Why are Economic Data Seasonally Adjusted?

NABE Economic Measurement Seminar – Seasonal Adjustment Webinar

July 12, 2022

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Senior Director, Economics has specialized in the development of business cycle indicators and in forecasting aggregate economic activity worldwide. He also oversees The Conference Board's Global Economic Outlook and the research program in productivity, innovation and competitiveness. He has published in international peer-reviewed academic journals. He is also a faculty member in MS in Applied Economics at Boston College. Ozyildirim often speaks to business and professional audiences on economic and business cycle trends and is frequently cited by national and global media.

Previously, Ozyildirim worked for Management Science Associates, Inc. and was a lecturer at Pennsylvania State University. A native of Istanbul, he received his BA from Ithaca College and his PhD from the Pennsylvania State University.

The Conference Board
Selected Economic Indicators & Surveys

- Monthly Indicators:
  - ✓ US Consumer Confidence Index®; Leading Economic Indexes (LEI): Australia, Brazil, Euro Area, China, France, Germany, India, Japan, Korea, Mexico, Spain, UK, US and Global Economy, Employment Trends Index™
- Quarterly Indicators:
  - ✓ Measure of CEO Confidence™: US, Europe, China
- Other Indicators/Services:
  - ✓ The Business Council Survey – 3x per year
  - ✓ Business & Economics Portfolio – quarterly
  - ✓ Business Cycle Indicators Database – weekly
  - ✓ Job Satisfaction Survey – annual
- Global Economic Outlook, labor market and consumer research

Agenda:

Why are Economic Data Seasonally Adjusted?

- Business cycles and the problem of seasonality
- How does seasonal adjustment work?
- Potential pitfalls: modeling and real time analysis

Business cycles and the problem of seasonality

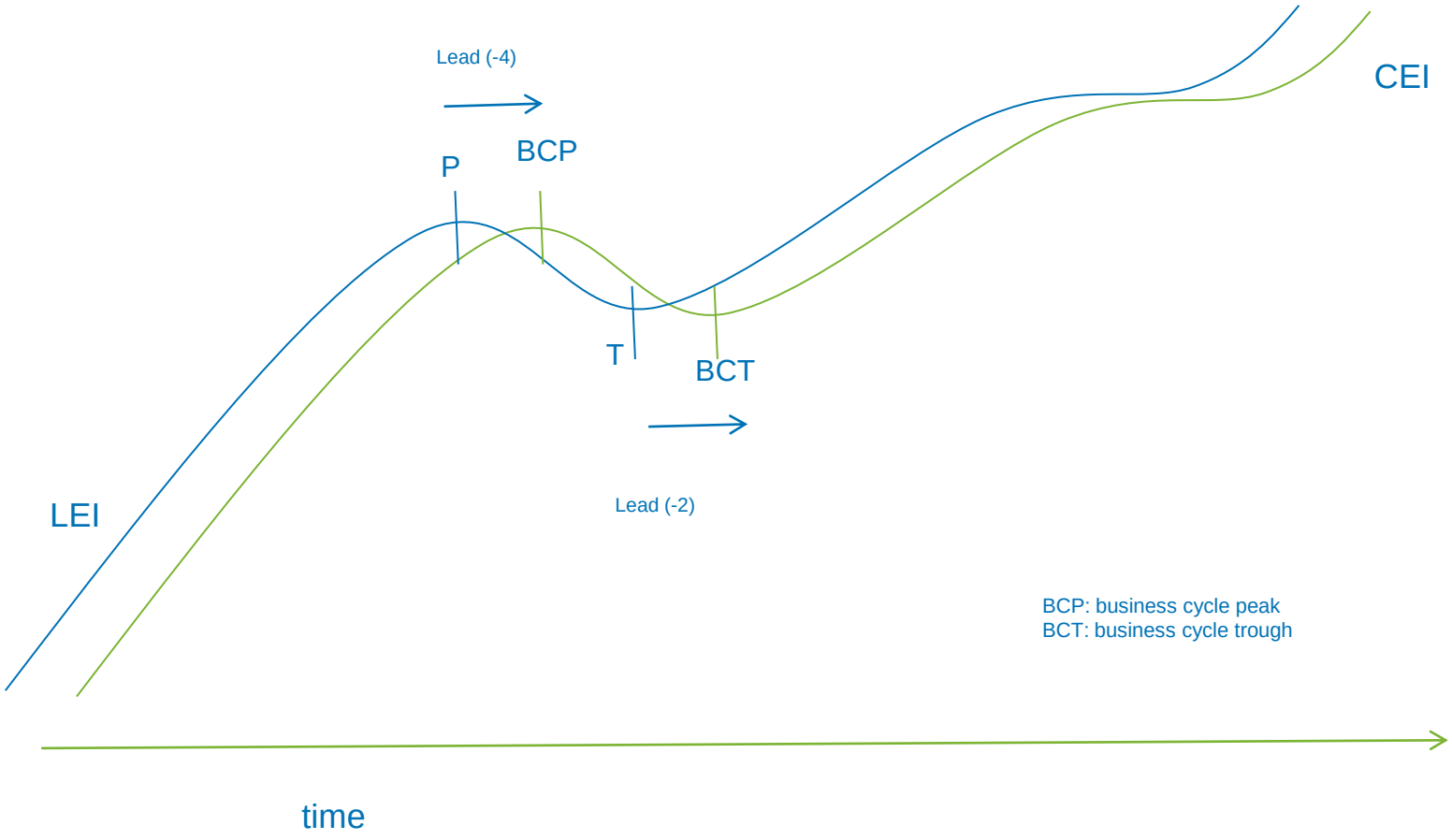
Business cycles defined

"Business cycles are a type of fluctuation found in the aggregate economic activity of nations that organize their work mainly in business enterprises: 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 phase of the next cycle; this sequence of changes is recurrent but not periodic; in duration business cycles vary from more than one year to ten or twelve years; they are not divisible into shorter cycles of similar character with amplitudes approximating their own."

Wesley C. Mitchell, (1927), Business Cycles: The Problem and Its Setting, New York, NY: National Bureau of Economic Research.

Burns, A. F., and Mitchell, W. C. (1946), Measuring Business Cycles, New York, NY: National Bureau of Economic Research.

Timing in trend-cycle components: leading vs. coincident indicators



Regular cycles are an enduring feature of economic data….But, some cycles are more regular than others….

