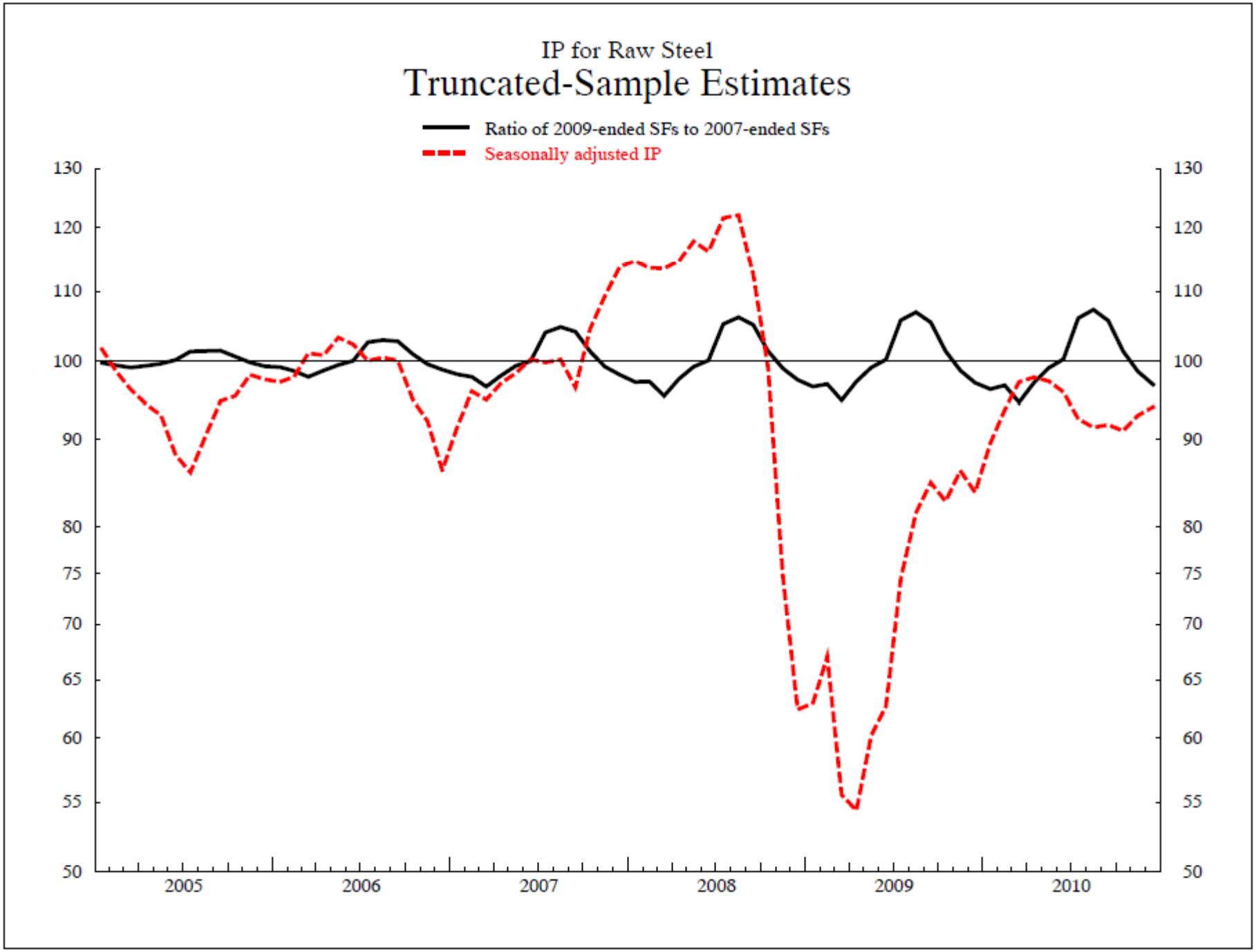
Recessions and the Seasonal Adjustment of Industrial Production

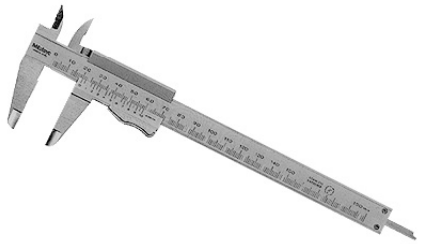
The Problem

- X12 appears to allow swings related to recessions to affect its estimated seasonal factors to some extent.
  - X12 decomposes a series into trend plus business cycle, seasonal, and irregular components, but the moving averages to derive the trend plus cycle component do not always conform as well as one might like to specific recession patterns.
- For example, consider the industrial production index for raw steel.


