

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

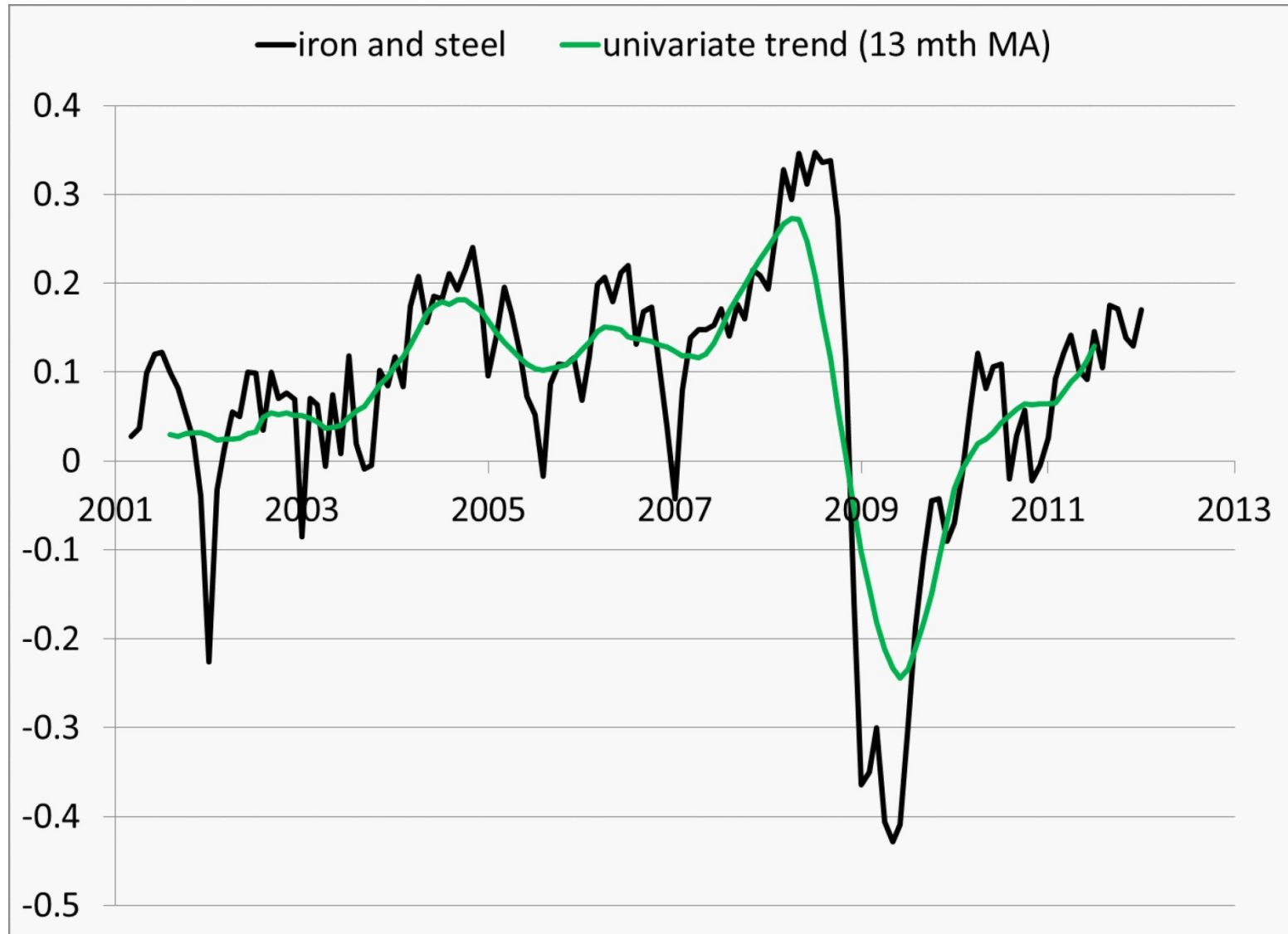
X-11 Univariate Seasonal Adjustment

- Model:

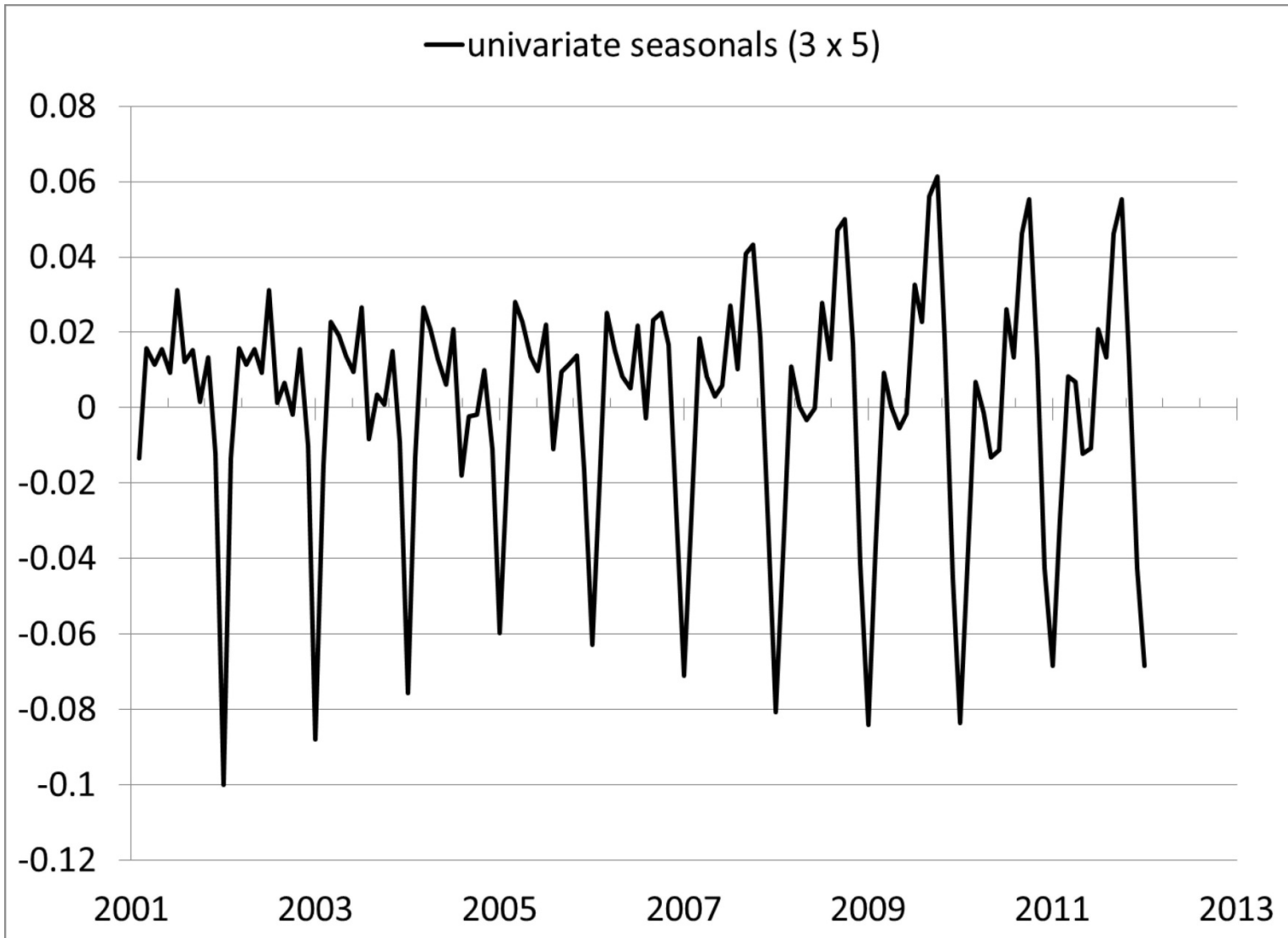
$$x_t = c_t + s_t + e_t$$

- 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

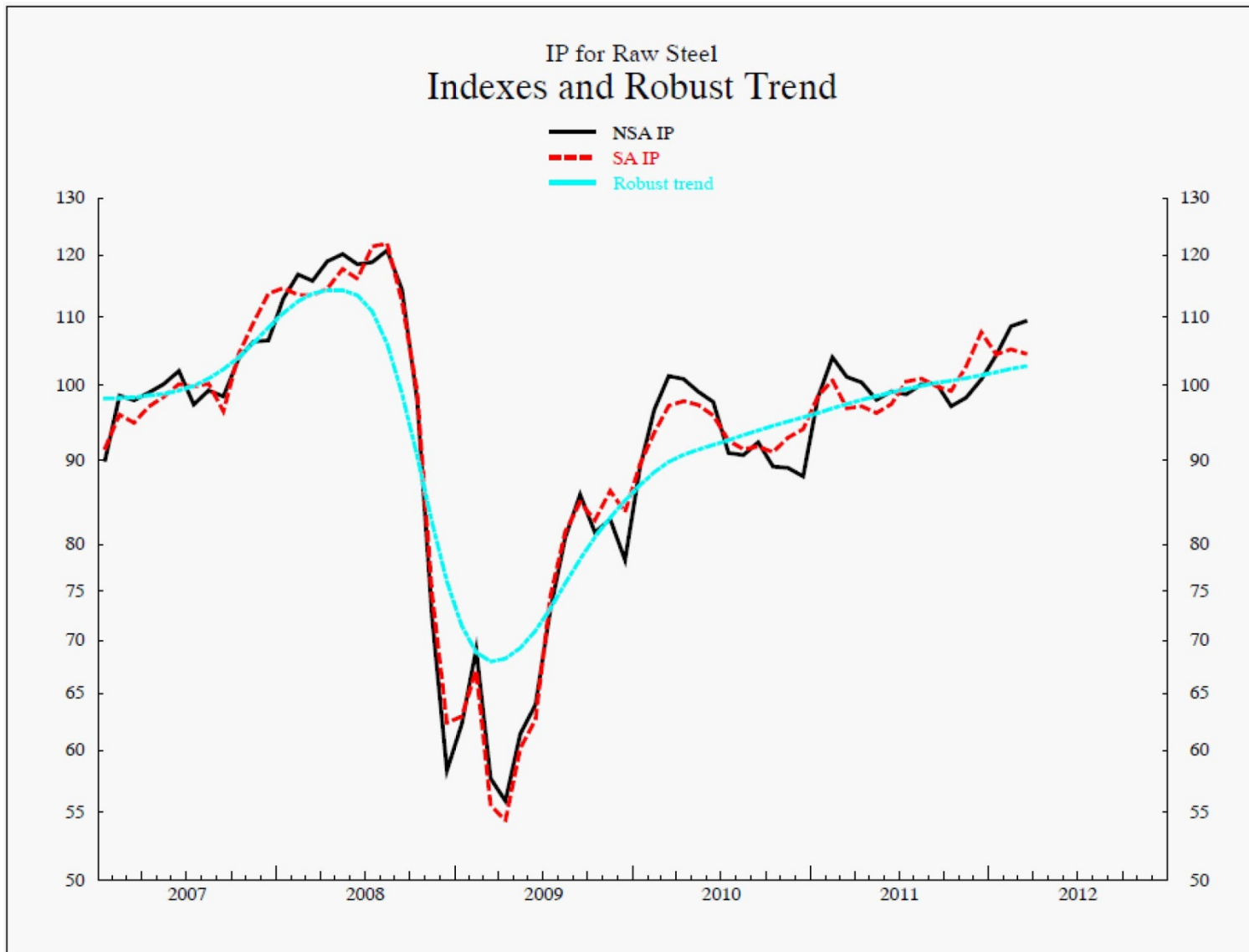