"In contrast [to regular and predictable seasonal fluctuations], recurrent slumps that generate declines in sales, production, and incomes along with rises in unemployment clearly belong to the sphere of public interest, and so do recurrent inflationary or speculative booms."

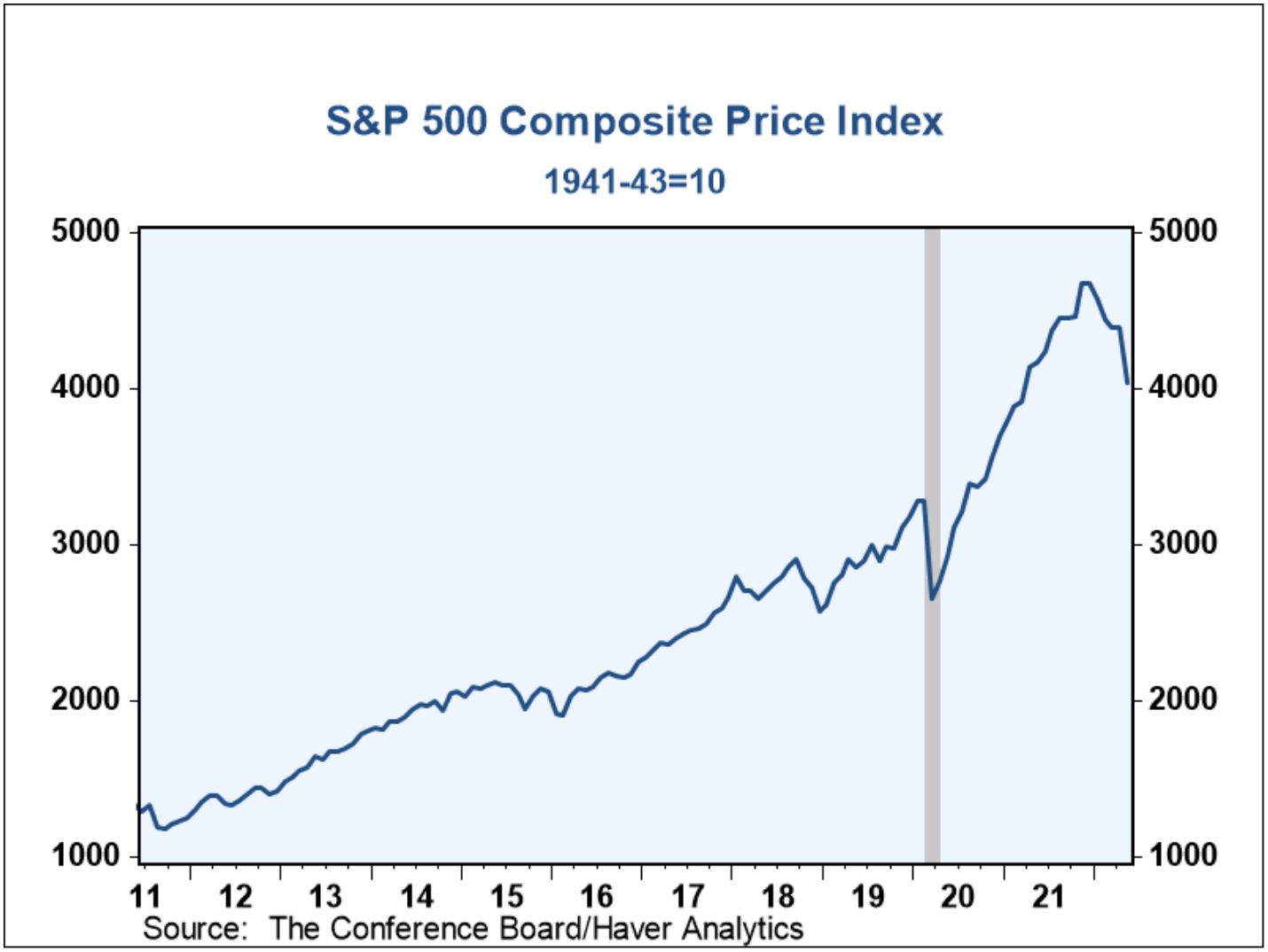
Zarnowitz (1992) p. 262

- Sales
- Production
- Income
- Employment

Seasonal fluctuations are a common feature of most economic data

- Intra-year variation that occurs at or about the same point each year -- not necessarily regular, but easily predictable
- Usually caused by exogenous factors:
  - Weather
  - Institutions
  - Holidays (Christmas, Easter, Ramadan, Chinese New Year, etc.)
- Could account for majority of the variation in economic data
- Could be present in every type of economic activity, but not a significant feature of stock prices and interest rates
- Difficult to incorporate into formal economic models due to lack of clear theoretical foundation

Seasonality is not an issue in stock markets



Composite coincident, leading, and lagging indexes combine best indicators to bring out and summarize common cyclical movements

- ✓ BCI-02 - Labor Force, Employment, and Unemployment
- ✓ BCI-03 - Output, Production, and Capacity Utilization
- ✓ BCI-04 - Sales, Orders, and Deliveries
- ✓ BCI-05 - Fixed Capital Investment
- ✓ BCI-06 - Inventories and Inventory Investment
- ✓ BCI-07A - Prices-Producer & Consumer
- ✓ BCI-07B - Prices-Commodity price detail
- ✓ BCI-09 - Wages, Labor Costs and Productivity
- ✓ BCI-10 - Personal Income and Consumer Attitudes
- ✓ BCI-12 - Money, Credit, Interest Rates, and Stock Prices
- ✓ BCI-13 - National Defense
- ✓ BCI-14 - Exports and Imports
- ✓ BCI-15A - Int'l Comparisons-Industrial Production & Consumer Prices
- ✓ BCI-15B - Int'l Comparisons-Stock Price Indexes & Exchange Rates

Composite indexes reveal historical business cycles

The indexes

- Bring cycles and turning points into focus
- “Real time” monitoring

- *The components are*
  - ✓ *Seasonally adjusted*
  - ✓ Deflated
  - ✓ Volatility adjusted
  - ✓ Aggregated with equal weights

