

# Technical note on seasonal adjustment for Non food credit

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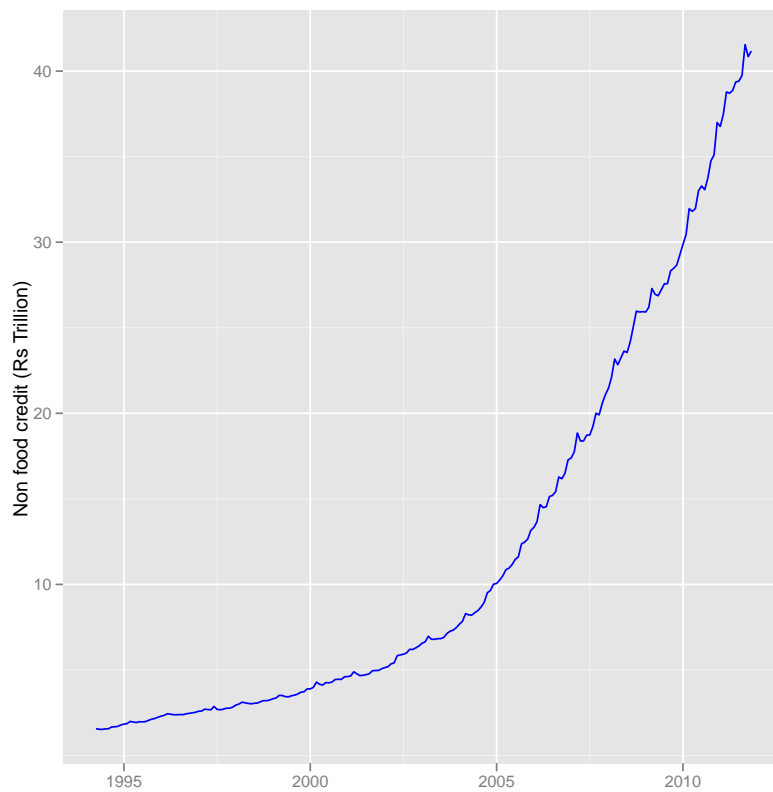
# 1 Non food credit

We analyse the monthly data for Non food credit in Rs.Trillion from April, 1994 onwards. Figure 1 shows the original plot of the series. 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.

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**Figure 1** Non food credit (Non seasonally adjusted)

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## 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.

## 2 Steps in the seasonal adjustment procedure

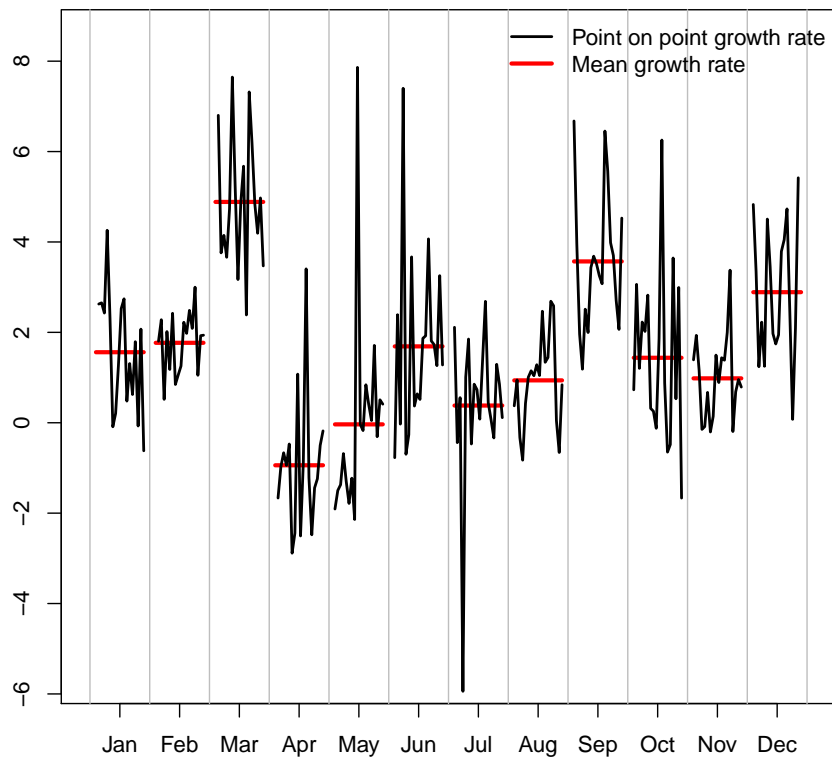
Given that seasonality exists, it is important to model seasonality before the application of seasonal adjustment procedure. Seasonality in time series can be deterministic or stochastic. Stochastic seasonality can be stationary or non-stationary.

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.

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**Figure 2** Monthly growth rates across the years

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Figure 2 shows seasonal peaks in the month of March.

