

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

Brent R. Moulton (prepared by Ryan Greenaway-McGrevy) OECD Working Party on National Accounts Paris

October 4–5, 2012



# 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

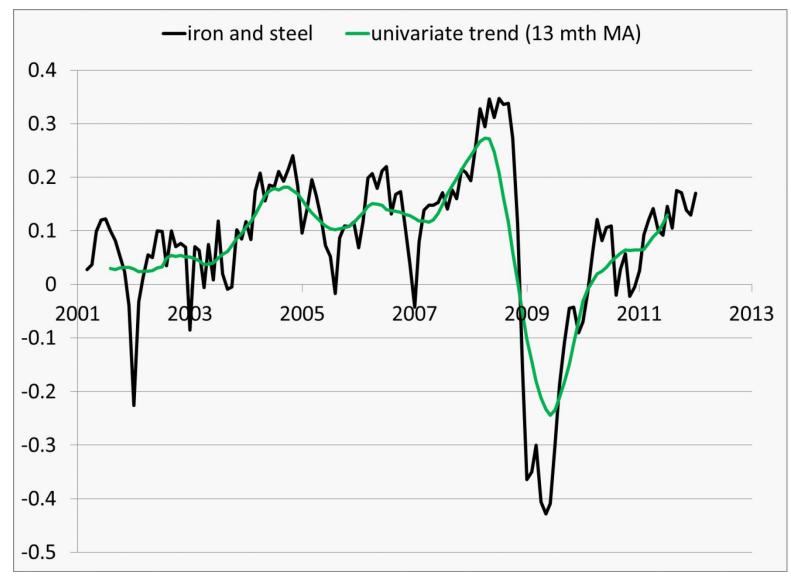
# X-11 Univariate Seasonal Adjustment

Model:

 $x_t = c_t + s_t + e_t$ 

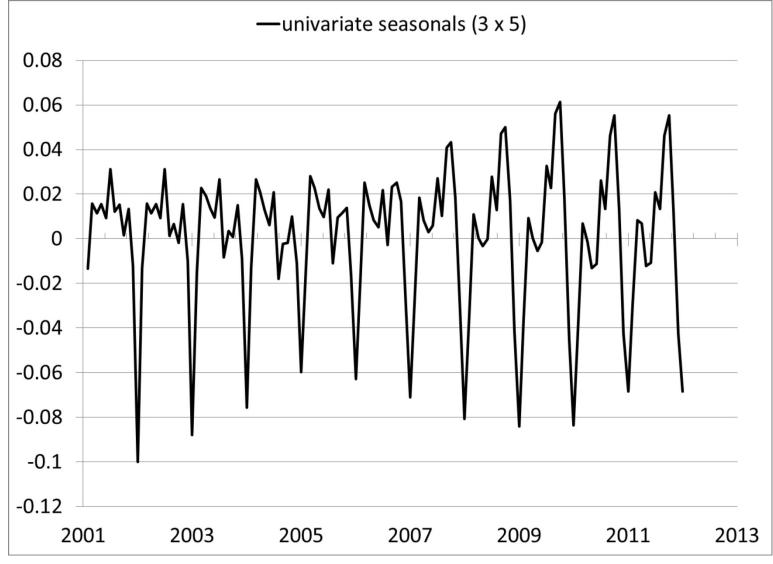
- Trend c<sub>t</sub> (low frequency variation)
- Seasonal factors s<sub>t</sub> (predictable pattern, permitted to change over time)
- Irregular component *e*<sub>t</sub>
- Estimation of seasonal factors:
  - Estimate trend (e.g., centered moving average)
  - De-trend series
  - Estimate seasonals from de-trended series (moving average)
  - Remove seasonals from x<sub>t</sub>