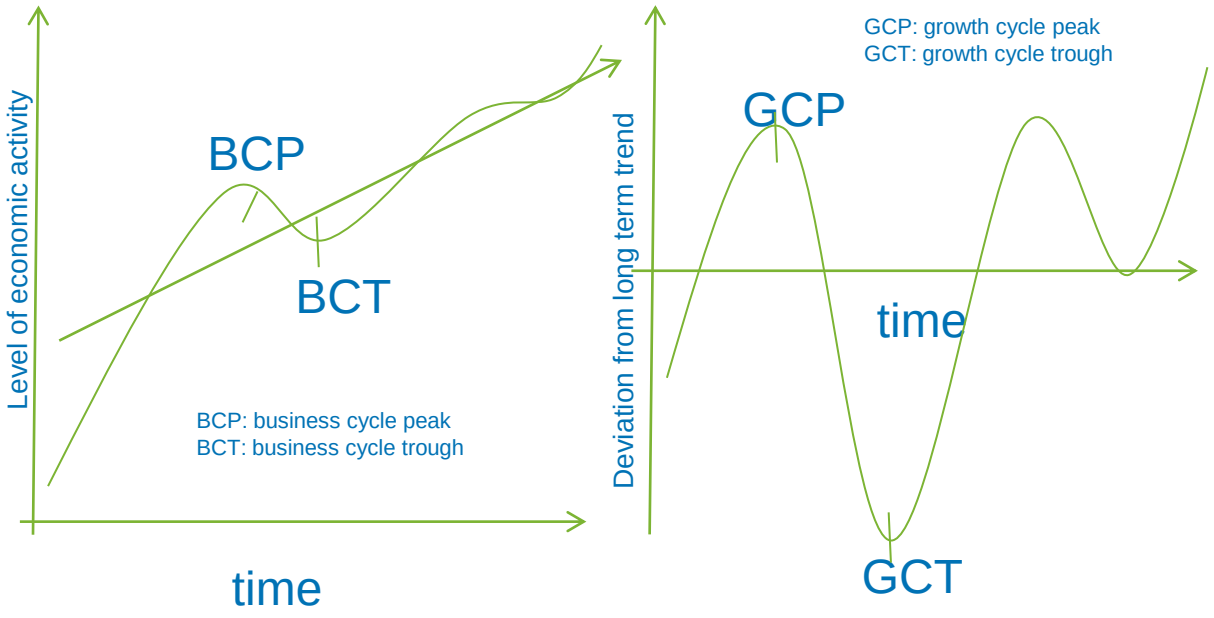
Selection criteria for composite index components: strong seasonality can affect many of these criteria

- Economic Significance
- Conformity
- Consistent Timing
- Smoothness
- Statistical Adequacy
- Currency or Timeliness

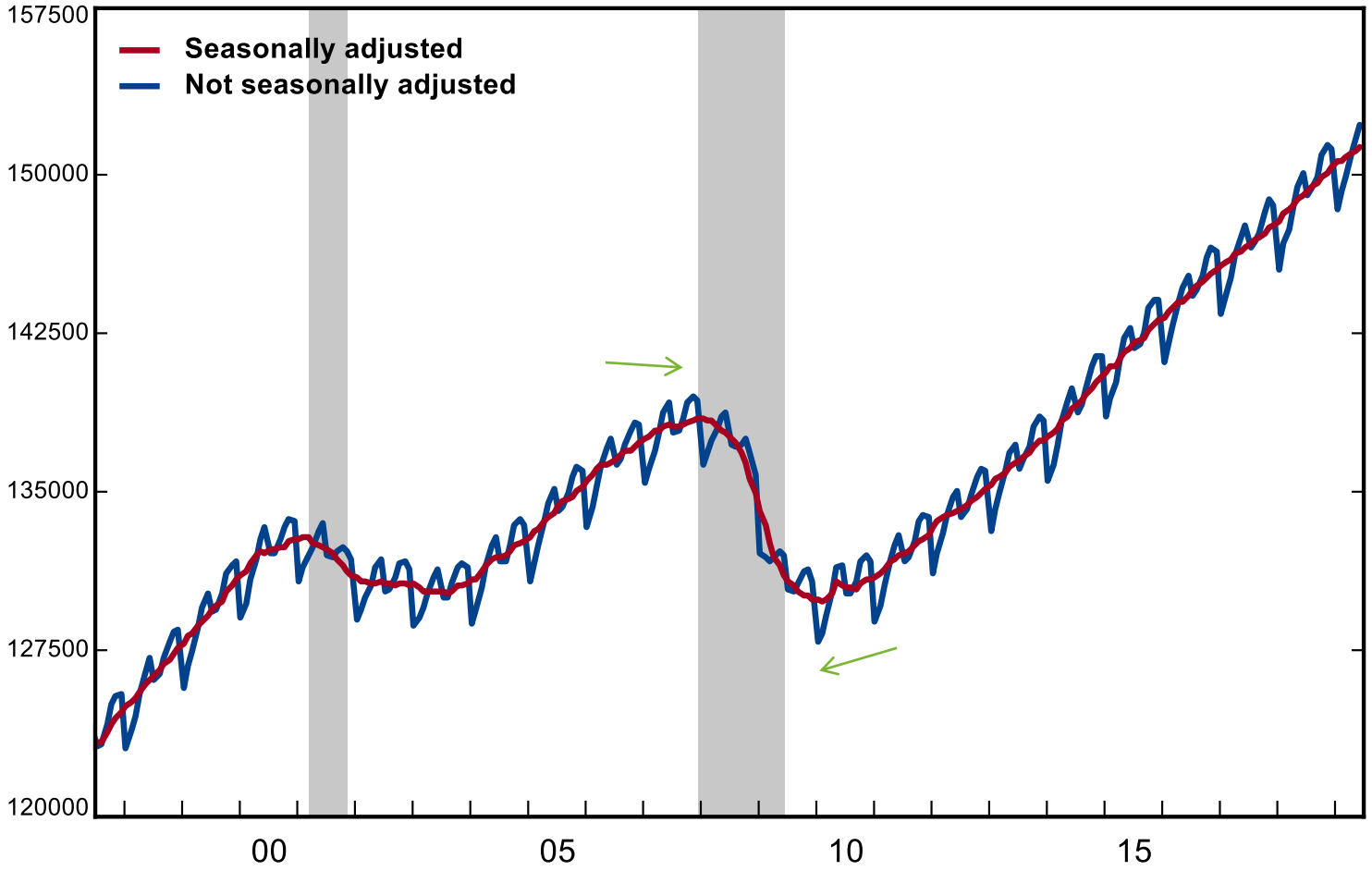
The indicator approach to business cycle analysis of recurring and uniform sequences in economic activity

