Technical note on seasonal adjustment for Index of industrial production (Capital goods)

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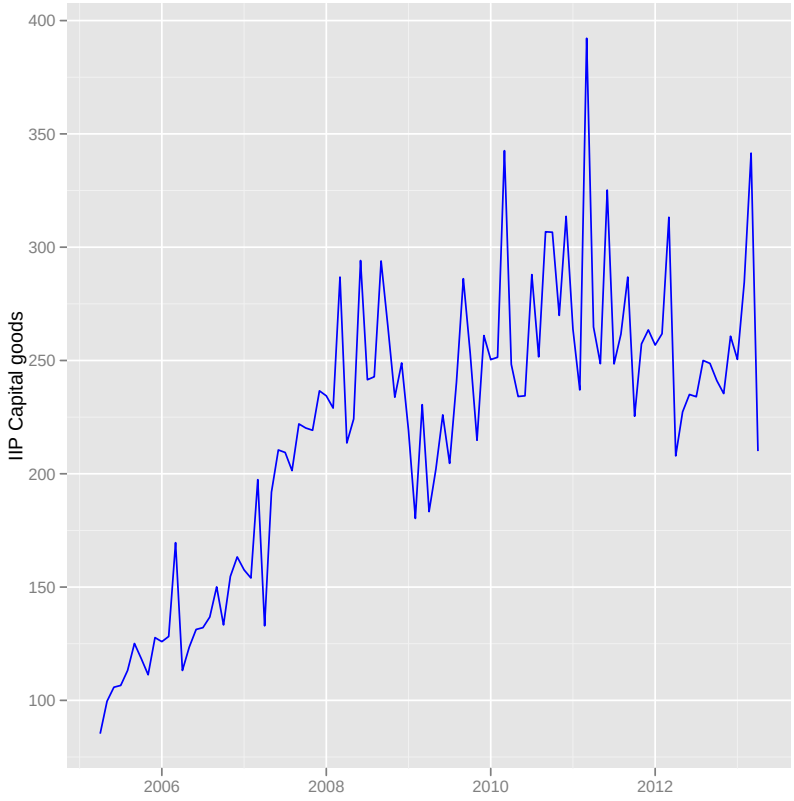
1 IIP Capital goods

We analyse the monthly data for IIP Capital goods from April, 1994 onwards. Figure 1 shows the original plot. The plot shows seasonal peaks which are increasing over time. In a non-seasonally adjusted series, it is difficult to discern a trend as the seasonal variations may mask the important characteristics of a time series.

Figure 1 IIP Capital goods (Non seasonal adjusted)



2 Steps in the seasonal adjustment procedure

Given that seasonality exists, it is important to model seasonality before the application of seasonal adjustment procedure. Seasonality in time series can be deterministic or stochastic. Stochastic seasonality can be stationary or non-stationary.

A visually appealing way of looking at the raw data is to plot the growth rates in each of the months across the years i.e the growth of April over March in each of the years from 1994 onwards. This gives us some idea of the presence of seasonal peaks, if any in the series.

The nature of seasonality can also be inferred intutively from the plot before the application of the testing procedures.

Figure 2 Monthly growth rates across the years

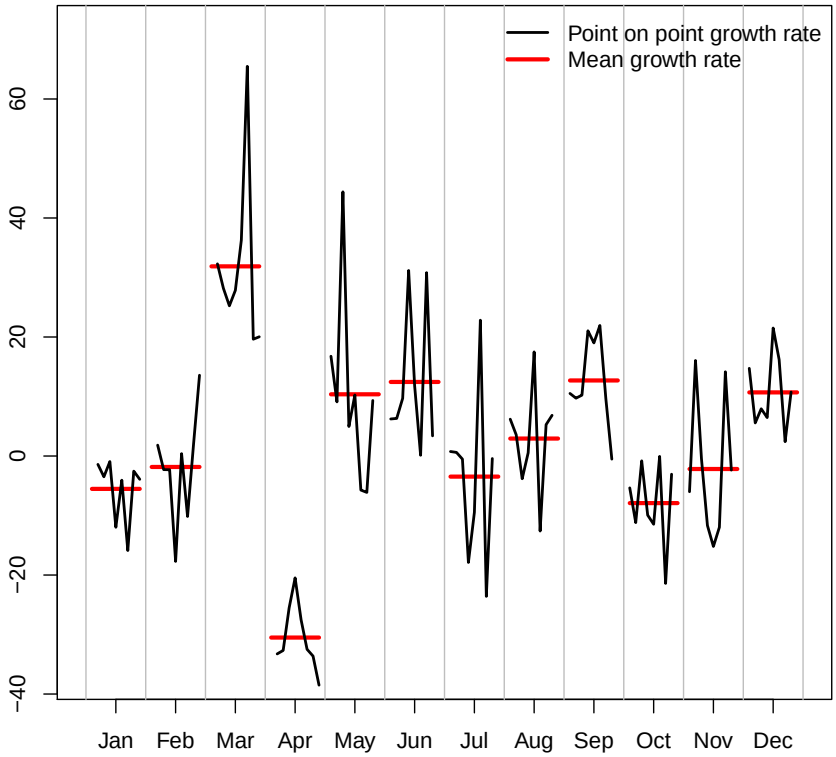


Figure 2 shows seasonal peaks in the month of March. The growth rates in each of the months do not show a stable pattern. Intutively, seasonality in the series cannot be inferred to be deterministic.

