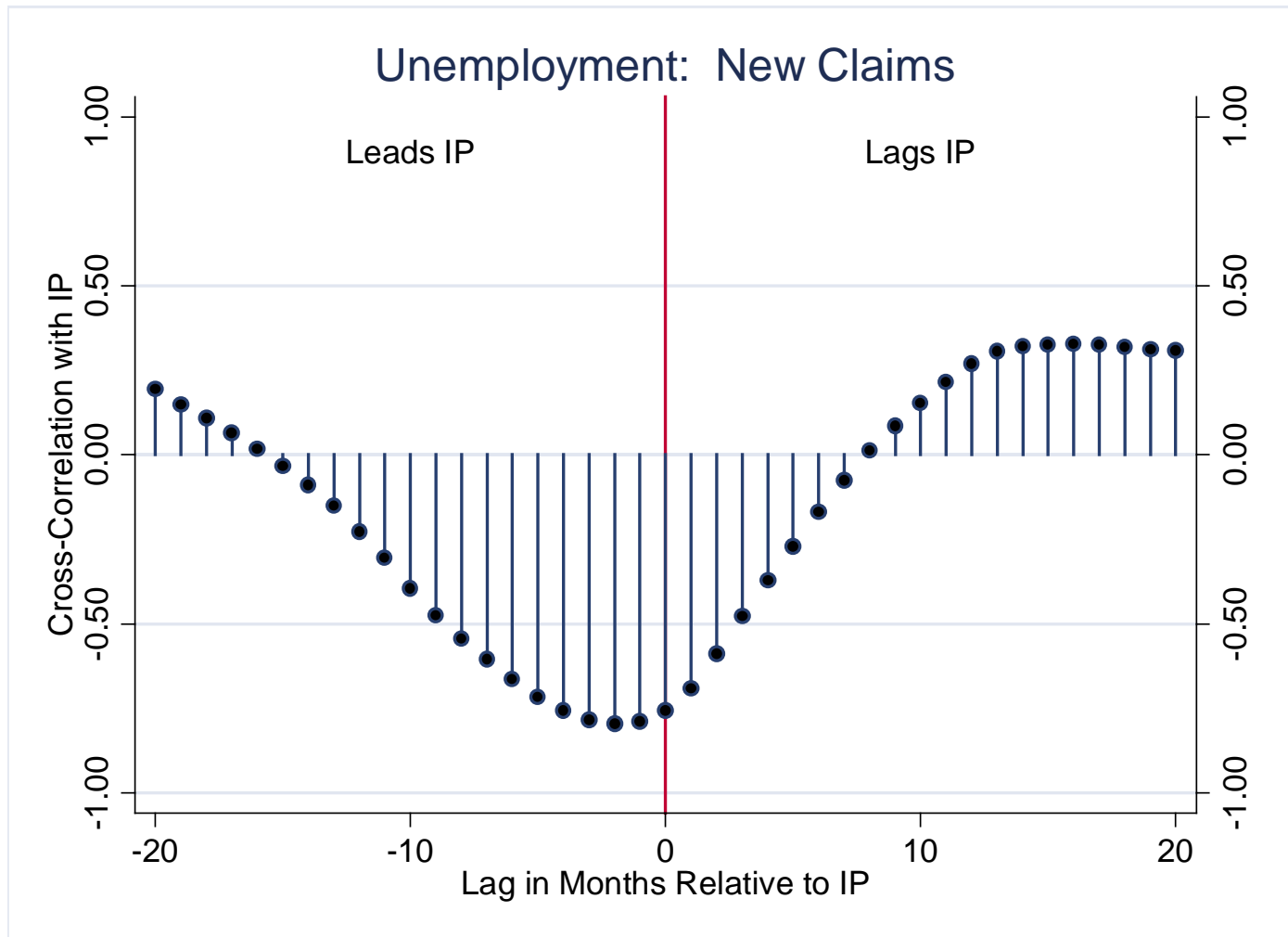
Use data marked

- Red for x
- Blue for y

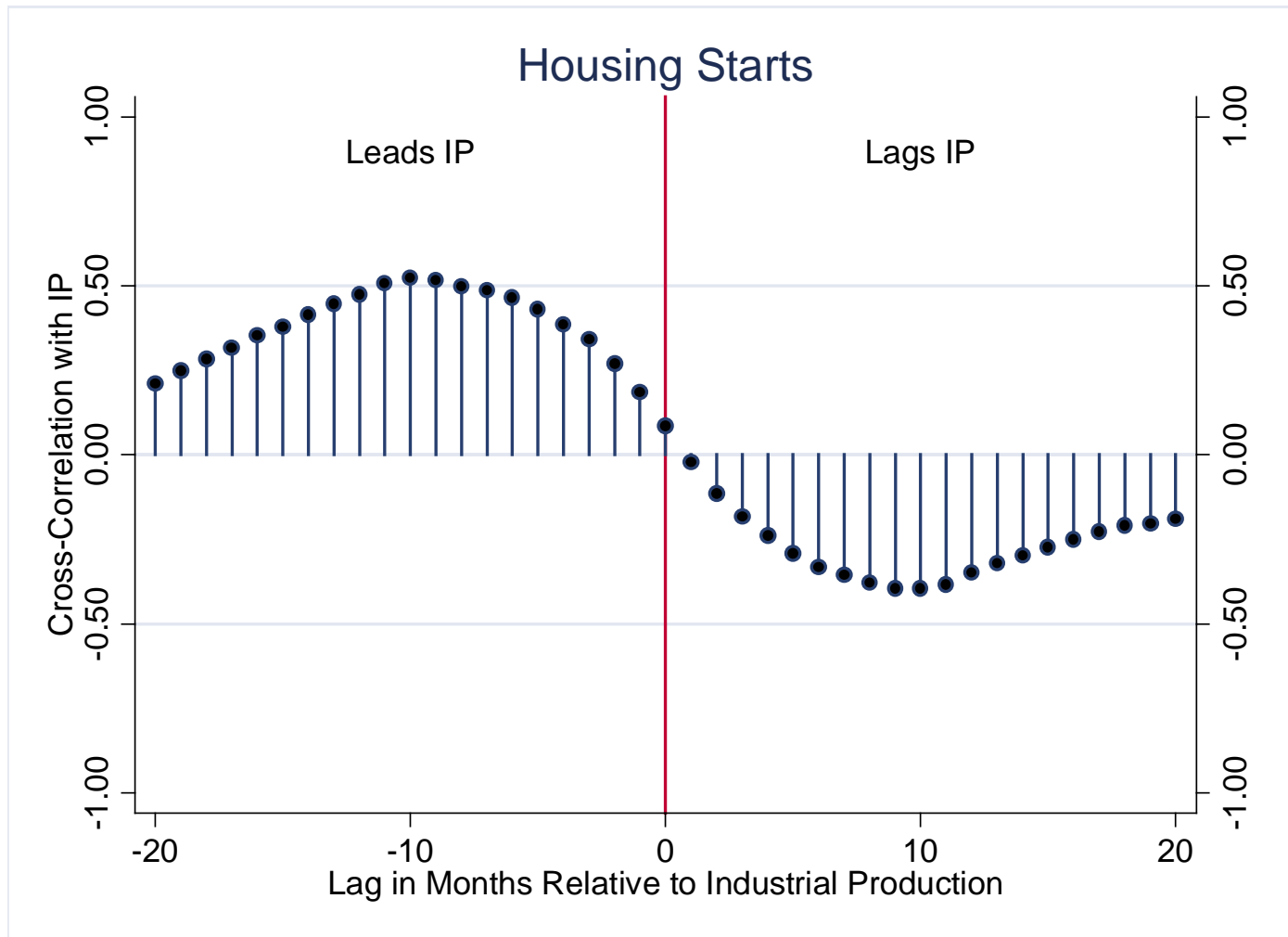
Unemployment rates



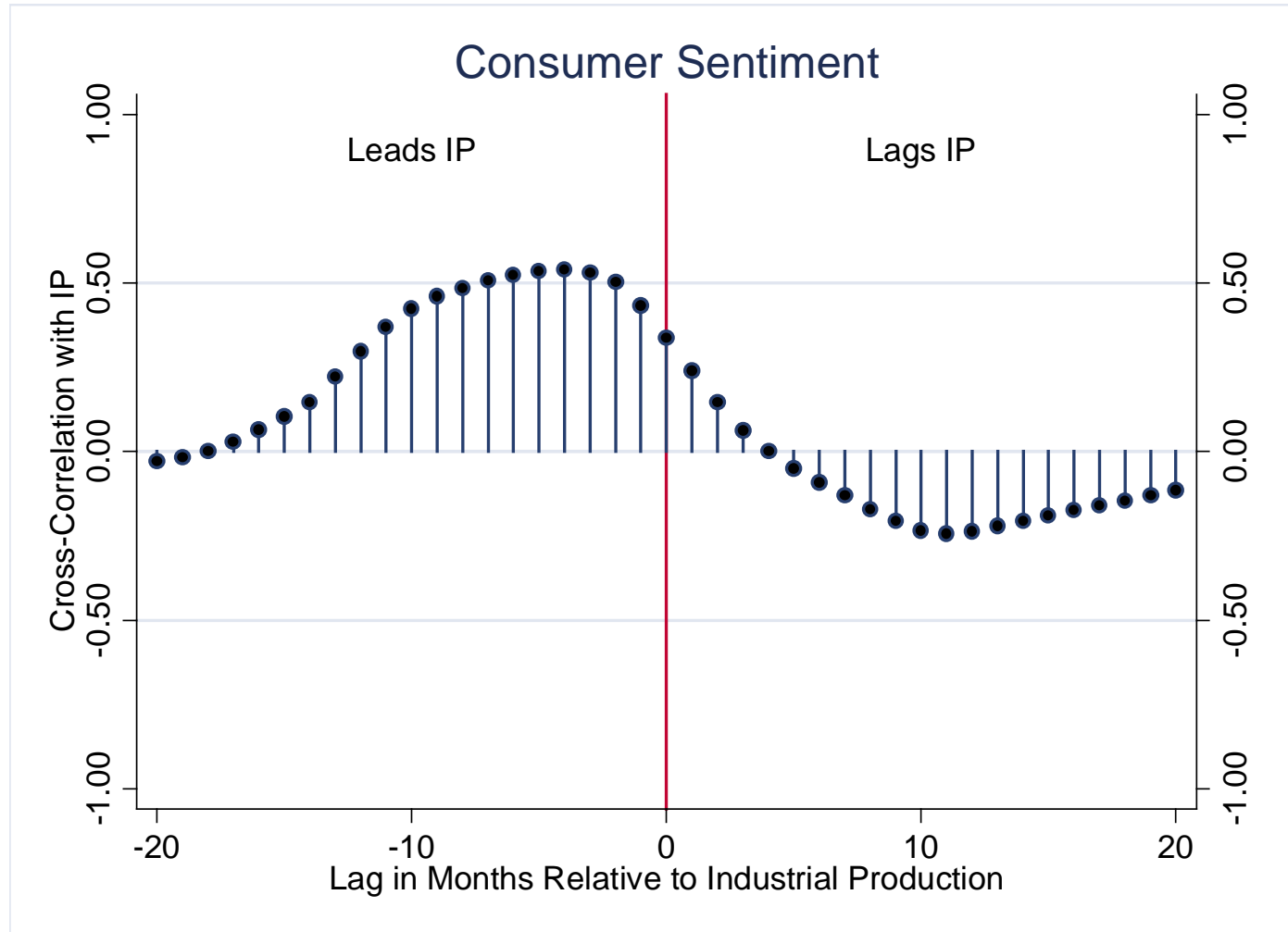
New unemployment claims



