Technical note on seasonal adjustment for Capital goods imports

July 1, 2013

Contents

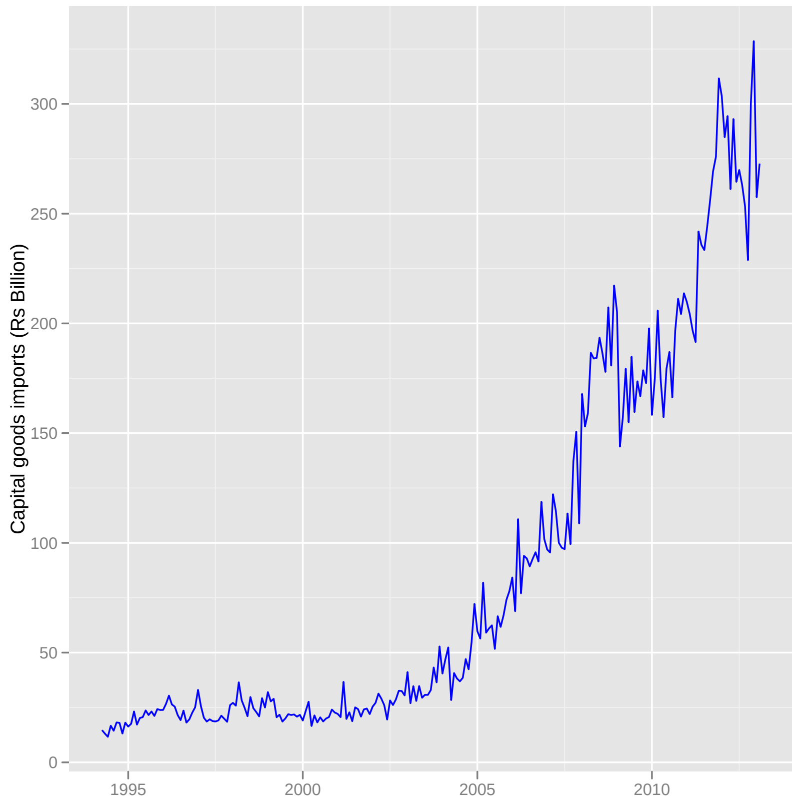
List of Figures

List of Tables

1 Capital goods imports

We analyse the monthly data for Capital goods imports in Rs.Billion 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 Capital goods imports (Non seasonal adjusted)



1.1 Additive versus multiplicative seasonality

X-12-ARIMA has the capability to determine the mode of the seasonal adjustment decomposition to be performed i.e whether multiplicative or additive seasonal adjustment decomposition is appropriate for the series. For the given series, multiplicative seasonal adjustment is considered appropriate on the basis of the model selection criteria. The plot of the series also shows multiplicative seasonal adjustment.

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.