2.1 Seasonal adjustment of IIP Capital goods with X-12-ARIMA

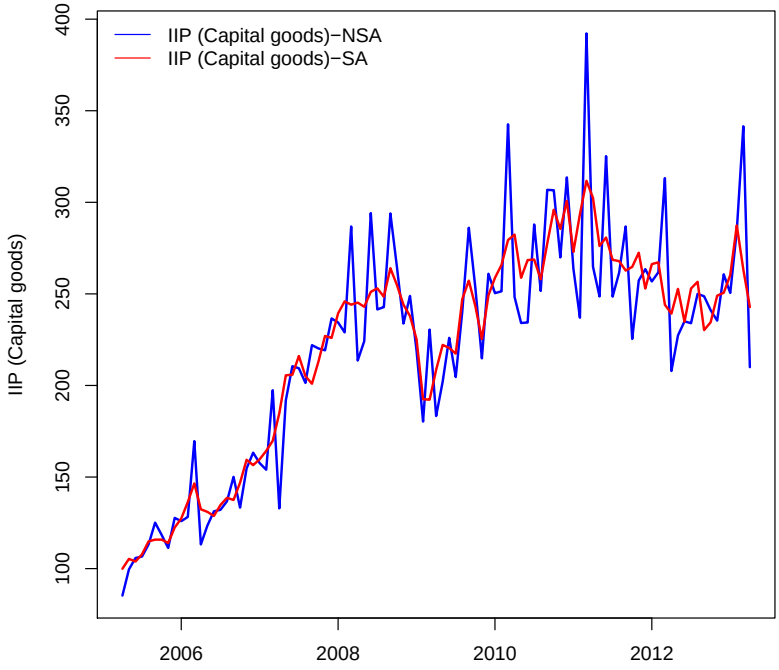
Seasonal adjustment is done with X-12-ARIMA method.

Figure 3 shows the non-seasonally and seasonally adjusted IIP Capital goods. The seasonal peaks are dampened after seasonal adjustment.

2.1.1 Presence of identifiable seasonality

The statistic M7 shows the amount of moving seasonality present relative to stable seasonality. It shows the combined result for the test of stable and moving seasonality in the series. A value lesser than 0.7 is desirable to show identifiable seasonality in the series. The value of

Figure 3 IIP Capital goods (NSA and SA)



M7 statistic for IIP Capital goods is 0.626
IIP Capital goods series show identifiable seasonality on the basis of M7 statistic.

3 Year on year growth versus seasonally adjusted point on point growth

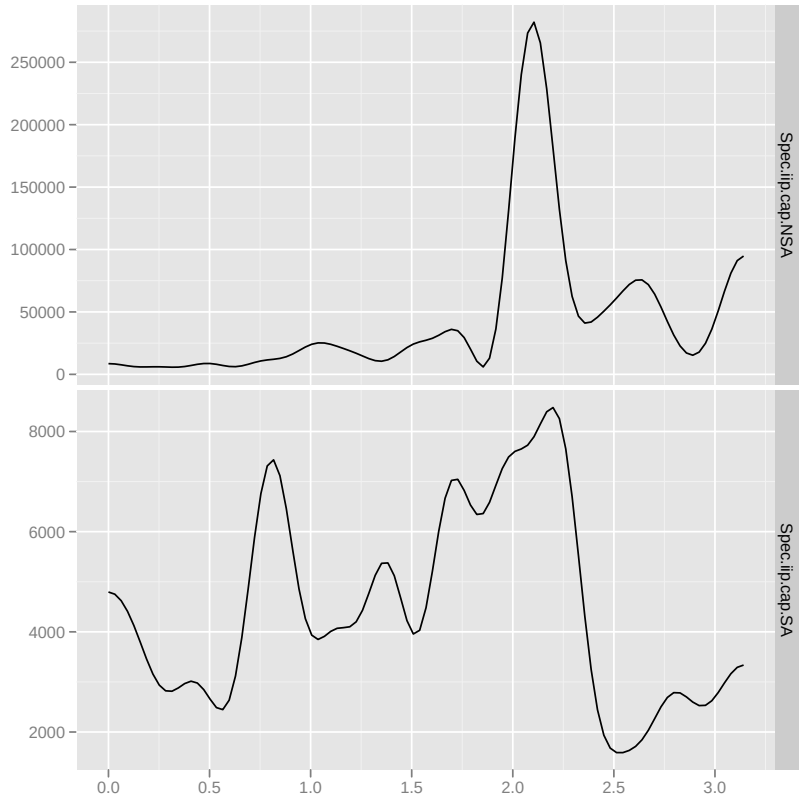
Growth rates can be computed either year on year or point on point. The year on year growth rate is computed as the percentage change with respect to the corresponding month (or quarter) in the preceding year, while the point on point growth rate is computed as the percentage change with respect to the preceding period.

