# Technical note on seasonal adjustment for Non oil exports

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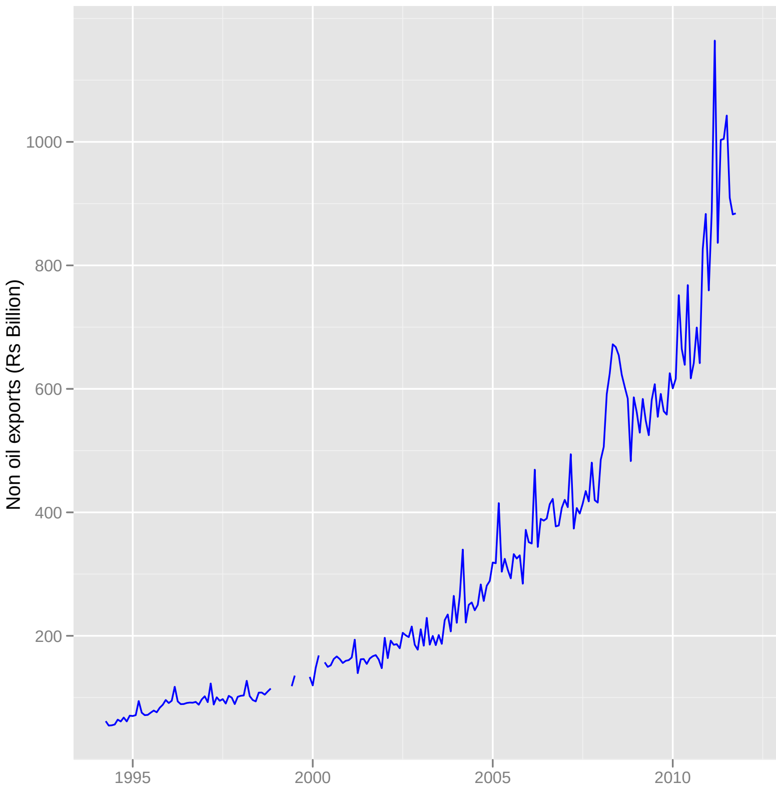
# 1 Non oil exports

We analyse the monthly data for Non oil exports in Rs.Billion from April, 1994 onwards. Figure 1 shows the original plot of the series. The plot shows seasonal variations. 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** Non oil exports (Non seasonal adjusted)




## 1.1 Additive verus 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

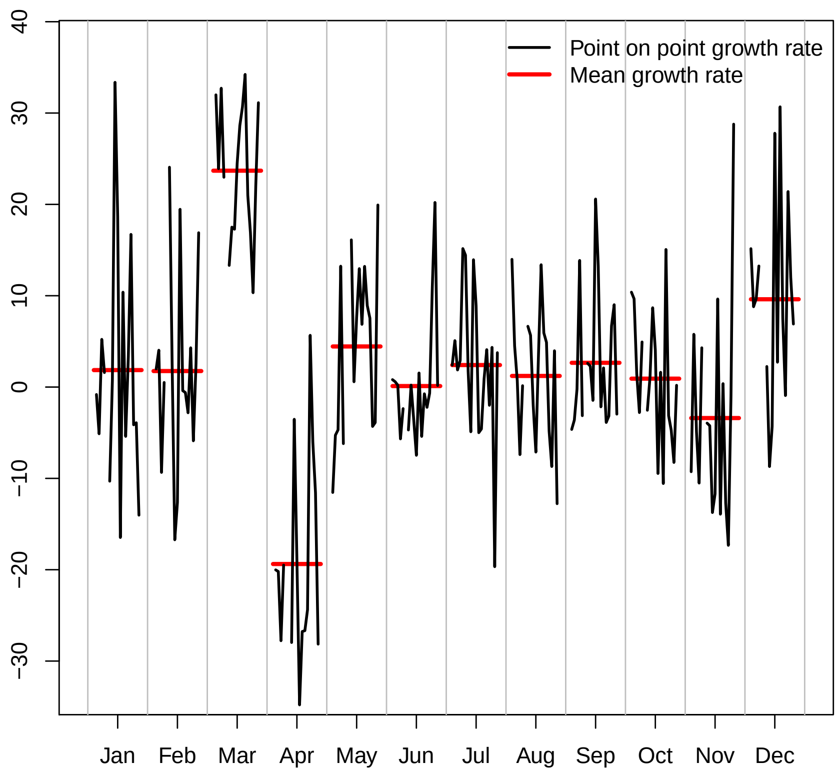



Figure 2 shows seasonal peaks in the month of March and to a lesser extent in December.