Figure 2 Monthly growth rates across the years

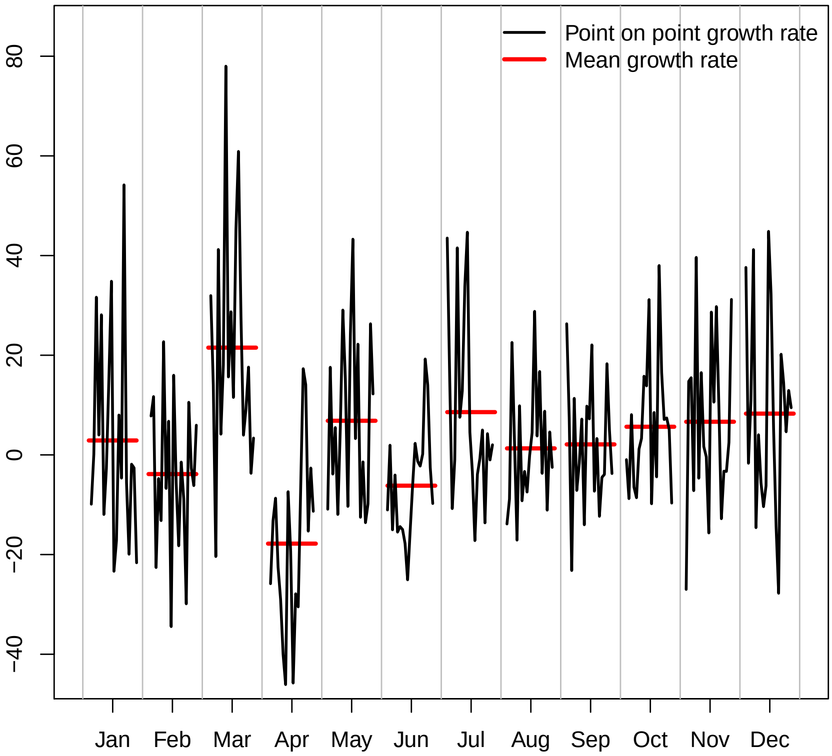


Figure 2 does not show a very high level of seasonality as seen in the series of capital goods imports.

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

Seasonal adjustment is done with X-12-ARIMA method. The series shows trading day effect hence trading day adjustment is made in the specification.

Figure 3 Capital goods imports (NSA and SA)

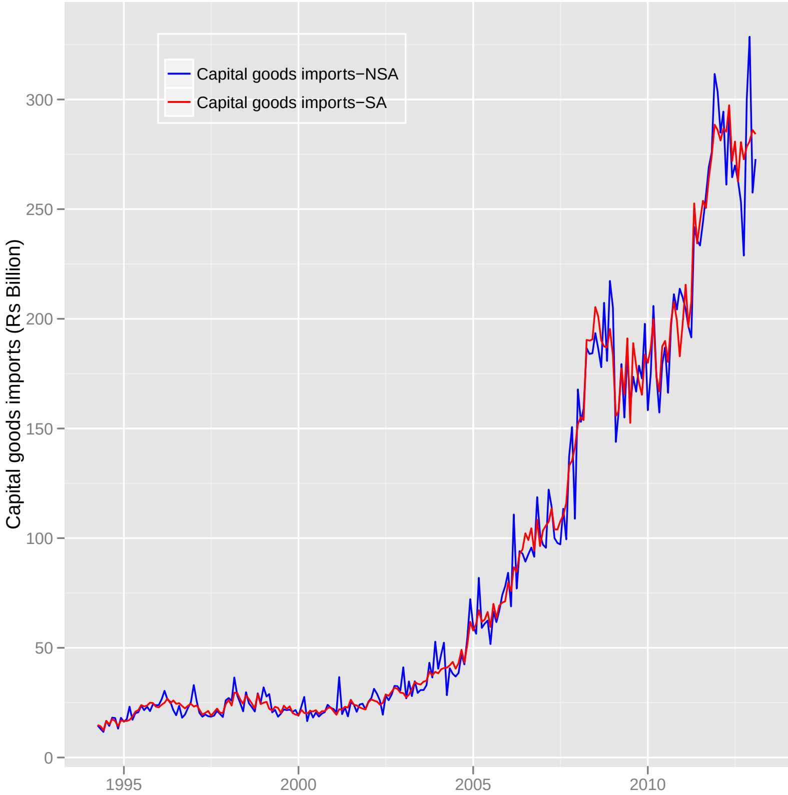


Figure 3 shows the non-seasonally and seasonally adjusted Capital goods imports. In recent months we do not see a substantial difference between the raw and seasonally adjusted series.