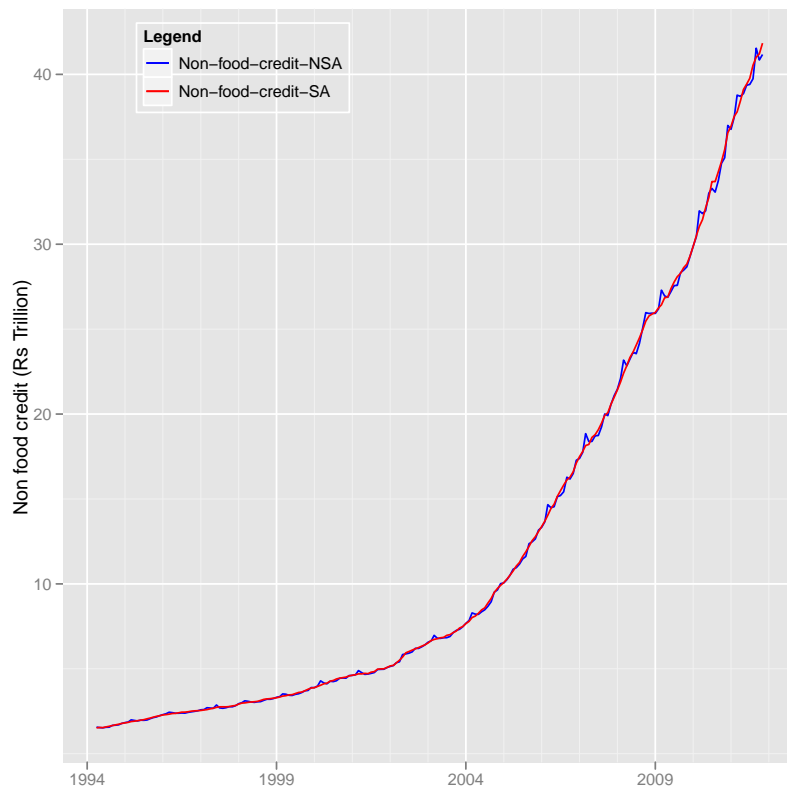
### 2.1 Seasonal adjustment with X-12-ARIMA

Seasonal adjustment is done with X-12-ARIMA method. Since the seasonal pattern is taken to be stochastic, seasonal dummy is not added in the regARIMA specification.

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**Figure 3** Non food credit (NSA and SA)

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Figure 3 shows the non-seasonally and seasonally adjusted Non food credit. 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.

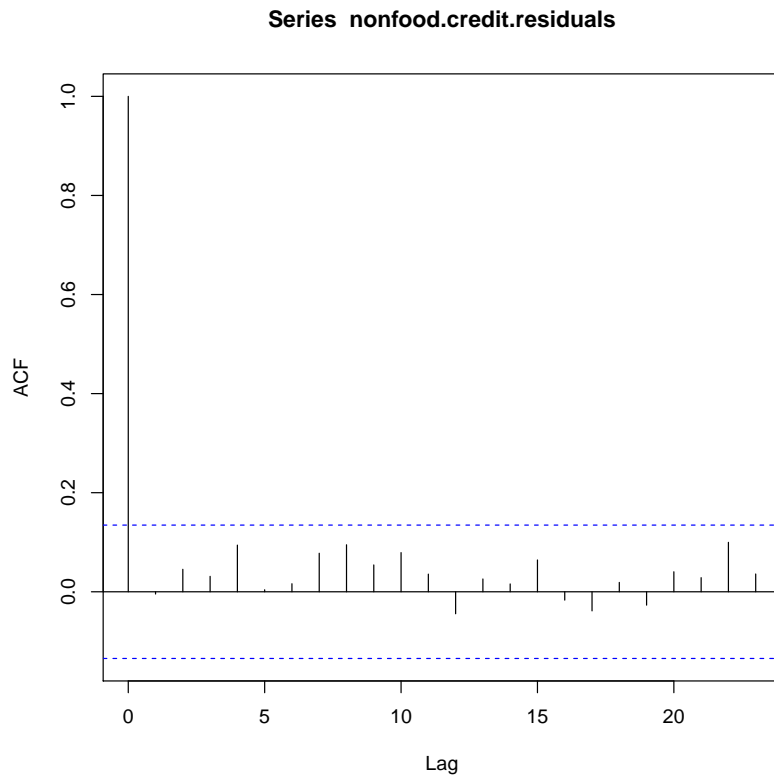
### 2.2.1 Validation of the automodel choice by X-12-ARIMA

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.

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**Figure 4** ACF of residuals

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### 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 food credit is 0.319.

*Non food credit shows 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 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.