# Example: Iron and Steel Industrial Production





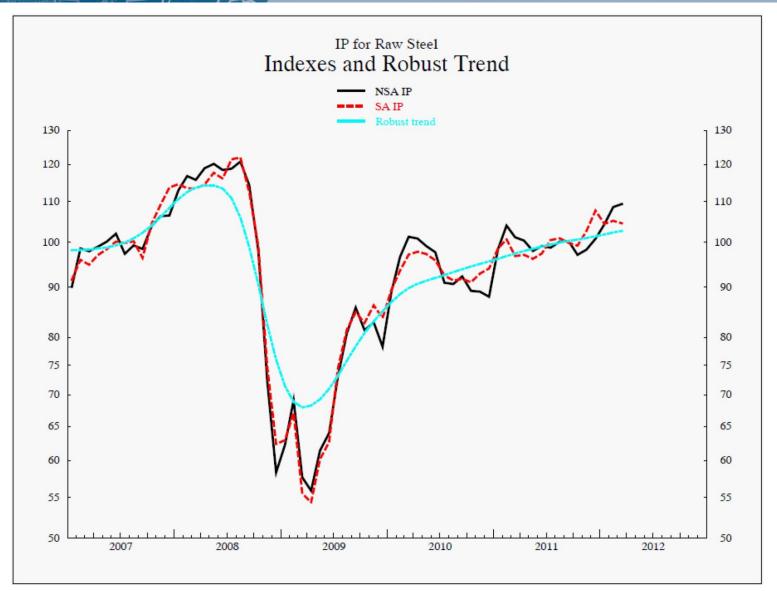
#### Example: Iron and Steel IP



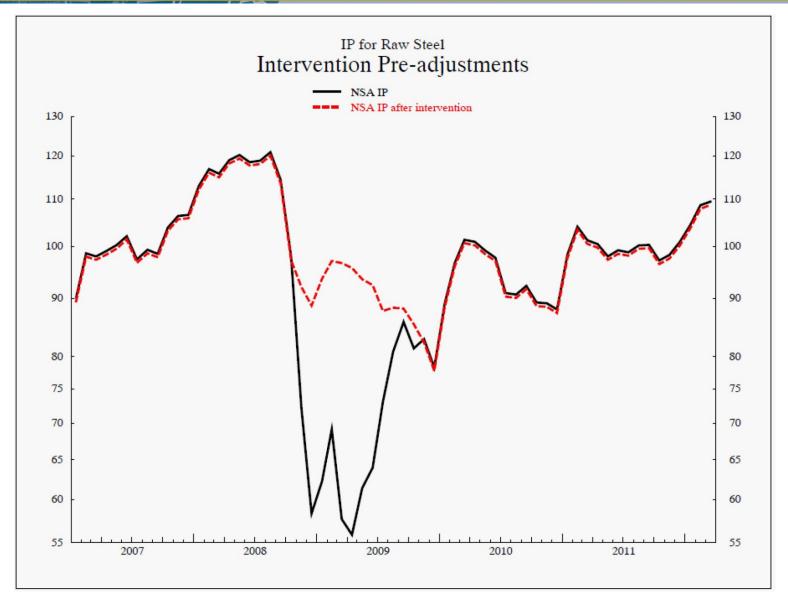
# Univariate Seasonal Adjustment: Interventions

- 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



# Outlier Approach





# Multivariate Seasonal Adjustment

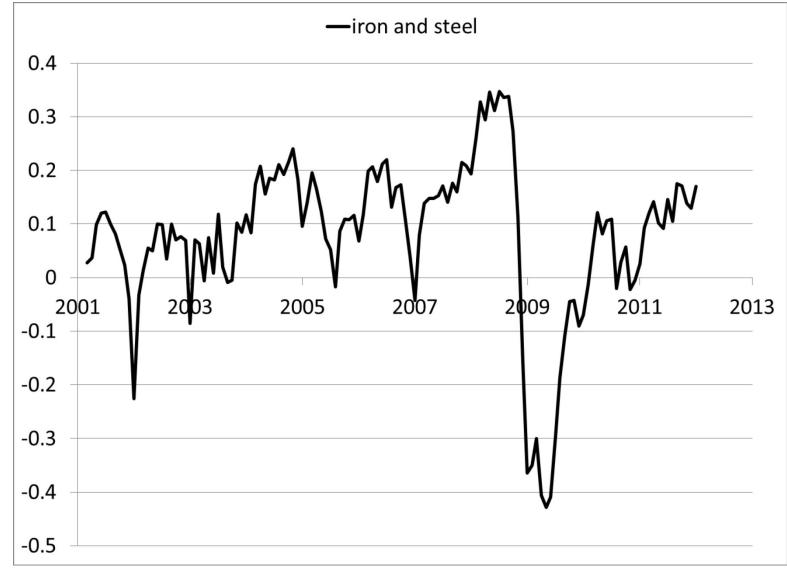
- Common trend extracted from multiple related time series
  - Approximate factor model (Chamberlain and Rothschild, 1983)
  - Permits heterogeneity in the common trend
- Intuitively, common sudden abrupt changes easy to accommodate (e.g., recessions)
  - Recessions not treated as outliers