IP for Raw Steel
Truncated-Sample Estimates
Ratio of 2009-ended SFs to 2007-ended SFs
Seasonally adjusted IP
130
120
110
100
90
80
75
70
65
60
55
50
2005
2006
2007
2008
2009
2010

Past efforts to avoid recession-related distortions to seasonal factors

- Since the 1920s, seasonal adjustment of IP has used a ratio-to-moving-average method.



Past efforts to avoid recession-related distortions to seasonal factors (continued)

- Because the 1957-58 recession was recognized as distorting seasonal factors during the work on the 1959 revision to IP, seasonal factors were estimated using data only through 1957.

Past efforts to avoid recession-related distortions to seasonal factors (continued)

- During the work on the 1976 revision to IP, the sharp drop in IP in late 1974 and its subsequent recovery was recognized as producing distortions in seasonal factors so data only through the end of 1974 was fed to X11.

Past efforts to avoid recession-related distortions to seasonal factors (continued)

- In the process of the 1976-78 revision to IP, data for the recession that ended in early 1975 continued to distort estimated seasonal factors, so the indexes for 1967 to 1973 were linked to the indexes for 1976 to 1978 and X11 was run on these modified indexes.

- A second procedure was also tested in the 1976-78 revision to IP—replacing the 1974-75 values for the index with more typical values based on the preceding and subsequent years. The results of the two methods were similar.

Past efforts to avoid recession-related distortions to seasonal factors (continued)

- The 1985 revision to IP incorporated the Box-Tiao **intervention** technique in calculating seasonal factors. This procedure used an ARIMA model and additive outliers to replace recession-affected values with more normal values prior to running X11.