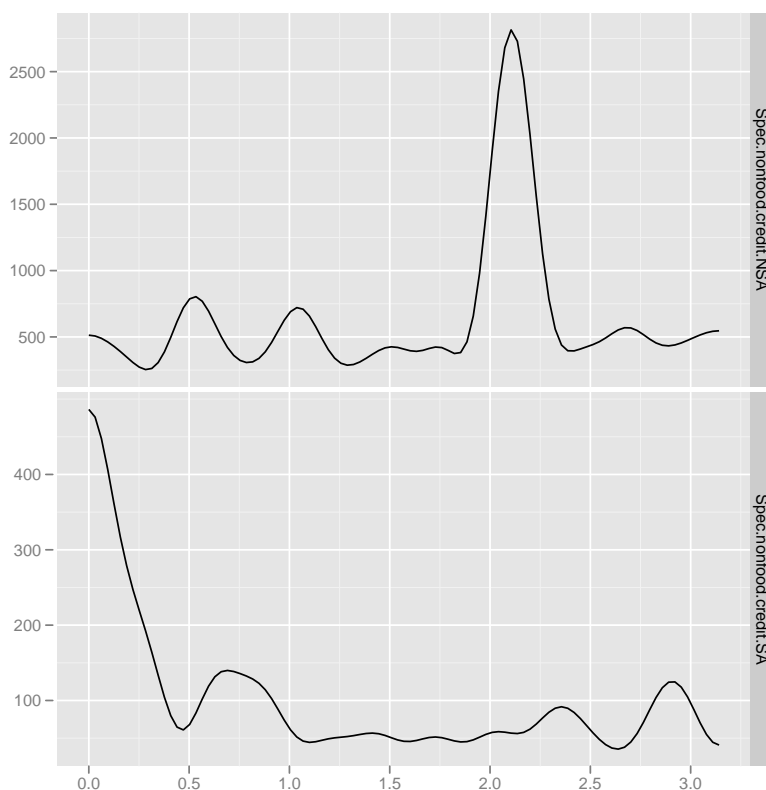
The x-axis represent frequency from 0 to  $\pi$  (3.14). The seasonal frequencies are  $\pi/6$  (0.52 on the x-axis),  $\pi/3$  (1.04 on the x-axis),  $\pi/2$  (1.57 on the x-axis),  $2\pi/3$  (2.09 on the x-axis) and  $5\pi/6$  (2.6 on the x-axis). In terms of periods (months); they are 12 months, 6 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. Other peaks seen in the lower panel of the figure are not at seasonal frequencies

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**Figure 5** Non food credit Spectral plot (NSA and SA)

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## 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  $MM\% > 40.0$ .

For Non food credit the programme gives the warning that the range of the means of the seasonal factors is too low for sliding span measures to be reliable. Hence this diagnostic

measure is not relied for this series.

**WARNING: 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. 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 food credit.

**Table 1** Year on year and point on point growth rates

	Y.o.Y.growth	Point.on.point.growth
2006 Jan	32.52	27.21
2006 Feb	33.18	28.48
2006 Mar	39.60	29.47
2006 Apr	33.35	34.17
2006 May	32.78	20.21
2006 Jun	35.57	37.20
2006 Jul	32.61	25.78
2006 Aug	32.75	25.51
2006 Sep	31.64	22.88
2006 Oct	29.65	11.97
2006 Nov	30.44	23.24
2006 Dec	31.30	36.70
2007 Jan	30.41	26.15
2007 Feb	29.90	20.89
2007 Mar	28.52	23.25
2007 Apr	26.88	4.21
2007 May	26.44	27.00
2007 Jun	23.69	10.56
2007 Jul	23.23	18.08
2007 Aug	24.74	23.88
2007 Sep	22.88	28.09
2007 Oct	23.08	9.62
2007 Nov	24.74	29.79
2007 Dec	22.02	23.38
2008 Jan	23.43	24.20
2008 Feb	24.54	26.34
2008 Mar	22.97	27.79
2008 Apr	24.27	23.50
2008 May	26.34	24.91
2008 Jun	26.24	16.77
2008 Jul	25.73	20.27
2008 Aug	25.60	21.13
2008 Sep	25.26	22.96
2008 Oct	30.46	24.34
2008 Nov	25.95	14.21
2008 Dec	23.04	5.23
2009 Jan	20.79	4.58
2009 Feb	18.51	12.12
2009 Mar	17.77	8.20
2009 Apr	18.01	18.84
2009 May	15.67	1.95
2009 Jun	15.14	21.76
2009 Jul	17.02	16.73
2009 Aug	14.12	13.76
2009 Sep	13.03	8.19
2009 Oct	9.63	14.13
2009 Nov	10.59	8.85
2009 Dec	12.82	19.20
2010 Jan	15.24	23.39
2010 Feb	16.24	25.07
2010 Mar	17.11	21.03
2010 Apr	17.99	15.69