- Relationships between *non-seasonal* part of data is main concern in business cycle analysis
- Sequences are revealed in seasonally adjusted indicators, classified according to cyclical timing
  - ✓ Coincident, Leading, Lagging indicators
- Recurrence of these timing sequences and relationships between types of economic activity
- Composite indexes define and predict turning points
  - ✓ The Conference Board Coincident Economic Index® (CEI)
  - ✓ The Conference Board Leading Economic Index® (LEI)

An important note: Business cycles vs. growth cycles



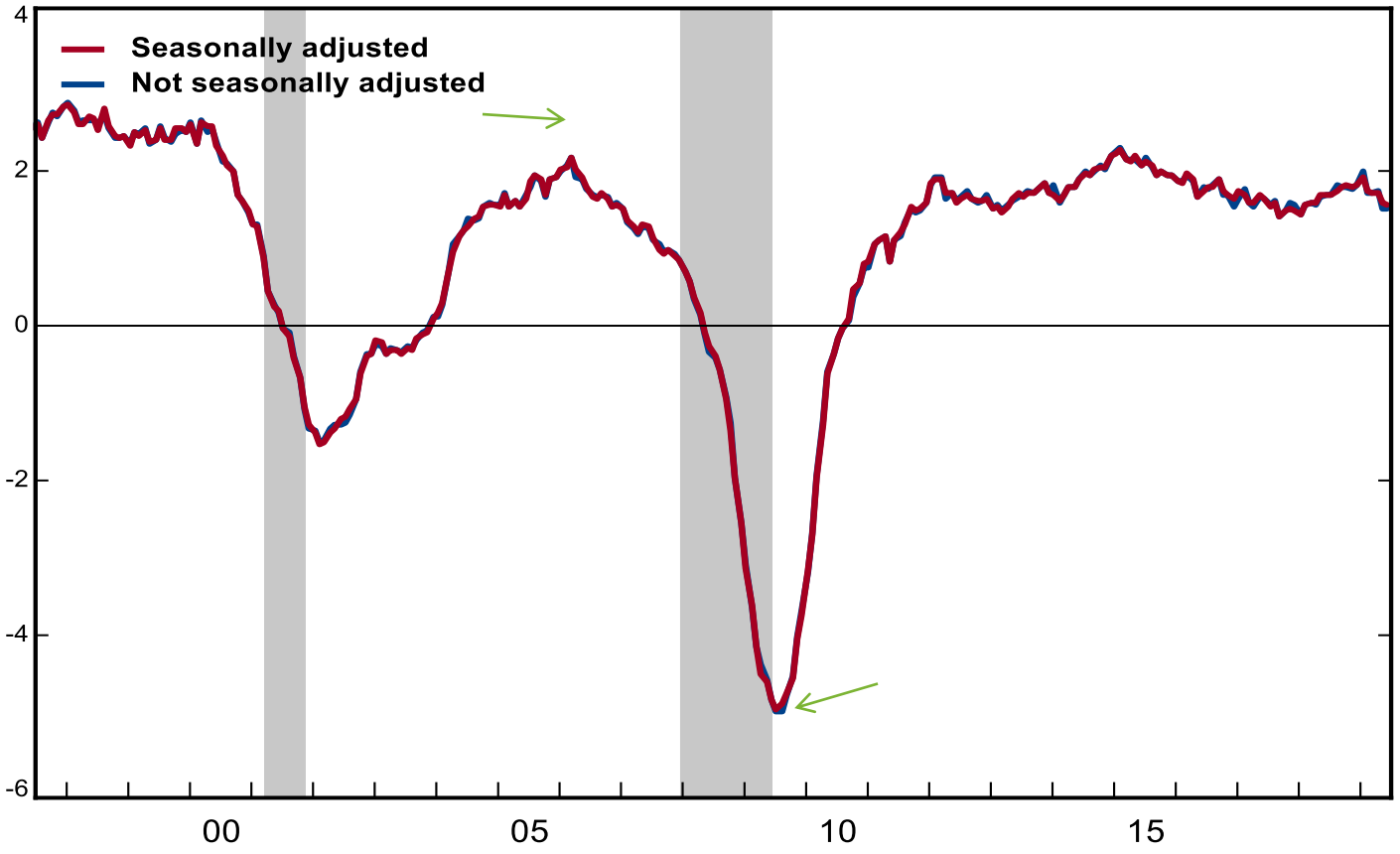
Seasonality accounts for majority of the variation in most indicators of real activity (e.g. payroll employment)