### 2.1 Seasonal adjustment with X-12-ARIMA

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

**Figure 3** Non oil exports (NSA and SA)

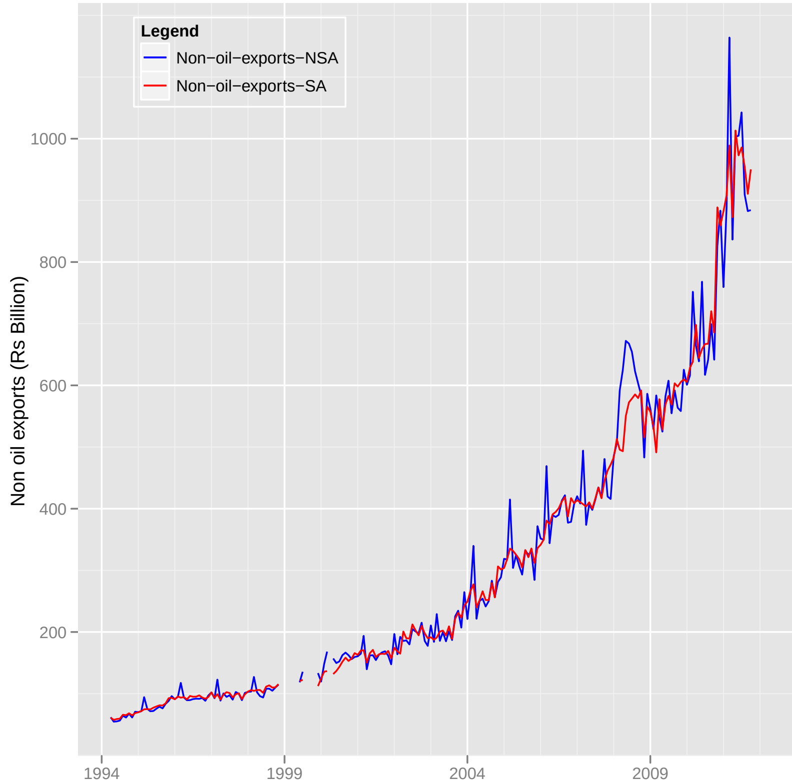



Figure 3 shows the non-seasonally and seasonally adjusted Non oil exports. The blue line shows the non-seasonally adjusted series and the red line shows the seasonally adjusted one.

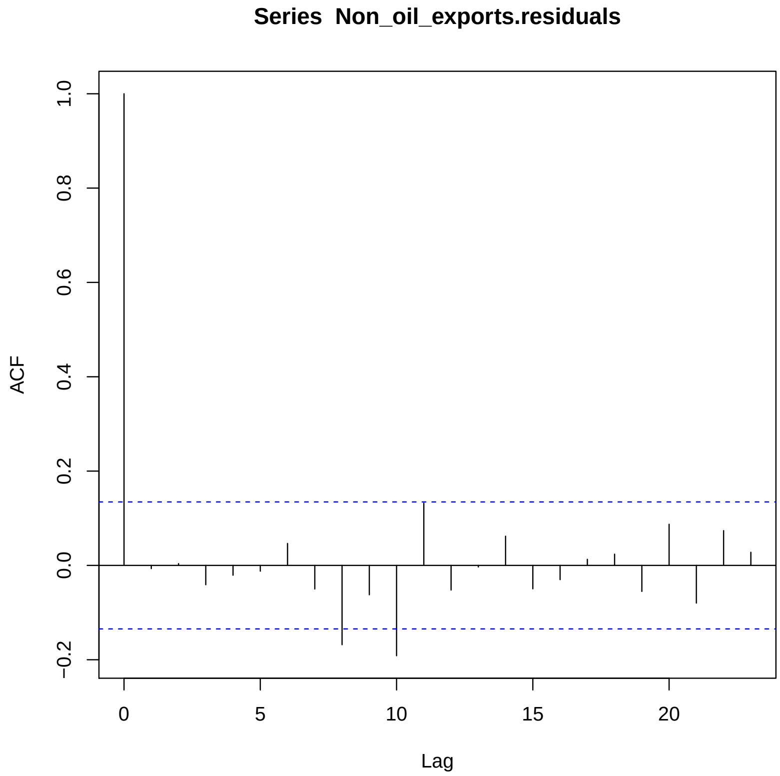
## 2.2 Diagnostic checks

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




### 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 0.7 is desirable to show identifiable seasonality in the series. The value of M7 for Non oil exports is 0.388.

*Non oil exports show identifiable seasonality on the basis of M7 statistic*

## 3 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 un-

stable (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 non oil exports A% is 13.1 and MM% is 26.5. **The sliding span diagnostics is not reliable when the range of the seasonal factors in a particular span is low (less than 5).**

## 4 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 non oil exports.