Univariate Seasonal Adjustment: Interventions

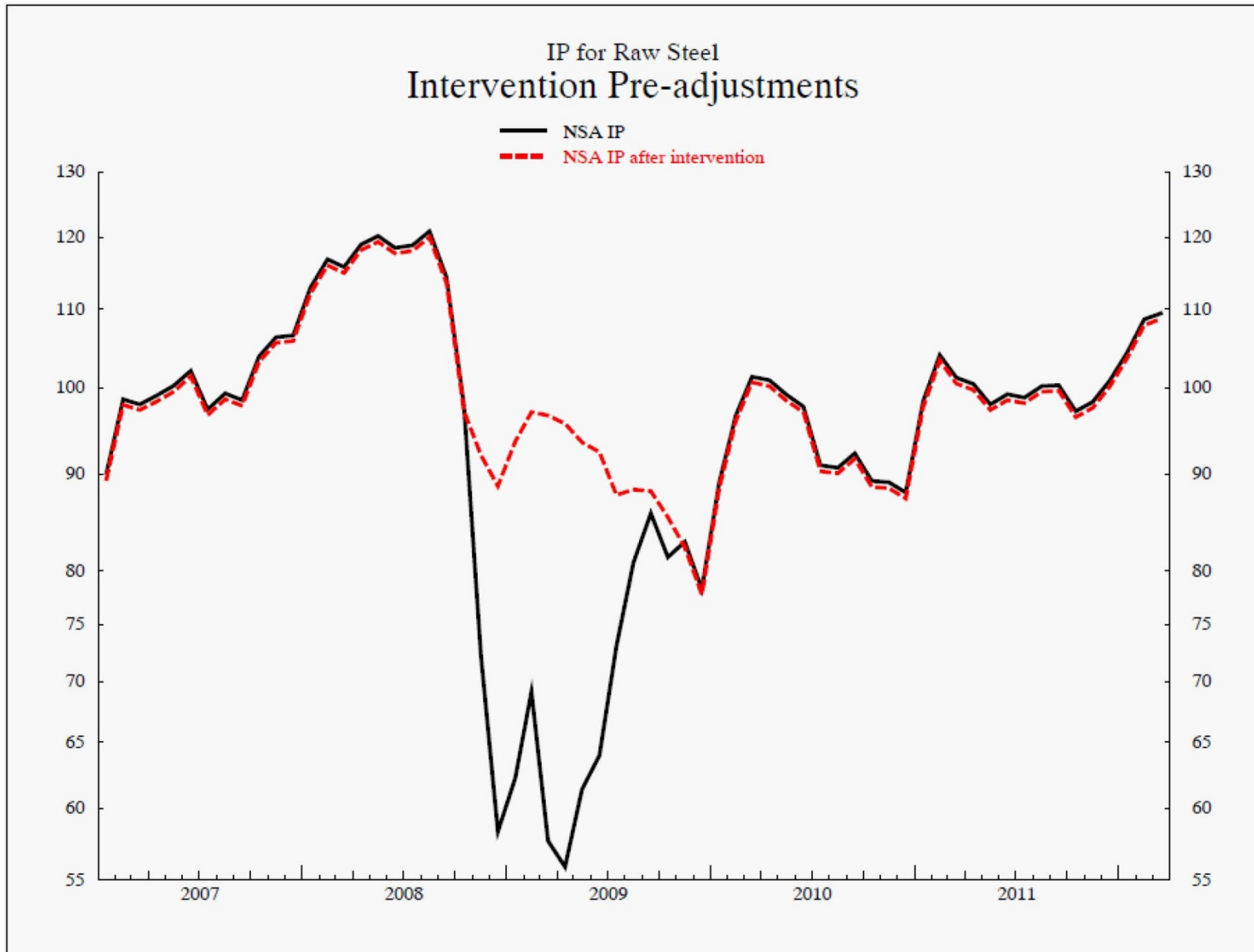
- regARIMA (X-12) solutions:
 - Other trend filters (e.g., Henderson, robust detrending at FRB)
 - Interventions
 - Outliers (data effectively eliminated)
 - Ramps (hard to implement in timely manner)