Source: Bureau of Labor Statistics

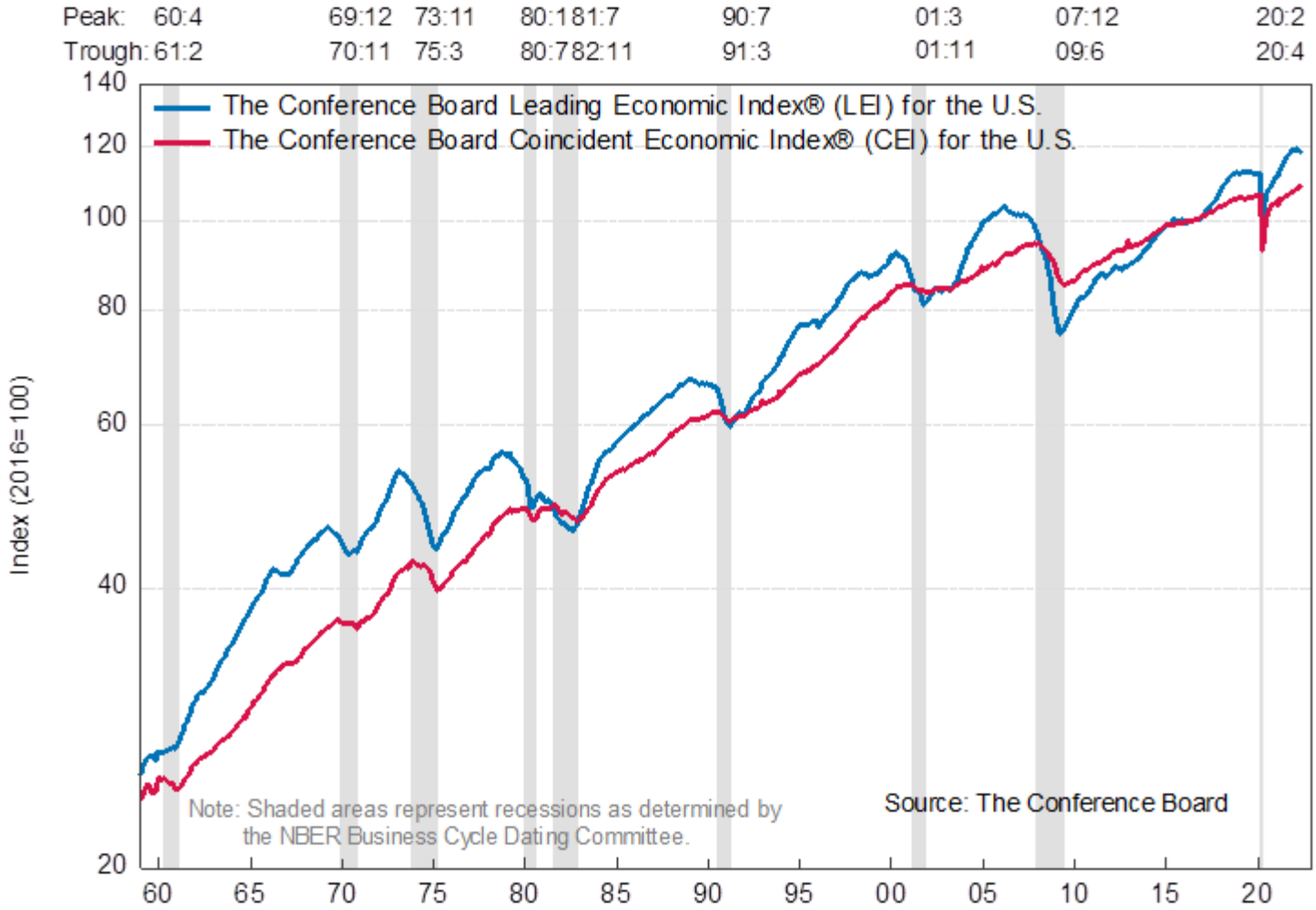
Phase shift problem: Simplest seasonal adjustment often used for short term analysis smooths the data, but ill-equipped for historical business cycle research

Employment, total nonfarm
year over year percent change



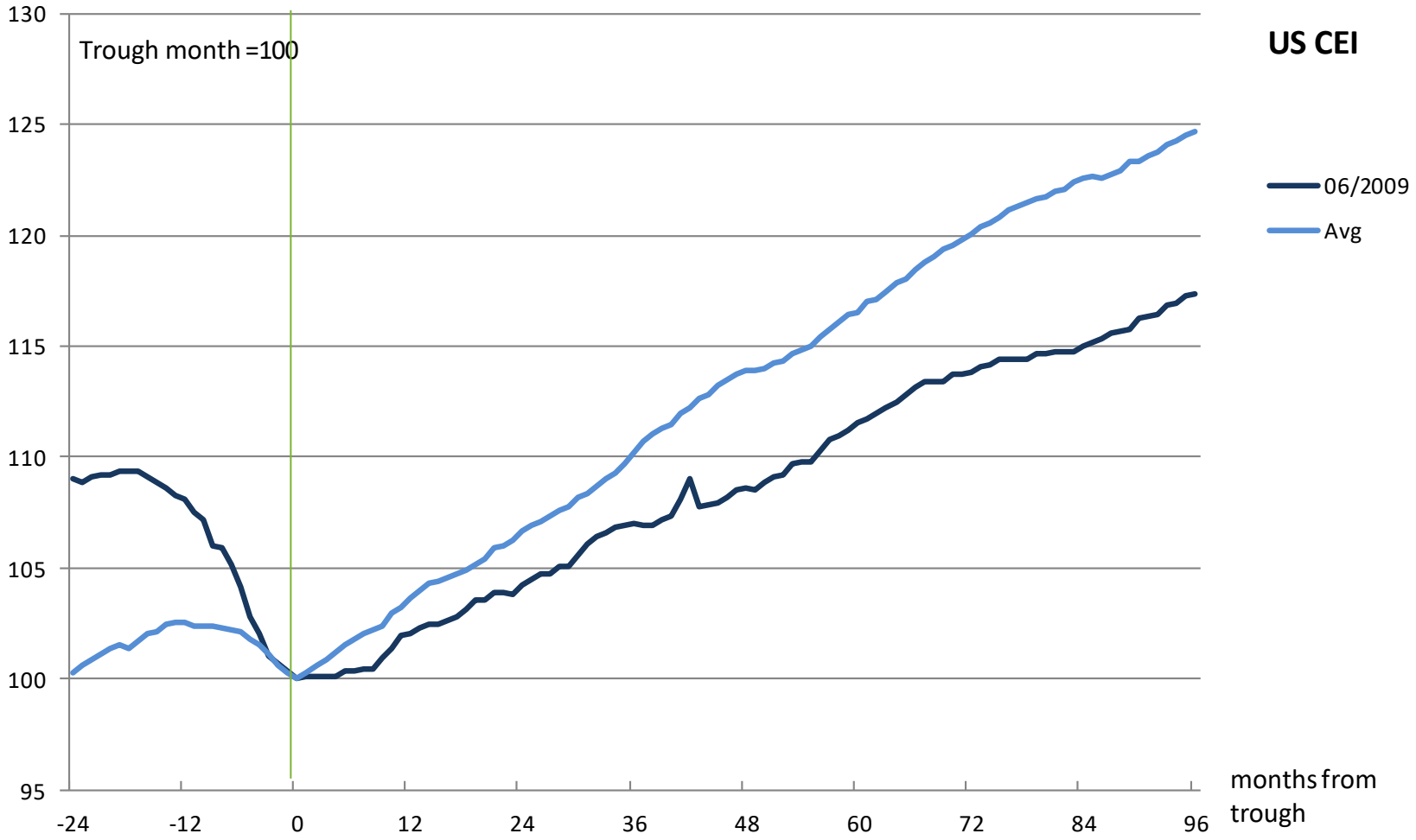
Source: Bureau of Labor Statistics

Leading Economic Index summarizes and helps to predict the state of the economy and its interaction with short-term cyclical forces



