The Effect of the Business Cycle on the Methods Used for Seasonal Adjustment

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Why Seasonally Adjust?

- Many economic time series exhibit seasonal patterns related to weather, holidays, school schedules, etc.

- Because recurring seasonal patterns are of relatively little interest to data users, it is desirable to seasonally adjust quarterly/monthly data to abstract from seasonal effects (*SNA 2008, 18.37*)

- Better view underlying movements
  - Cycles and trends
  - Identify direction and turning points
Overview – Problem

- Standard seasonal adjustment methods:
  - Seasonal factors extracted from single time series
  - Decomposition into trend, seasonal, & irregular components

- Difficult to accommodate abrupt change in trend
  - Trend estimated by smoothing
  - Sharp fall in 2008:Q4 and 2009:Q1 interpreted as change in seasonal patterns
  - Seasonally adjusted data are then
    - artificially strong in Q4 and Q1
    - artificially weak in Q2 and Q3
Overview – Potential Solutions

- Traditional approach – “interventions”:
  - outliers, ramps, different trend estimators

- Alternative approach – Multiple time series
  - Trend extracted from \( n \) related time series
    - Trend is less smooth
  - Apart from this, the approach follows X-12
  - More timely and less need for diagnostics and interventions in response to level shift
    - Judgment still required to select seasonal filter
Outline

- Overview of univariate methods
  - Problems caused by recessions

- Description of multivariate approach
  - Factor model of cross-sectional dependence
  - Application to seasonal adjustment problem

- Comparison of the two methods using industrial production (IP) data
  - $T = 120$; January 2002 to December 2011
  - Series with abrupt fall & recovery
  - Series with abrupt fall only
  - Series with abrupt fall & change in seasonal pattern
X-11 Univariate Seasonal Adjustment

Model:

\[ x_t = c_t + s_t + e_t \]

- Trend \( c_t \) (low frequency variation)
- Seasonal factors \( s_t \) (predictable pattern, permitted to change over time)
- Irregular component \( e_t \)

Estimation of seasonal factors:

- Estimate trend (e.g., centered moving average)
- De-trend series
- Estimate seasonals from de-trended series (moving average)
- Remove seasonals from \( x_t \)
Example: Iron and Steel Industrial Production
Example: Iron and Steel IP

univariate seasonals (3 x 5)
Univariate Seasonal Adjustment: Interventions

- **regARIMA (X-12) solutions:**
  - Other trend filters (e.g., Henderson, robust detrending at FRB)
  - Interventions
    - Outliers (data effectively eliminated)
    - Ramps (hard to implement in timely manner)

- **Problems with the solutions:**
  - Choosing when to begin & end intervention (calendar time)
  - Begin & end intervention (real time)
  - “Throwing out” information
FRB Robust De-Trending Approach

IP for Raw Steel
Indexes and Robust Trend

- NSA IP
- SA IP
- Robust trend

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<th>SA IP</th>
<th>Robust Trend</th>
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Common trend extracted from multiple related time series
- Approximate factor model (Chamberlain and Rothschild, 1983)
- Permits heterogeneity in the common trend

Intuitively, common sudden abrupt changes easy to accommodate (e.g., recessions)
- Recessions not treated as outliers
Multivariate Seasonal Adjustment

- Potential benefits:
  - Less need for interventions over the business cycle
  - No information ignored in estimating seasonal factors over downturns
  - Less need for analyst judgment in interventions

- Potential drawbacks:
  - Trend is less smooth

- Factor model is described in forthcoming BEA working paper by Ryan Greenaway-McGrevy
Example: Iron and Steel IP

![Graph showing the iron and steel index over time](chart.jpg)
Example: Iron and Steel IP
Example: Iron and Steel IP

- univariate seasonals (3 x 5)
- multivariate seasonals (3 x 5)
Other Seasonal Adjustment Issues

- Maintaining consistency between seasonal adjustment of the national accounts and the source data

- Coordination of seasonal adjustment in a decentralized statistical system

- “Residual seasonality” – A series derived as an aggregate of seasonally adjusted components may nevertheless exhibit seasonality