Table 2 shows the year on year growth and seasonally adjusted annualized rate in percent, point on point.

4 Spectral representation

Figure 4 shows the spectral plot of the growth rate of the unadjusted and seasonally adjusted series. Spectral plot, an important tool of the frequency domain analysis shows the portion of variance contributed by cycles of different frequencies.
The x-axis represent frequency from 0 to pi (3.14). The seasonal frequencies are pi/6 (0.52 on the x-axis), pi/3 (1.04 on the x-axis) , pi/2 (1.57 on the x-axis), 2pi/3 (2.09 on the x-axis) and 5 pi/6 (2.6 on the x-axis). In terms of periods (months); they are 12 months, 6 months, 4 months, 3 months and 2.4 months.
The figure at the lower panel shows that peaks at seasonal frequencies are eliminated after seasonal adjustment. Other peaks seen in the lower panel of the figure are not at seasonal frequencies.

Figure 4 IIP (Capital goods) Spectral plot (NSA and SA)



5 Sliding span diagnostics

Sliding span diagnostics are descriptive statistics of how the seasonal adjustments and their month-to-month changes vary when the span of data used to calculate them is altered in a systematic way.

It is based on the idea that for a month common to more than one overlapping spans, the percent change of its adjusted value from the different spans should not exceed the threshold value and for a month common to more than one span, the difference between the month on month change from the different spans should not exceed the threshold value (the threshold value being 0.03).

Sliding span gives the percentage of months (A%) for which the seasonal adjustment is unstable (the difference in the seasonally adjusted values for a particular month from more than one span should not exceed 0.03). It also gives the percentage of months (MM%) for which the month on month changes of the seasonally adjusted values is unstable i.e exceeding the threshold value.

The seasonal adjustment produced by the procedure chosen should not be used if A% > 25.0 (> 15.0 is considered problematic) or if M M % > 40.0.

For this series, we do not rely on the sliding span diagnostics. **The sliding span diagnostics is not reliable when the range of the seasonal factors in a particular span is low**

(less than 5).

6 Accounting for India-specific moving holiday effects

Accounting for moving holiday effect is a crucial component of pre-treatment of the series before the application of seasonal adjustment method. X-12-ARIMA is capable of handling the moving holiday effects through the inclusion of regressors for Easter Sunday, Labor Day, and Thanksgiving Day. These are important moving holidays for U.S time series.

We use the GENHOL program of X-12-ARIMA to analyse India-specific moving holiday effect. The program generates regressor matrices from holiday date file to enable X-12-ARIMA, estimation of complex moving holiday effects. It has the capability to generate regressors for before the holiday interval, surrounding the holiday interval and past the holiday interval.

The key assumption is that the fundamental structure of a time series changes for a fixed number of days before, after or for a fixed interval surrounding the holidays. We estimate the effect of Diwali which is an important moving holiday in Indian scenario. For estimating Diwali effect, we assume that the level of economic activity changes 5 days before Diwali (including the day on which Diwali falls). Regression variable for Diwali is not found to be significant for IIP (Capital goods).

Table 1 Year on year and point on point growth rates

	Y.o.Y.growth	Point.on.point.growth
2007 Jan		47.21
2007 Feb		81.52
2007 Mar		86.59
2007 Apr	32.71	-121.72
2007 May	24.00	-12.72
2007 Jun	24.10	-20.58
2007 Jul	23.92	54.40
2007 Aug	20.85	34.50
2007 Sep	19.98	-10.40
2007 Oct	12.58	79.90
2007 Nov	38.99	98.06
2007 Dec	27.88	-22.28
2008 Jan	25.18	24.27
2008 Feb	20.12	33.97
2008 Mar	16.39	39.63
2008 Apr	17.40	101.16
2008 May	55.38	128.17
2008 Jun	60.32	1.50
2008 Jul	58.52	58.48
2008 Aug	47.22	-62.74
2008 Sep	47.90	-24.52
2008 Oct	65.19	70.77
2008 Nov	41.69	75.83
2008 Dec	44.89	-5.81
2009 Jan	48.73	69.21
2009 Feb	48.70	32.25
2009 Mar	45.29	-8.73
2009 Apr	60.72	5.52
2009 May	16.83	-11.20
2009 Jun	39.71	39.69
2009 Jul	15.33	8.86
2009 Aug	20.56	-21.63
2009 Sep	32.39	72.84
2009 Oct	20.21	-42.30
2009 Nov	6.66	-51.72
2009 Dec	5.20	-30.97
2010 Jan	-6.53	-65.41
2010 Feb	-21.27	-188.75
2010 Mar	-19.63	-1.61
2010 Apr	-14.19	97.63
2010 May	-9.86	75.96
2010 Jun	-23.16	-9.03
2010 Jul	-15.28	-16.95
2010 Aug	-0.99	153.97
2010 Sep	-2.65	47.84
2010 Oct	-4.31	-66.77
2010 Nov	-8.13	-91.89
2010 Dec	4.86	120.69
2011 Jan	14.29	45.20
2011 Feb	39.43	32.29
2011 Mar	48.63	59.77
2011 Apr	35.46	12.66