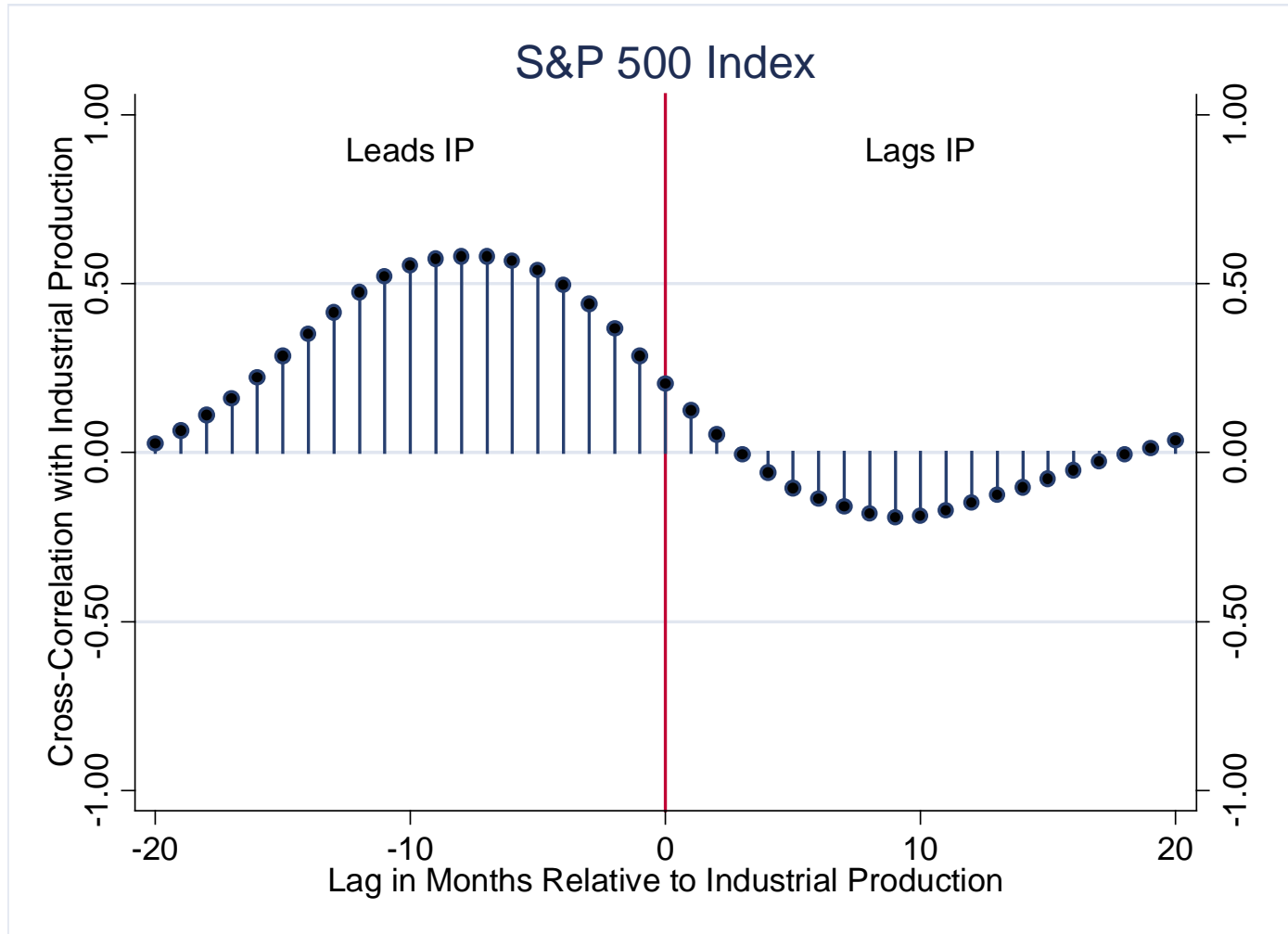
Housing starts



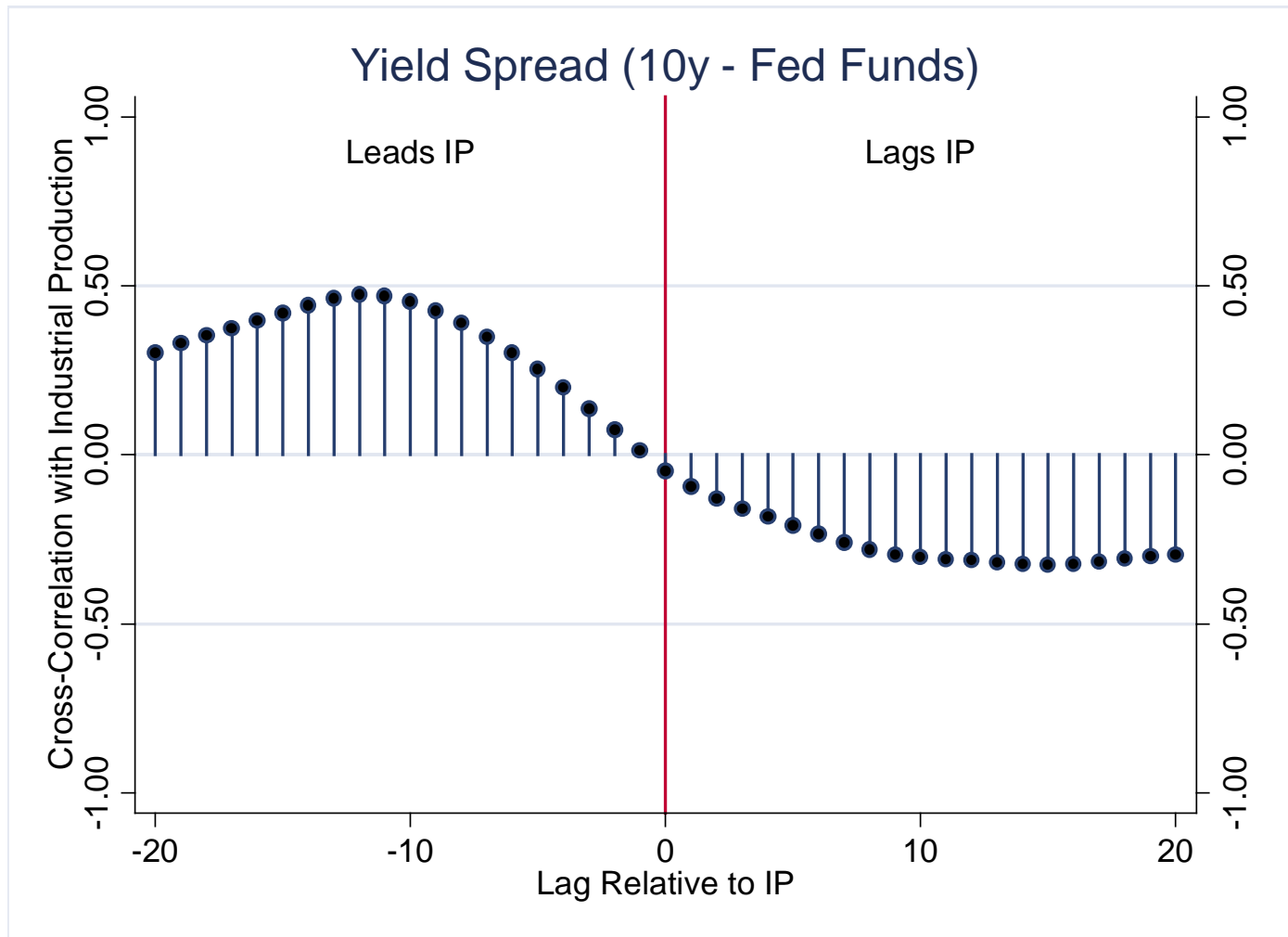
Consumer sentiment



S&P 500



Yield spread



Business cycle indicators

- Leading indicators
 - Stock market returns
 - Consumer sentiment
 - Hours worked
 - Durable goods orders
 - Housing starts, building permits
 - New claims for unemployment insurance
- Lagging indicators
 - Employment, unemployment rate

Summary

- GDP growth is volatile
- Information about fluctuations useful for
 - Production, employment, investment, and pricing
 - Asset management
- Indicators differ in
 - Volatility
 - Cyclicalities (pro or counter)
 - Lead and lag