# 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

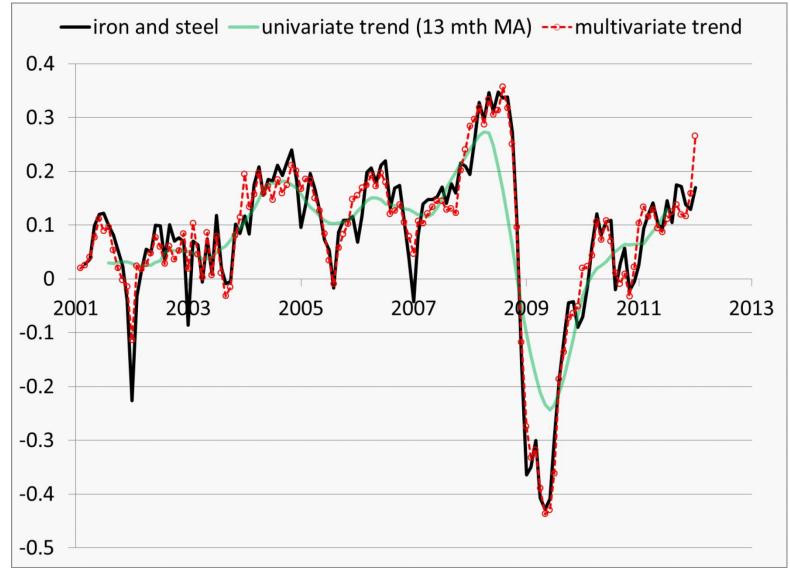


### Example: Iron and Steel IP



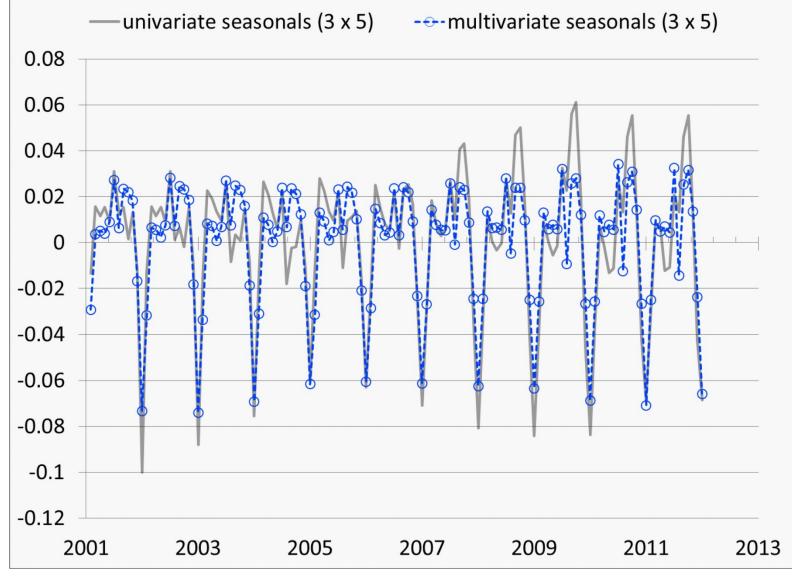
#### BUREAU OF ECONOMIC ANALYSIS SUBEARTMENT OF COMMERCE

### Example: Iron and Steel IP





### Example: Iron and Steel IP





# 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