2010 Revision to IP

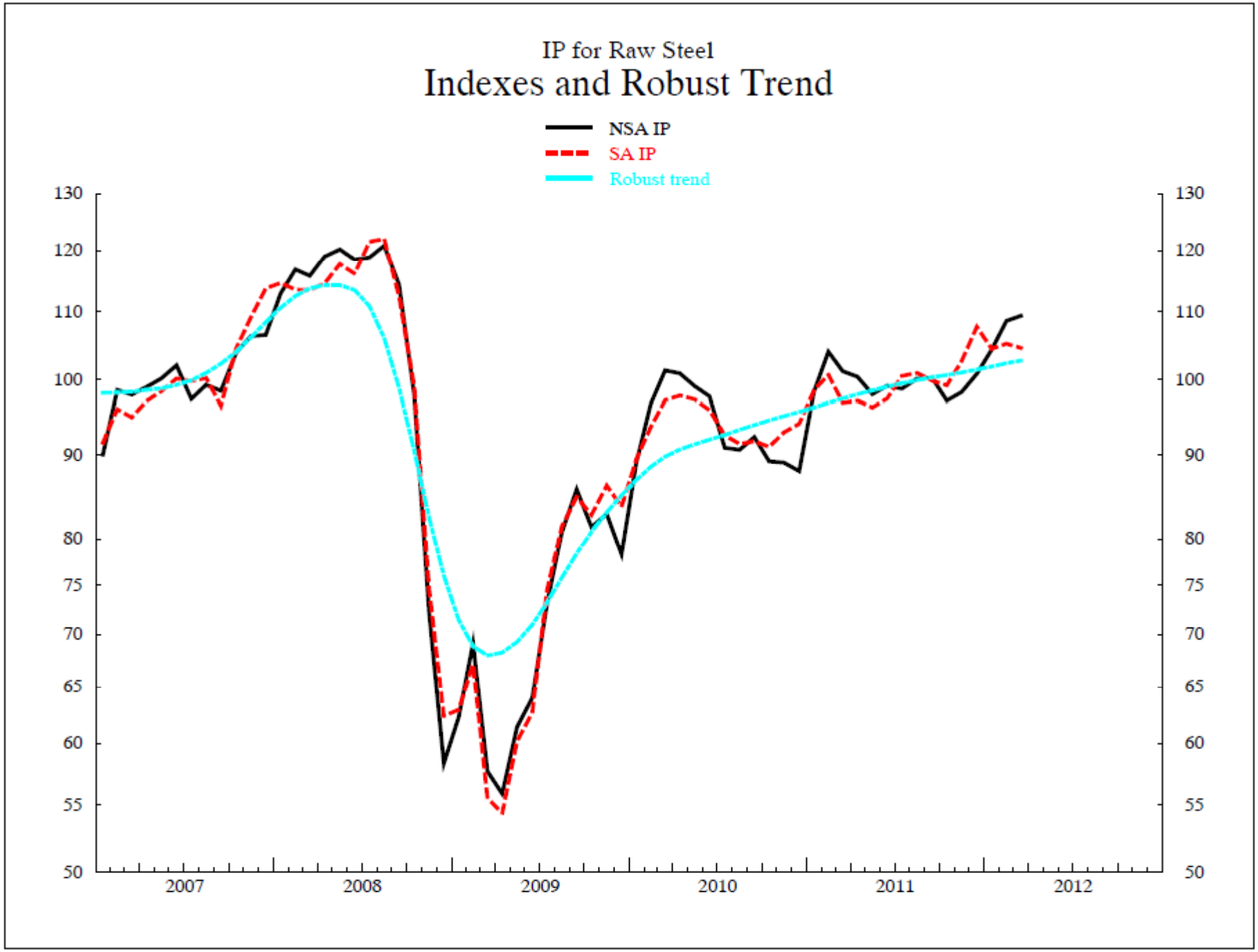
- Two approaches to correcting for recession-related distortions to the seasonal factors:
  - "Robust detrending" of the data as a preliminary filter before feeding to X12.
  - Intervention Procedure: Using a REGARIMA model, include additive outliers for the recession period and then replace that period's data with values that reflect the more typical seasonal pattern for that period.