The Global Economy

Forecasting

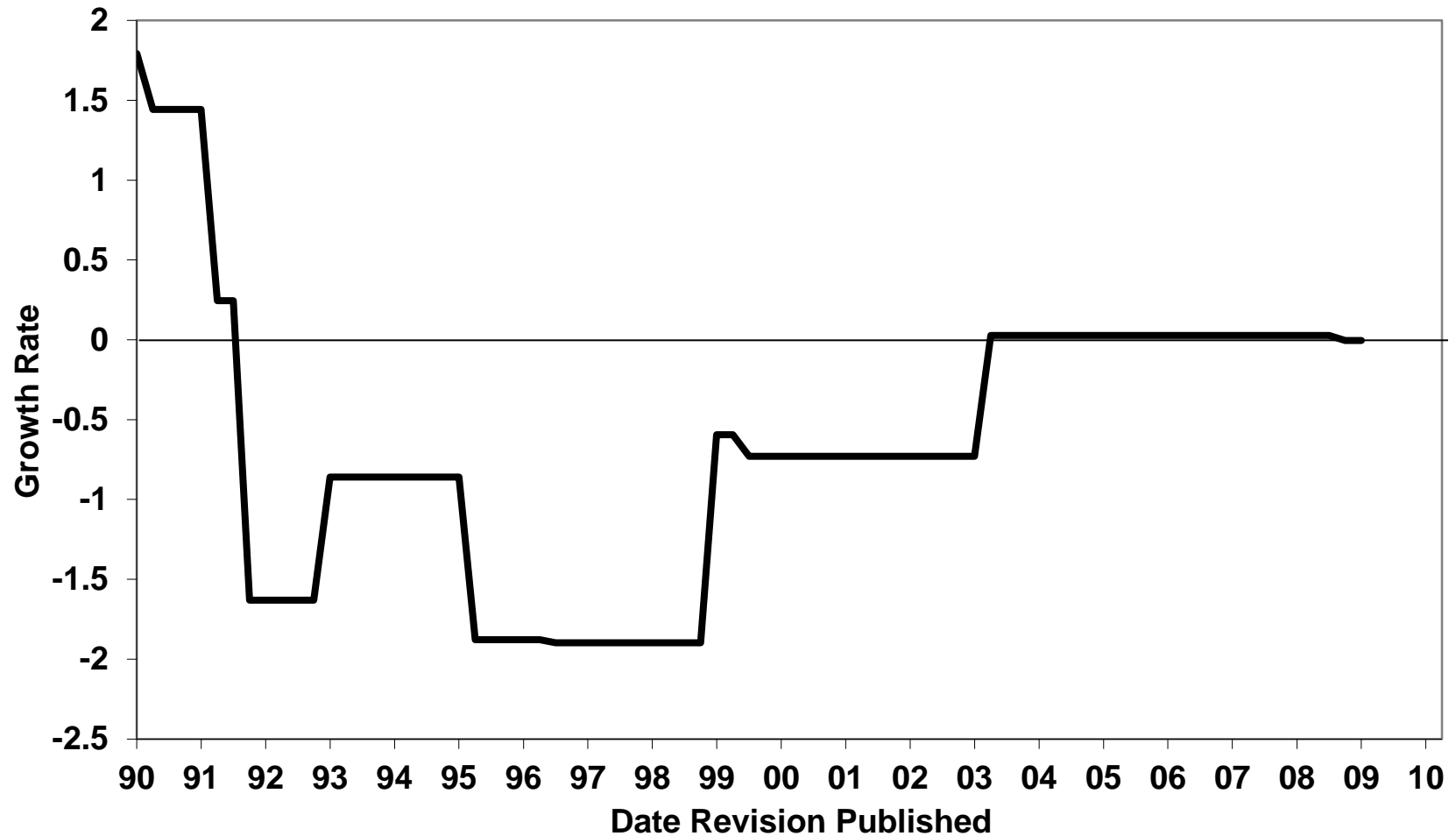
What's a good indicator?

- **Correlated** with the variable of interest
- **Leads** the variable
- **Timely**: available quickly
- **Stable**: not subject to significant revision that would make in-sample assessment unrealistic