- 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

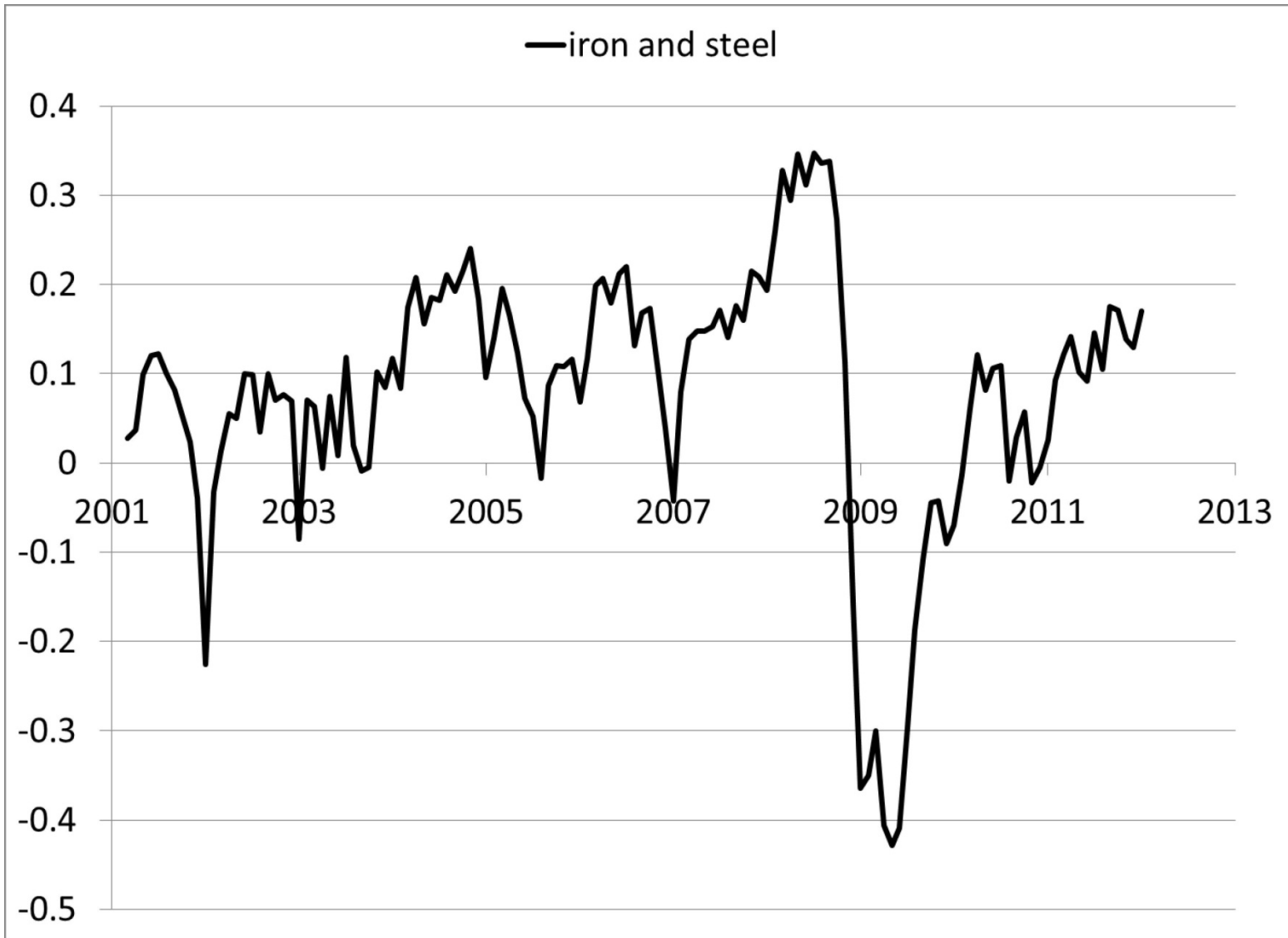
- Common trend extracted from multiple **related** time series
 - Approximate factor model (Chamberlain and Rothschild, 1983)
 - Permits heterogeneity in the common trend