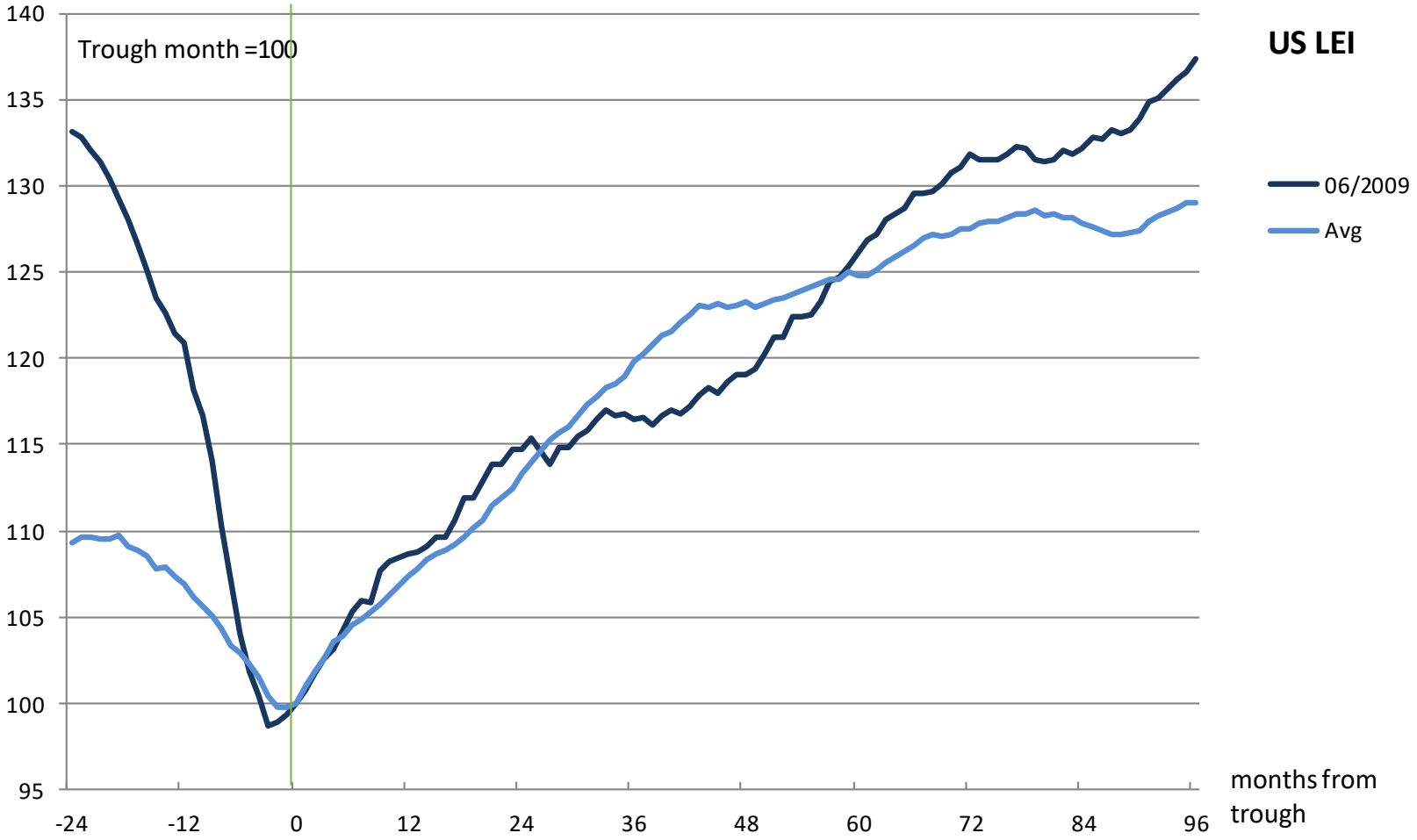
For more information: https://www.conference-board.org/topics/us-leading-indicators

U.S. CEI showed slower than average recovery post great recession since June 2009



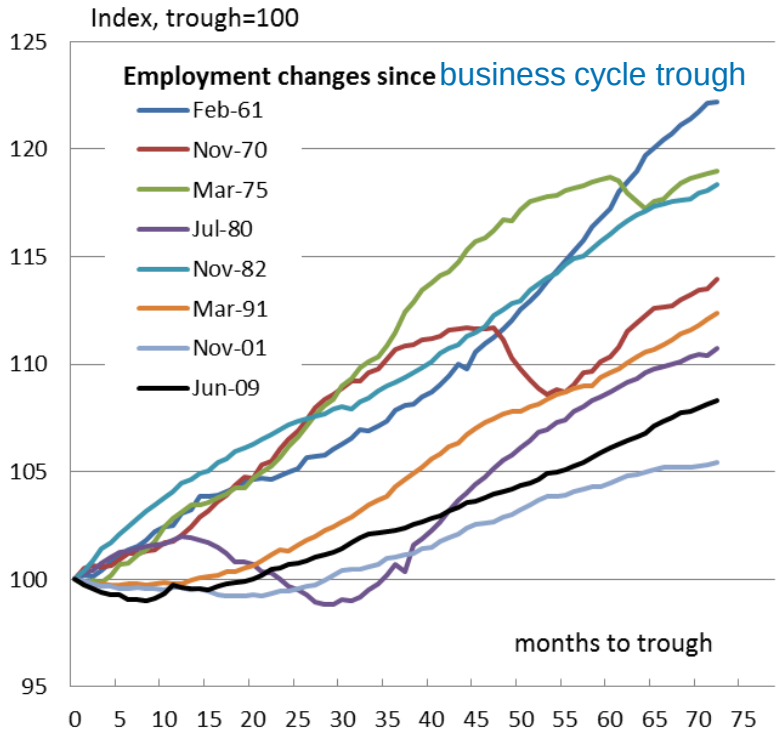
Source: The Conference Board. Recession dates are determined by NBER.