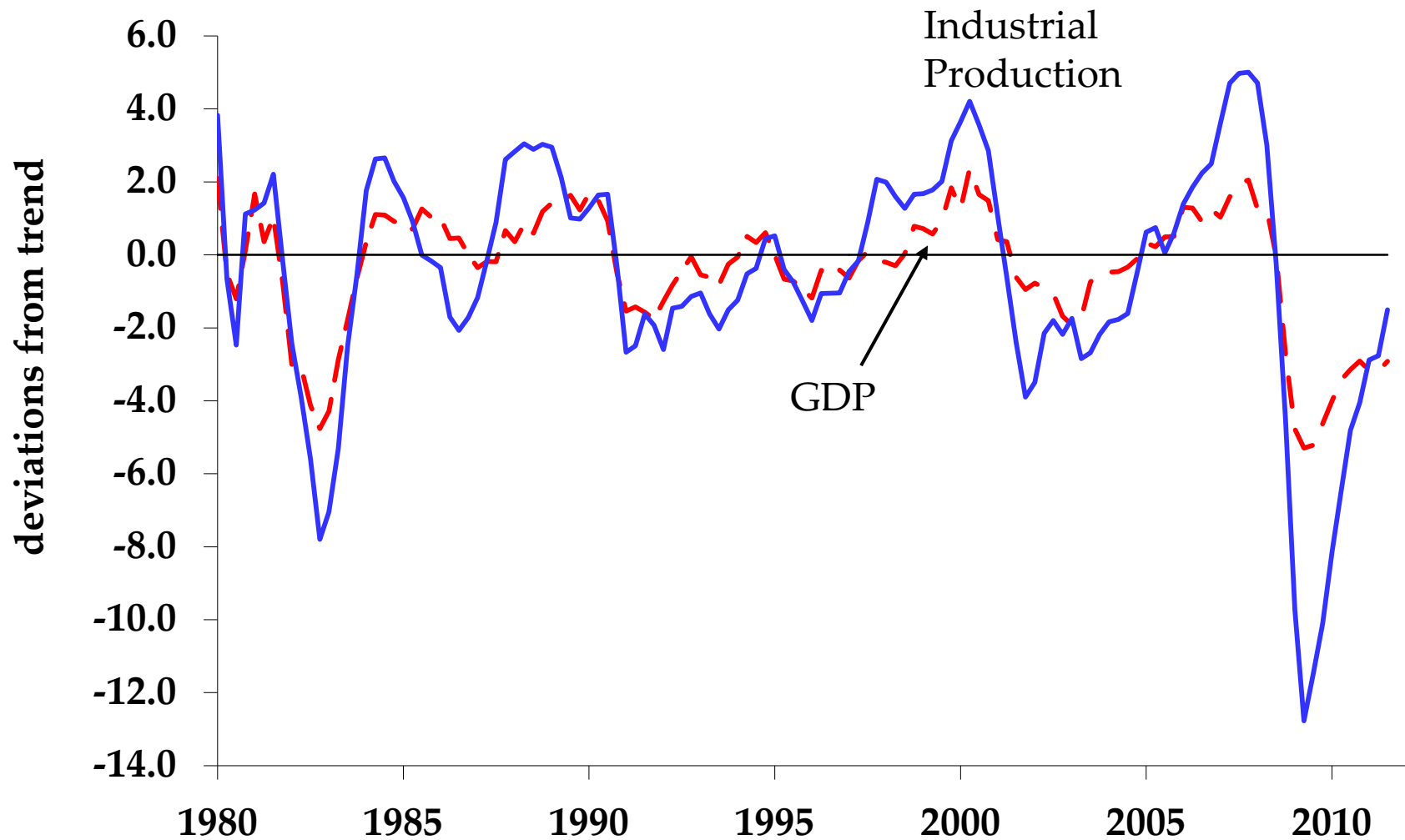
What to forecast?

- Forecast industrial production (IP)
 - A proxy for GDP
 - Available monthly, rather than quarterly
 - Covers mining, manufacturing, and utilities
 - More volatile than GDP

The Evolution of the Reported GDP Growth Rate for 3Q 1990



Industrial production



What to forecast?

- $\gamma_{t,t+k}$ = k-period growth rate of IP

$$\gamma_{t,t+k} = \ln \left(\frac{IP_{t+k}}{IP_t} \right) \times \left(\frac{12}{k} \right)$$

- Monthly data at annual rate
- This is a **forward-looking** growth rate. It is different than our usual growth rate!