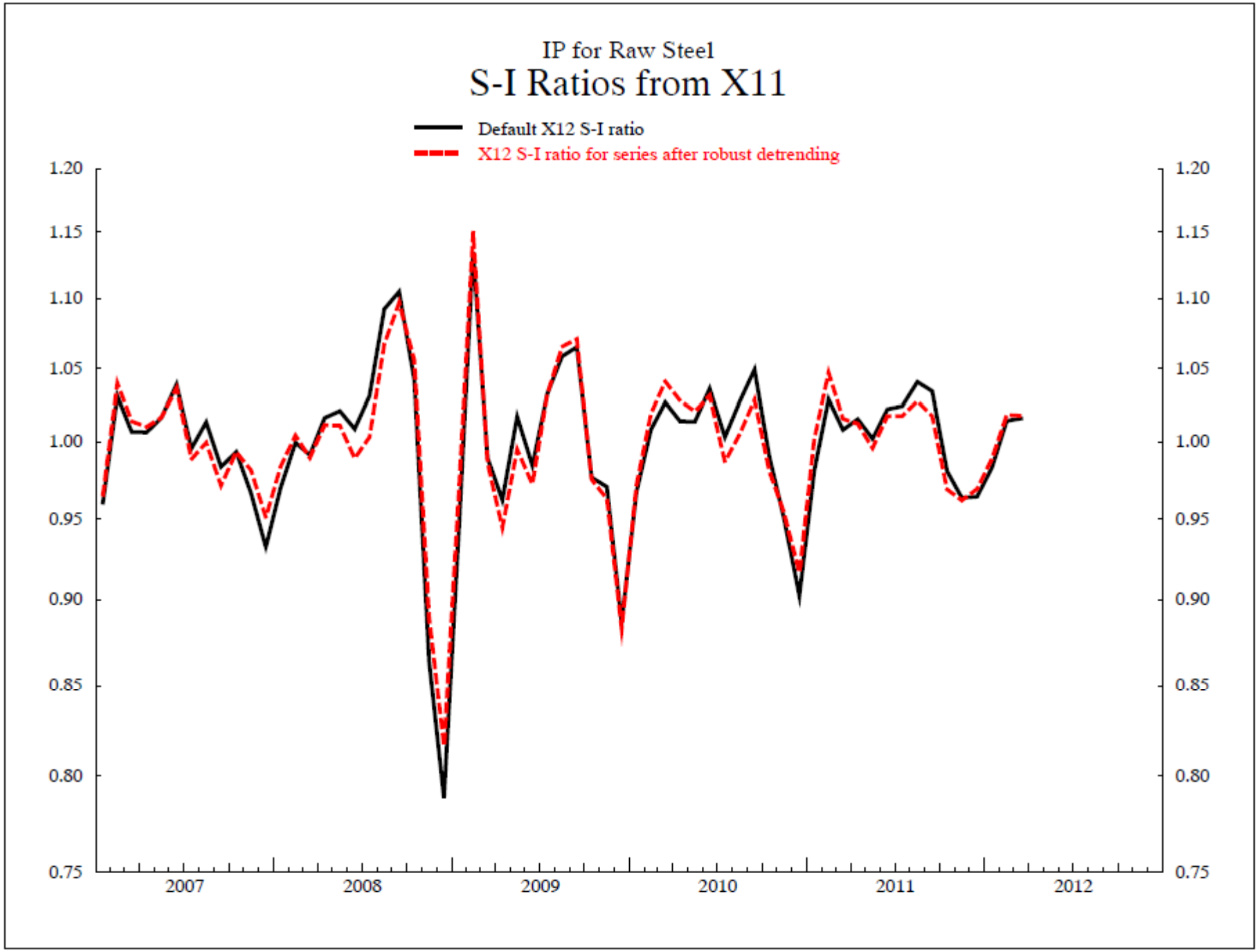
Robust Detrending

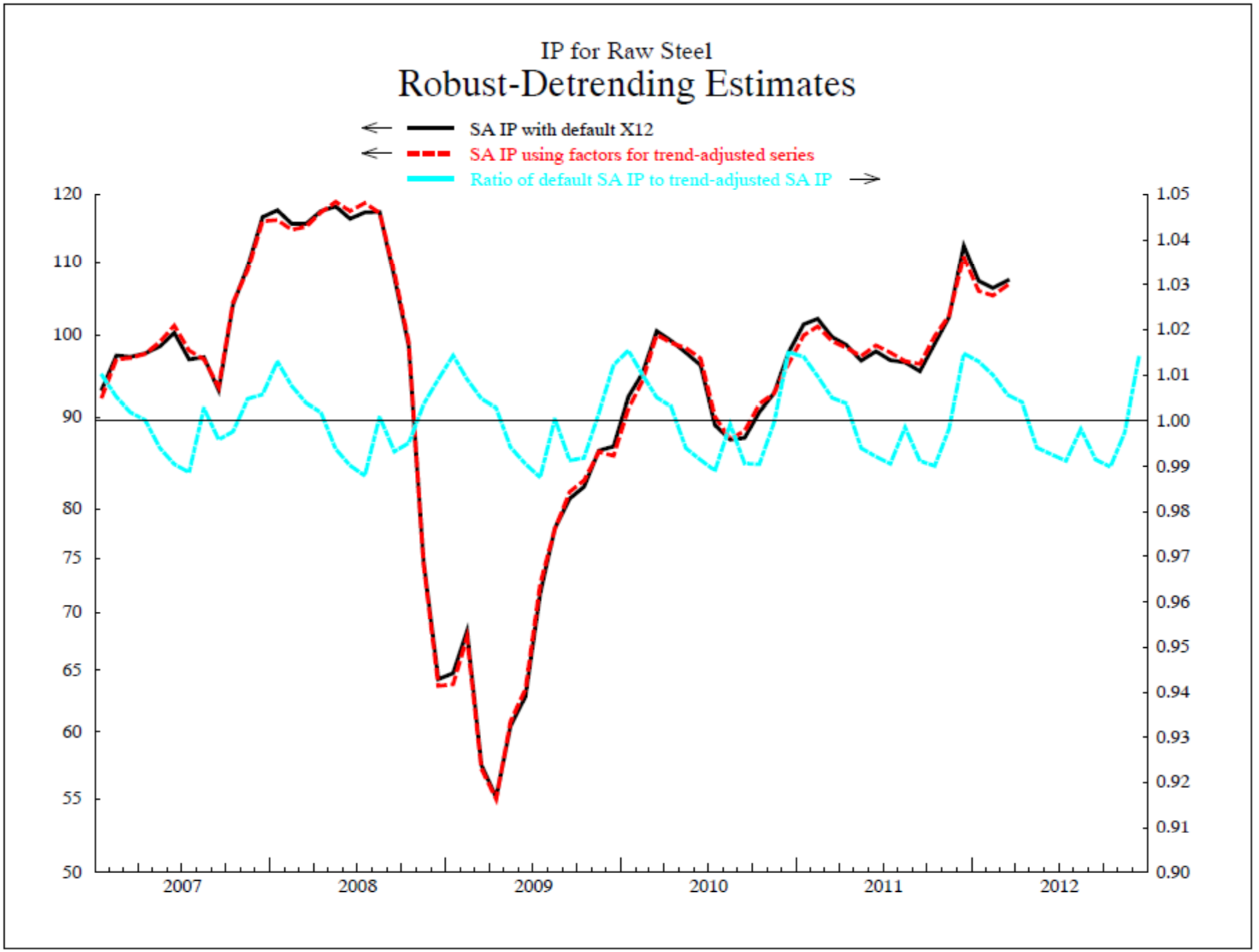
- We often pre-adjust a series using a “robust detrending” procedure designed by Bill Cleveland, who was the Board’s seasonal adjustment guru before he retired.
- By robust, we mean that it uses a mix of moving medians along with moving averages in order to keep extreme values from affecting the trend.

Robust Detrending (continued)

- The impact of the robust detrending is not dramatic, but it tends to reduce the effect of business cycles on the computed seasonal factors.
- The following chart illustrates the procedure for raw steel.