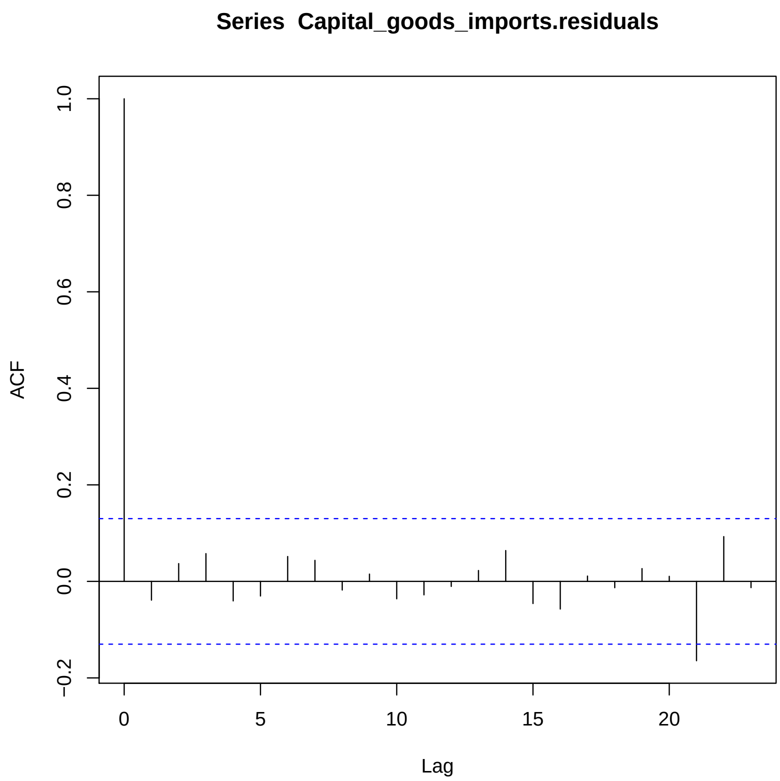
2.2 Diagnostic checks

After seasonal adjustment, a series of diagnostic checks are performed through relevant tests and quality assessment statistics.

2.2.1 Validation of the automodel choice by X-12-ARIMA

A test of validation of the auto model choice by X-12-ARIMA is the randomness of the residuals of the ARIMA model. The Ljung-Box test is conducted on the residuals of the fitted ARIMA model to check whether or not the residuals are white noise. The ACFs of the residuals are plotted to check for randomness.

Figure 4 ACF of residuals



The figure 4 does not reveal significant autocorrelation amongst the residuals.

2.2.2 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 1 is desirable to show identifiable seasonality in the series. The value of M7 statistic for Capital goods imports is 0.688
Though the value of M7 is less than 1, a comparison of the plots of NSA and SA series do not show much difference in the unadjusted and adjusted series.

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

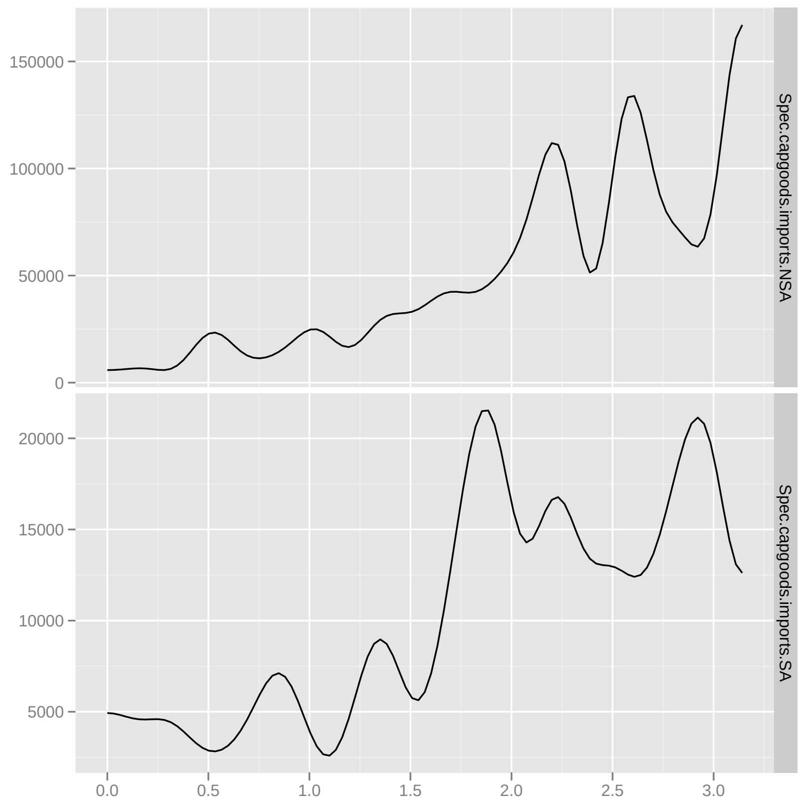
Growth rates can be computed either year on year or point on point. The year on year growth rate is computed as the percentage change with respect to the corresponding month (or quarter) in the preceding year, while the point on point growth rate is computed as the percentage change with respect to the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