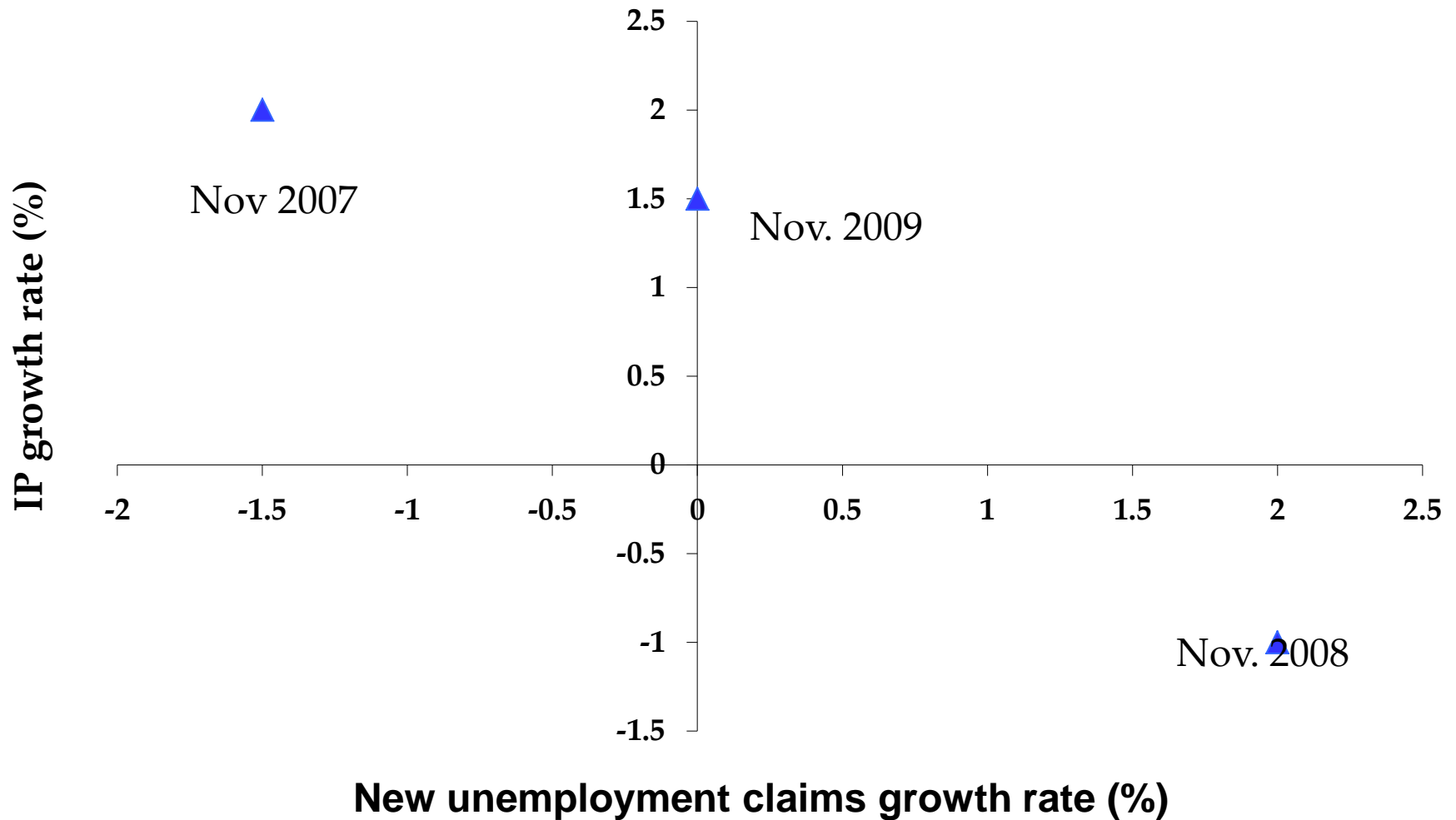


Forecasting

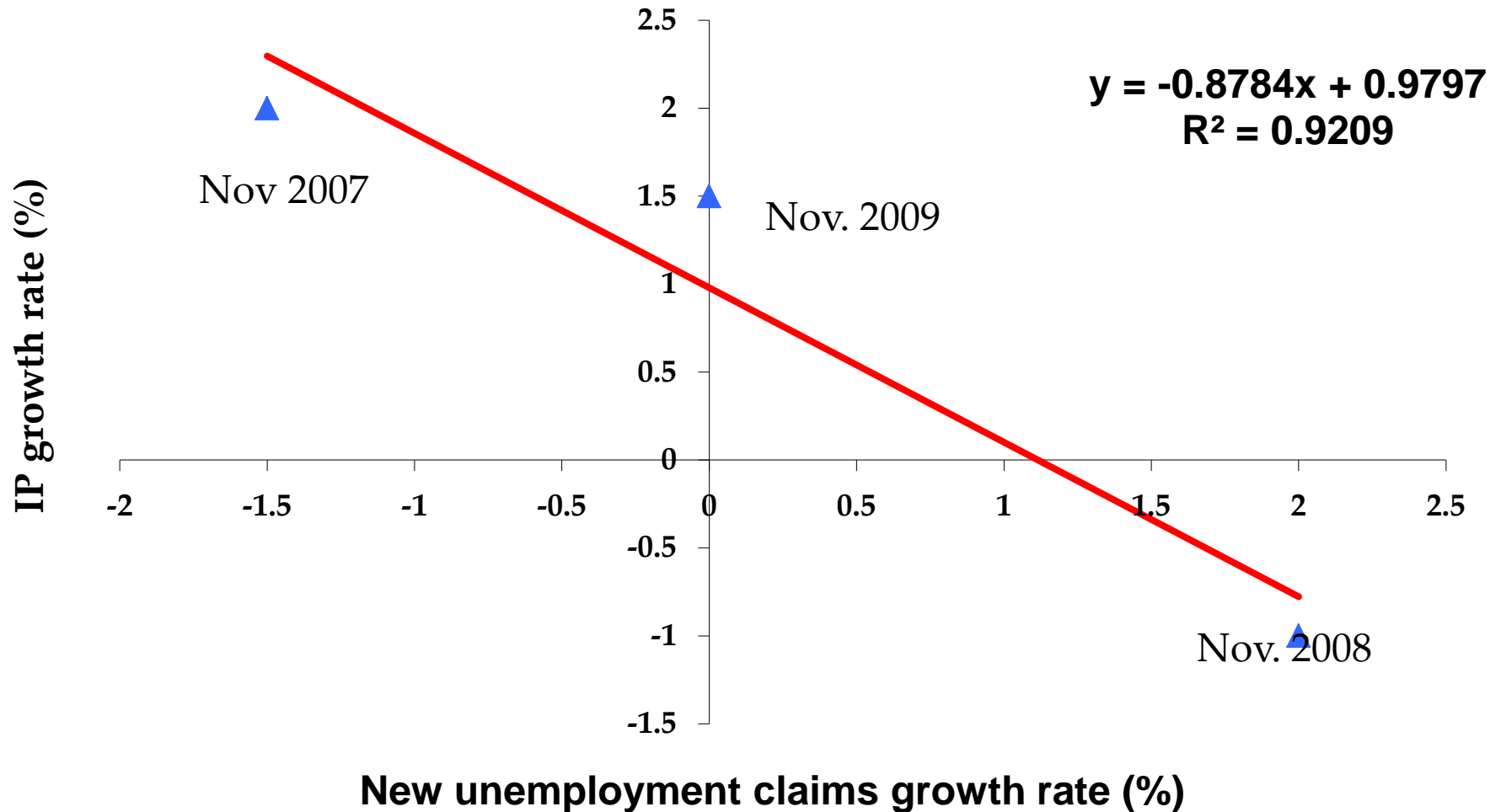
- Use historical patterns to predict future