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

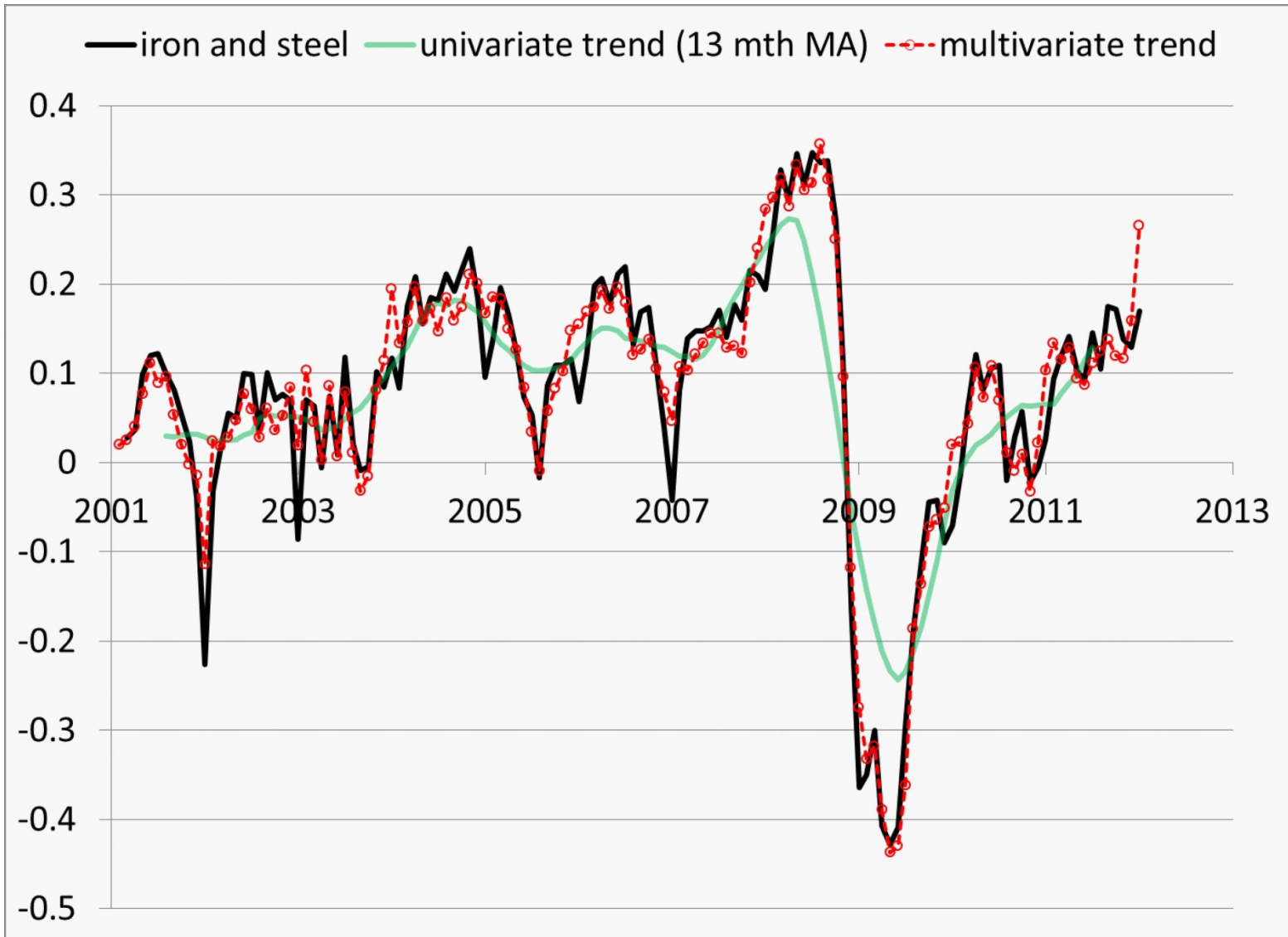
Multivariate Seasonal Adjustment

- 