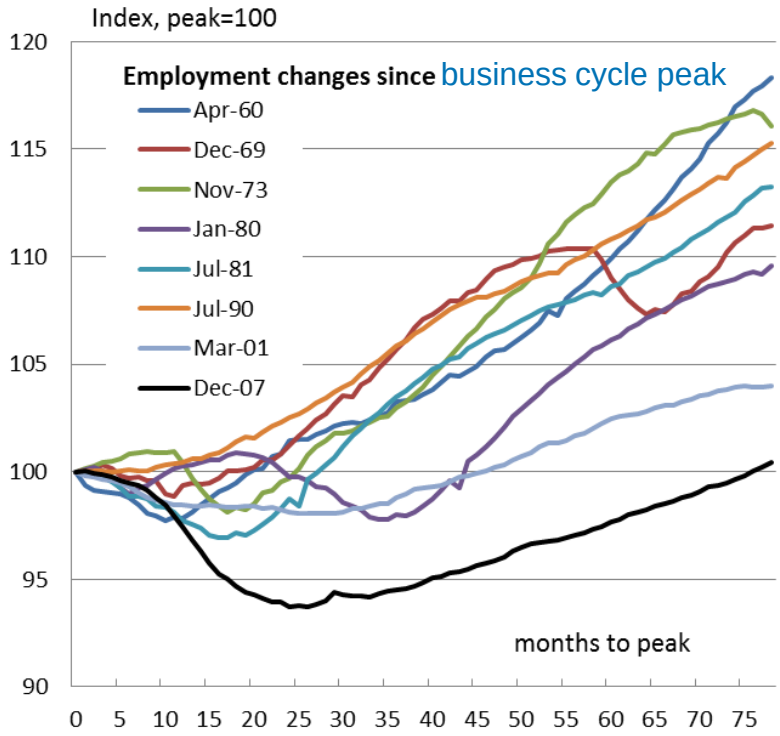
U.S. LEI showed long and volatile recovery period



Source: The Conference Board. Recession dates are determined by NBER.

Understanding the relative strength (weakness) of a recovery (recession): For example, seasonally adjusted employment provides a better basis of comparison





Source: Bureau of Labor Statistics

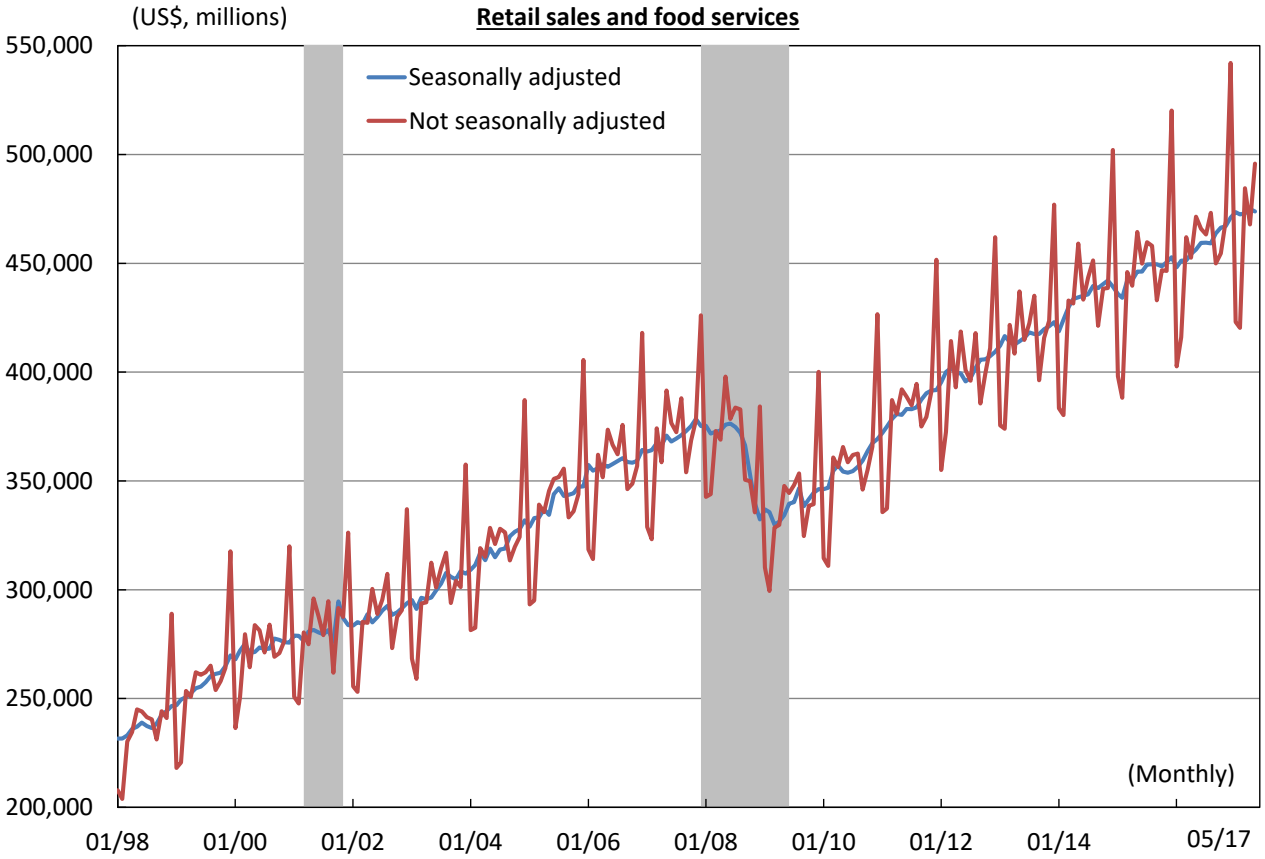
How does seasonal adjustment work?

Time series decomposition provides a solution to remove seasonality and reveal trend-cycle

- Three unobserved components in time series:
  - trend-cycle (TC),
  - seasonal (S),
  - and irregular(I).
- Estimate trend and seasonal factor from following equations:

  - $Y_t = TC_t * S_t * I_t$ (multiplicative)
  - $Y_t = TC_t + S_t + I_t$ (additive)

Relationship between seasonally adjusted and unadjusted series



Source: Haver Analytics

For multiplicative version:

Seasonally Adjusted Series

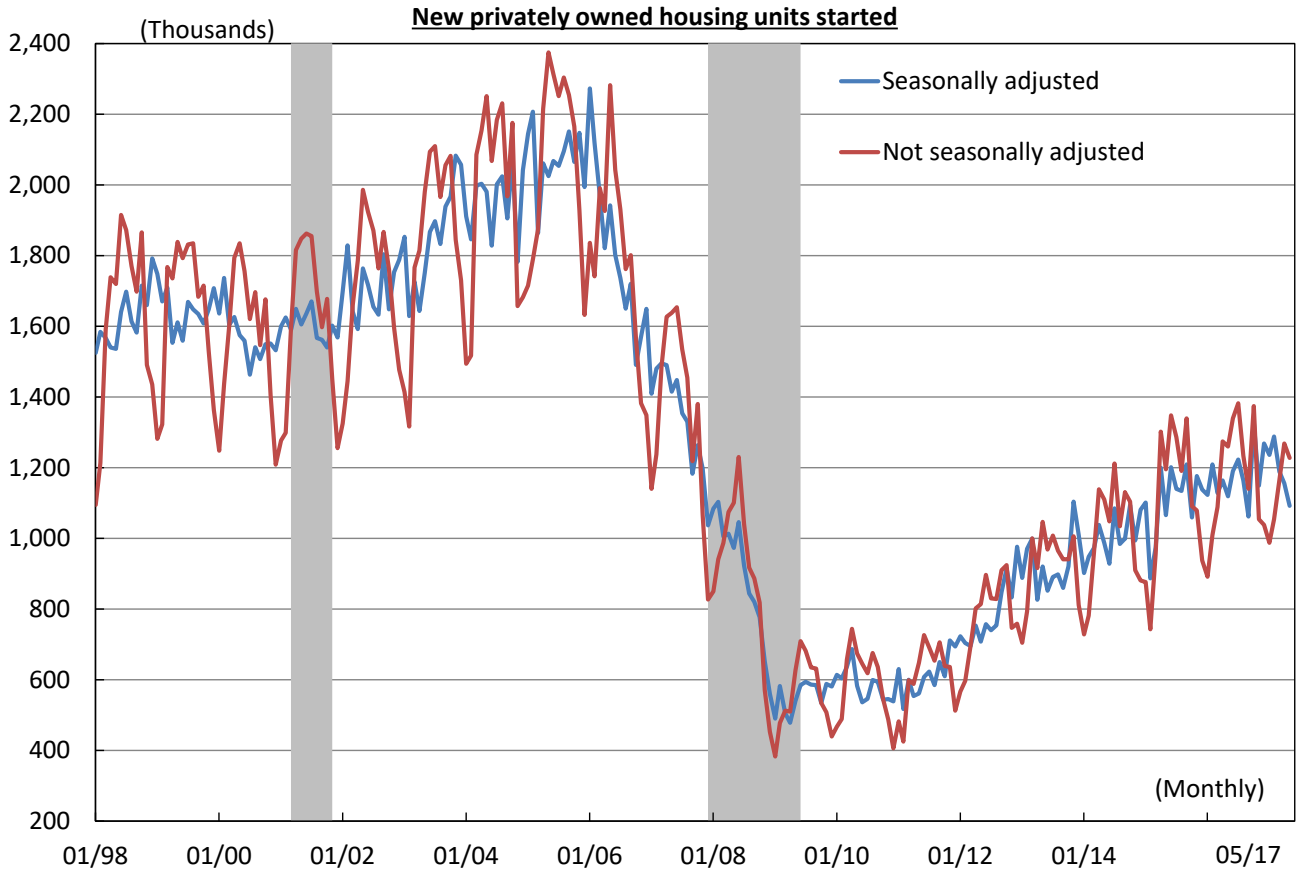
= Not Seasonally Adjusted Series / Seasonal Factor

For additive version:

Seasonally Adjusted Series

= Not Seasonally Adjusted Series + Seasonal Factor

Relationship between seasonally adjusted and unadjusted series: SA does not mean perfectly smooth data



Source: Haver Analytics

For multiplicative version:

Seasonally Adjusted Series

= Not Seasonally Adjusted Series / Seasonal Factor

For additive version:

Seasonally Adjusted Series

= Not Seasonally Adjusted Series + Seasonal Factor

Seasonal adjustment methods

- The Census X-12 ARIMA
  - Findley et. al. (1998); Based on X-11 program and the X-11-ARIMA/88 program developed at Statistics Canada.
    - Modifies and extends Census's X11 developed by Shiskin et. al. (1967)
    - Details and software available at: http://www.census.gov/srd/www/x12a/
- Tramo-Seats
  - "Time Series Regression with ARIMA Noise, Missing Observations, and Outliers"; Developed by Victor Gomez and Agustin Maravall
  - "Signal Extraction in ARIMA Time Series"
- Model based approaches
  - Signal extraction (Bell-Hillmer, 1984);
  - Box-Jenkins (1970) Multiplicative Seasonal ARIMA

Seasonal adjustment methods and resources

- X-13ARIMA-SEATS Seasonal Adjustment Program
- http://www.census.gov/srd/www/x13as/
- http://www.census.gov/srd/www/x13as/papers4newusers.html
- Eurostat: https://ec.europa.eu/eurostat/product?code=KS-GQ-18-001

Potential pitfalls: modeling and real time analysis

Potential pitfalls

- Seasonality can be introduced by deflation or other transformations of the data
- Seasonal adjustment with moving holidays: e.g. Chinese New Year has strong patterns and significant effects on China's monthly data
- Seasonality distorts real-time analysis of the underlying strength or weakness of economic trends
- Real-time analysis of economic trends is difficult, seasonality would make it doubly so

Consequences for modeling and inference

- SA could reduce data quality by introducing estimation errors
- SA could introduce
  - Spurious dynamic relationships
  - Asymptotic biases in parameter estimates of regressions
- One solution: use same seasonal adjustment filter on all variables (Sims, 1974)
- Unadjusted data could overstate dependence between variables due to common patterns in seasonal movements

Consequences of seasonality for real time analysis

- SA could reduce data quality by introducing estimation errors
- SA could increase frequency and size of data revisions
- Adjusted data could exhibit residual seasonality, moving seasonality, vis a vis disaggregate and aggregate indicators etc.
  - Indirect SA vs. direct SA vs. double SA
- Use both NSA and SA data in current analysis

Summary

- Seasonality is a common and highly predictable feature of economic data
- Seasonal adjustment removes the predictable pattern to reveal the underlying trend and cycle
- Seasonal adjustment is necessary for business and economic analysis
- Seasonal adjustment data is needed to
  - Understand past cycles
  - Predict future cycles
- Ways to improve seasonal adjustment methods
  - Methodological/modeling improvements?
  - Big data to the rescue?

Thank you!