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

4 Spectral representation

Figure 5 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 of the series 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. For example the first peak at 0.52 correspond to 12 months which is eliminated after seasonal adjustment, though the difference in the spectrum of the unadjusted and adjusted series is not very high.

Figure 5 Capital goods imports Spectral plot (NSA and SA)



5 Sliding spans 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 $MM\% > 40.0$.
For Capital goods imports A% is 18.2 and MM% is 33.7.
On the basis of the sliding span diagnostics we infer that the series does not have visible seasonal pattern.

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. We estimate the effect with different specifications about the number of days around the festival. However we did not find significant results for diwali effect on capital goods imports.

A visual inspection of plots and the results of the diagnostic tests show that the series does not have a strong seasonal pattern, hence we look at the non-seasonally adjusted annualised rate.

Table 1 Year on year and point on point growth rates

	Y.o.Y.growth	Point.on.point.growth
2009 Jan	22.26	-75.59
2009 Feb	-5.98	-196.81
2009 Mar	-1.18	15.40
2009 Apr	-3.88	141.80
2009 May	-15.76	-83.75
2009 Jun	0.29	172.40
2009 Jul	-17.51	-270.66
2009 Aug	-6.83	256.88
2009 Sep	-6.25	-66.60
2009 Oct	-13.83	-54.86
2009 Nov	-4.42	-38.53
2009 Dec	-8.99	126.37
2010 Jan	-22.83	-25.10
2010 Feb	21.67	44.17
2010 Mar	30.95	82.02
2010 Apr	-2.78	-168.89
2010 May	1.47	-47.73
2010 Jun	-2.96	139.47
2010 Jul	17.14	15.98
2010 Aug	-4.24	-62.55
2010 Sep	17.90	116.60
2010 Oct	18.25	53.46
2010 Nov	18.21	-49.46
2010 Dec	8.09	-103.49
2011 Jan	32.47	94.33
2011 Feb	16.67	103.00
2011 Mar	-4.46	-111.83
2011 Apr	9.81	67.07
2011 May	53.80	235.15
2011 Jun	31.48	-90.00
2011 Jul	24.83	50.56
2011 Aug	46.85	45.22
2011 Sep	30.26	-15.81
2011 Oct	27.44	62.97
2011 Nov	35.11	46.72
2011 Dec	45.81	59.80
2012 Jan	44.72	-10.22
2012 Feb	39.48	-20.25
2012 Mar	49.71	22.74
2012 Apr	36.38	-5.72
2012 May	21.18	49.71
2012 Jun	12.19	-107.30
2012 Jul	15.63	38.55
2012 Aug	7.78	-80.60
2012 Sep	-1.12	79.50
2012 Oct	-15.00	-34.07
2012 Nov	8.78	25.06
2012 Dec	5.44	10.55
2013 Jan	-15.17	21.78
2013 Feb	-4.22	-7.83
2013 Mar		
2013 Apr		