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

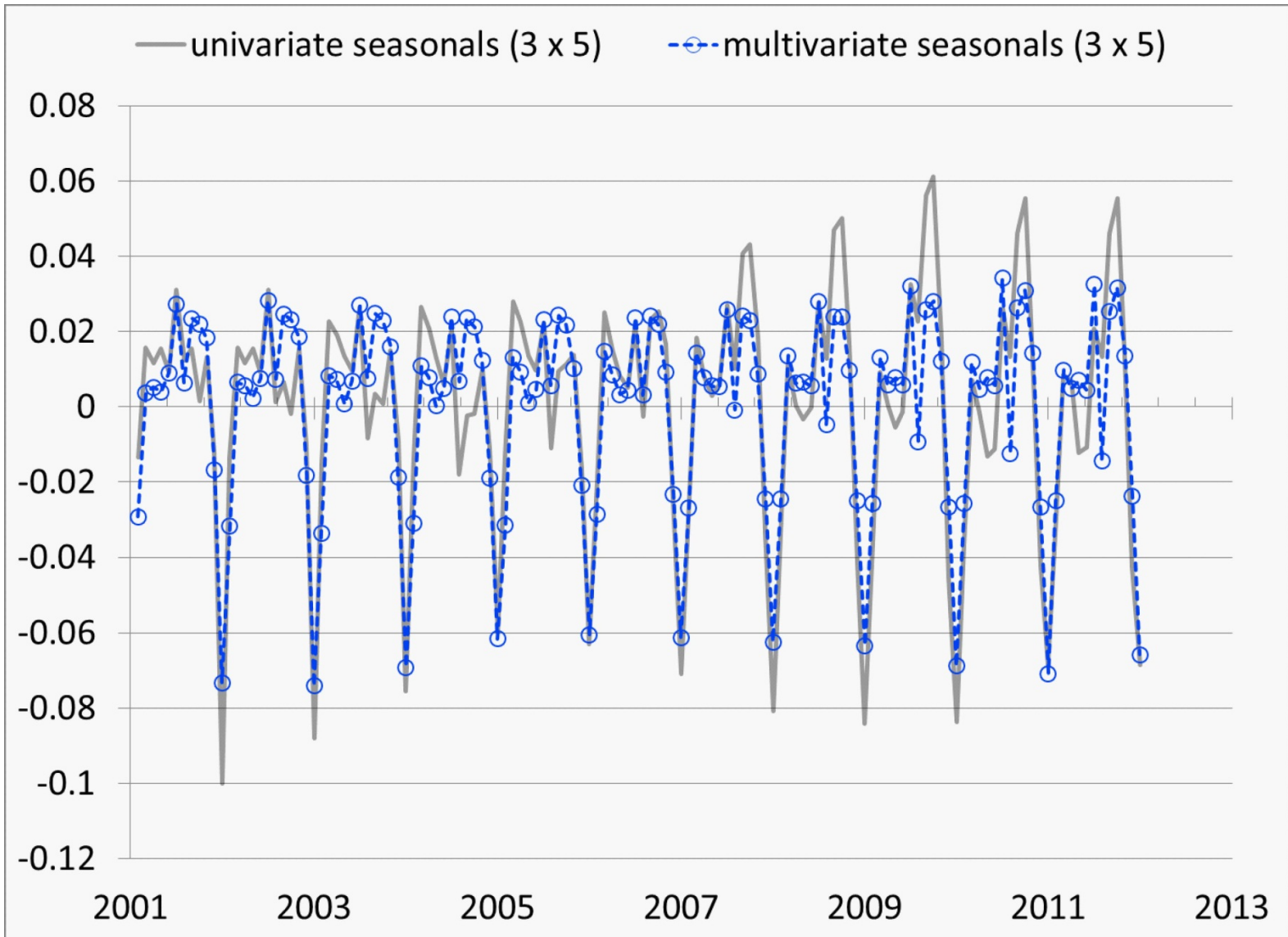
Example: Iron and Steel IP



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