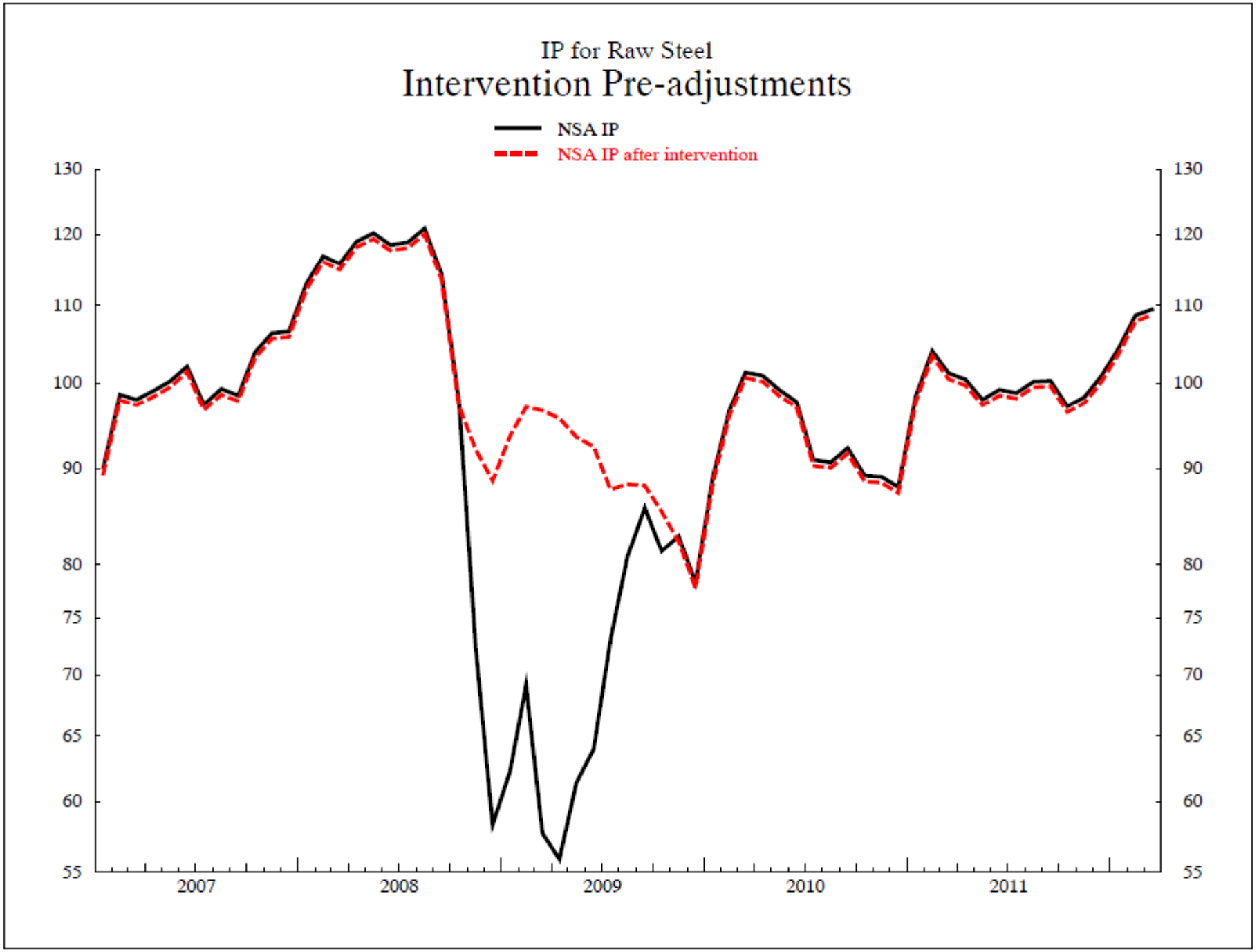

IP for Raw Steel
Indexes and Robust Trend
NSA IP
SA IP
Robust trend
130
120
110
100
90
80
75
70
65
60
55
50
2007
2008
2009
2010
2011
2012