Date	New unemployment claims (growth rate)	12 month forward growth rate of IP
November 2007	-1.5	2
November 2008	2.0	-1
November 2009	0	1.5
November 2010	-1	??

What is IP growth 2010-2011?



What is IP growth 2010-2011?



Forecasting

- Use historical patterns to predict future

- 2010-2011 growth rate

$$1.85 = (-0.87) * (-1) + 0.98$$

Date	New unemployment claims (growth rate)	12 month forward growth rate of IP
November 2007	-1.5	2
November 2008	2.0	-1
November 2009	0.0	1.5
November 2010	-1.0	??

How to forecast

- Using a linear regression

$$\gamma_{t,t+k} = a + bx_t + \varepsilon_t$$

- x is an indicator, ε is the residual

- Sources of forecast error

- Large residual variance (large standard error, low R^2)
- Uncertainty in estimates of (a,b)
- Relation between γ and x not stable
- Data on γ and x not stable
- Relationship between γ and x not linear

Forecasting

- Example:

x_t = yield spread

k = 24 months

- Assessment

- IP available monthly, revisions modest
- Spread available immediately, never revised
- $R^2 = 0.20$: roughly 20% “explained”, 80% not
- Standard error = 3.01% (+/- 2 std errors is huge!)
- Data stability: IP revised somewhat, spread not
- Bottom line: useful information

Interpreting Regression Results

- **R²**: Share of variance of dependent variable that is explained by regression. **Adjusted R²** accounts for the use of multiple explanatory variables.
- **Standard error of coefficient**: precision of estimate
- **t-statistic**: ratio of coefficient to standard error (for a normal distribution, two standard deviations is significant at a 95% confidence interval)
- **Standard error of regression**: can be used to establish a confidence interval around prediction. For example, plus/minus one standard deviation creates a 68% confidence interval around the forecast (assuming normality).

Flow chart

1. Compute **forward-looking** growth rate

$$\gamma_{t,t+k} = \ln(IP_{t+k} / IP_t) \times (12 / k)$$

2. Find indicator(s) x_t
3. Estimate a relation using historical data

$$\gamma_{t,t+k} = a + bx_t$$

4. Output of regression is (\hat{a}, \hat{b})
5. Use current indicator x_t and estimates (\hat{a}, \hat{b}) to forecast future growth $\gamma_{t,t+k}$

Questions

- How much data should we use?
 - More is better
 - But relationships might change
- Should we use multiple explanatory variables?
 - Yes
 - Lagged IP growth among them

Conference Board Index

Indicator	Weight
Average weekly hours, manufacturing	0.1946
Average weekly initial claims for unemployment insurance	0.0268
Manufacturers new orders, consumer goods	0.0504
Vendor performance, slower deliveries index	0.0296
Manufacturers new orders, non-defense capital goods	0.0139
Building permits, new private housing units	0.0205
Stock prices, 500 common stocks	0.0309
Money supply, M2	0.2775
Interest spread, 10 year T-bond less Federal Funds rate	0.3364
Index of consumer expectations	0.0193

Summary

- Forecasting
 - Interest spread works well for GDP/IP growth
 - Still a lot of unpredictable uncertainty out there
- Strategic issue: do you want to base plans on forecast, or build in “feedback” responses to inevitable surprises?
- Where can I learn more?
 - Forecasting course: B90.2302, Deo and Hurvich

For the ride home

- Google trends
 - Data on popularity of search terms
 - <http://www.google.com/insights/search/>
 - Can it be used to make better forecasts?
- More at:
<http://googleresearch.blogspot.com/2009/04/predicting-present-with-google-trends.html>