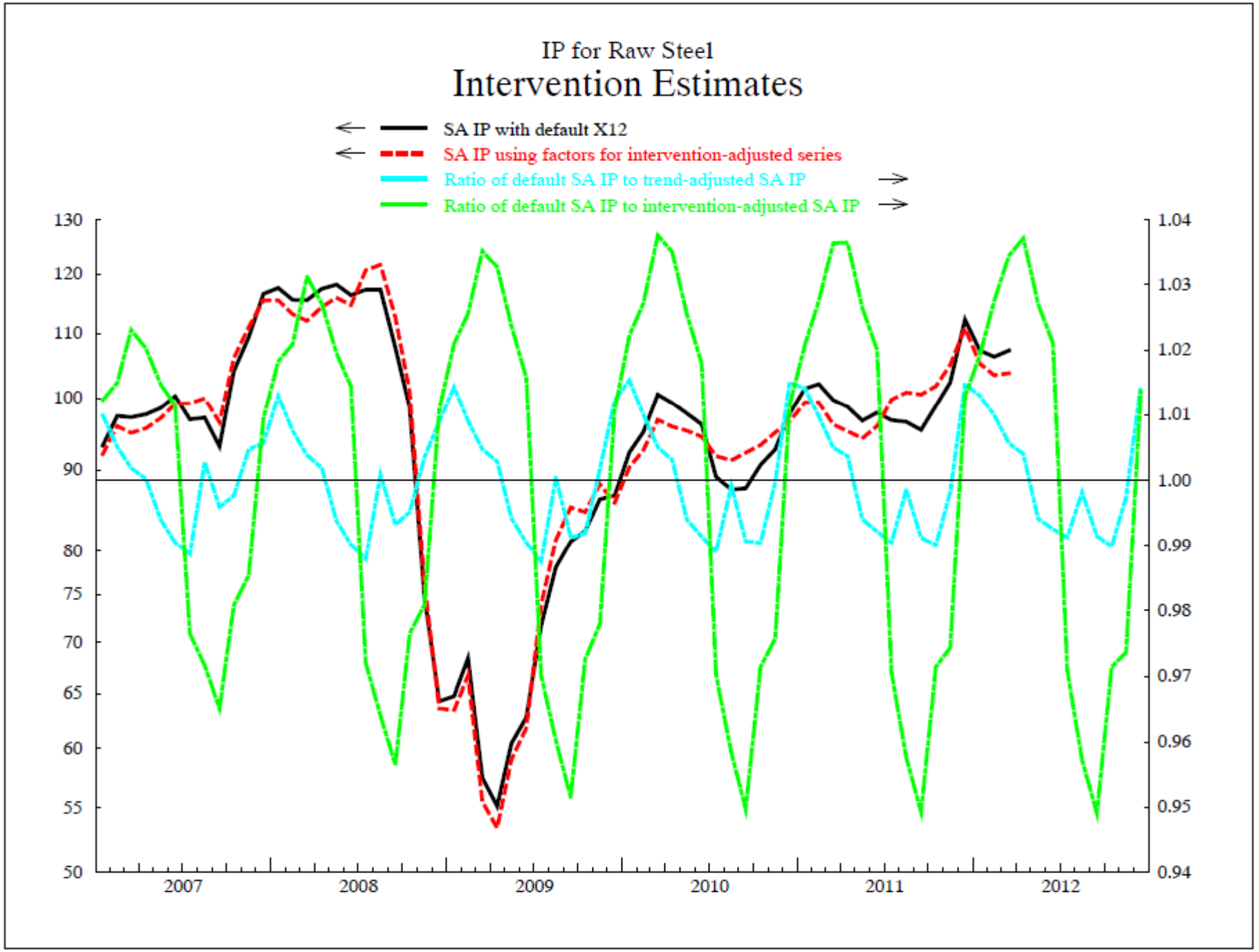

IP for Raw Steel
S-I Ratios from X11
Default X12 S-I ratio
X12 S-I ratio for series after robust detrending
1.20
1.15
1.10
1.05
1.00
0.95
0.90
0.85
0.80
0.75
2007
2008
2009
2010
2011
2012


IP for Raw Steel
Robust-Detrending Estimates
SA IP with default X12
SA IP using factors for trend-adjusted series
Ratio of default SA IP to trend-adjusted SA IP
120
110
100
90
80
75
70
65
60
55
50
1.05
1.04
1.03
1.02
1.01
1.00
0.99
0.98
0.97
0.96
0.95
0.94
0.93
0.92
0.91
0.90
2007
2008
2009
2010
2011
2012

Intervention Procedure

- Allowing for interventions using additive outliers, ramps, and level shifts in the context of an ARIMA model was one of the innovations in X12 relative to X11.
- Compared with the robust-detrending approach, the intervention procedure seems to more effectively reduce the recession-related distortions in the resulting seasonal factors.
- On the other hand, specifying the periods to treat as recession-related outliers requires more attention to individual series.
- The following charts show the effects for raw steel IP:


IP for Raw Steel
Intervention Pre-adjustments
NSA IP
NSA IP after intervention
130
120
110
100
90
80
75
70
65
60
55
2007
2008
2009
2010
2011


IP for Raw Steel
Intervention Estimates
SA IP with default X12
SA IP using factors for intervention-adjusted series
Ratio of default SA IP to trend-adjusted SA IP
Ratio of default SA IP to intervention-adjusted SA IP
130
120
110
100
90
80
75
70
65
60
55
50
1.04
1.03
1.02
1.01
1.00
0.99
0.98
0.97
0.96
0.95
0.94
2007
2008
2009
2010
2011
2012

Conclusions

- Seasonal factors derived from X11-like methods have long been perceived as not being insulated from recession-related distortions.
- Pre-adjustments to the data to moderate the business cycle before running X11 mitigates some of the distortions.