

Technical note on seasonal adjustment for Imports

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Contents

1 Imports	2
1.1 Additive versus multiplicative seasonality	2
2 Steps in the seasonal adjustment procedure	3
2.1 Tests for identifying the nature of seasonality	3
2.2 Seasonal adjustment of imports with X-12-ARIMA	4
2.2.1 Presence of identifiable seasonality	5
3 Year on year growth versus seasonally adjusted point on point growth	5
4 Spectral representation	6
5 Sliding spans diagnostics	6
6 Accounting for India-specific moving holiday effects	7

List of Figures

1 Imports (Non seasonal adjusted)	2
2 Monthly growth rates across the years	3
3 Imports (NSA and SA)	5
4 Imports spectral plot (NSA and SA)	6

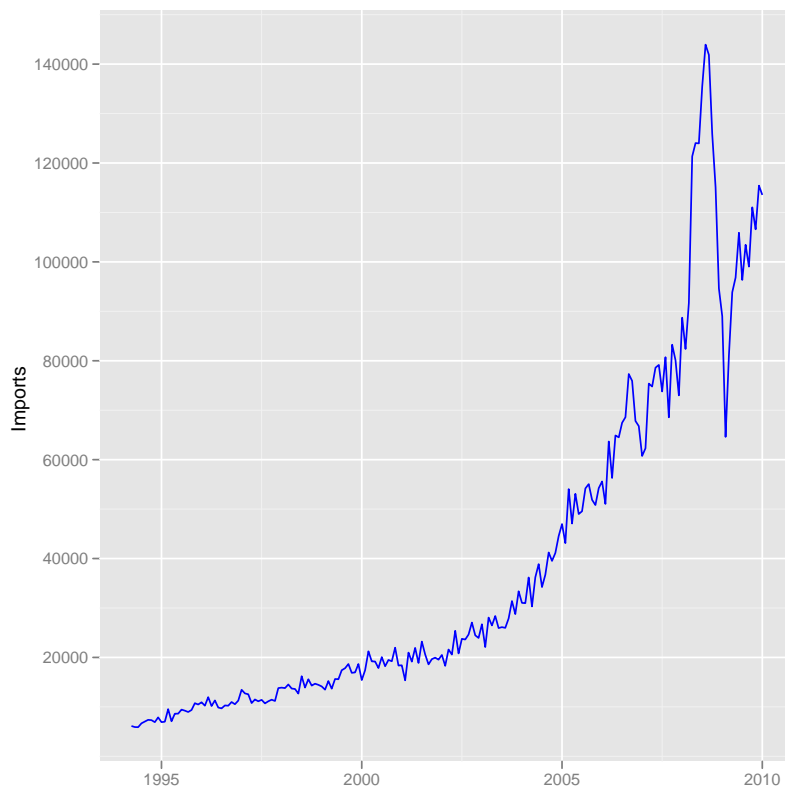
List of Tables

1 HEGY test statistics	4
2 Year on year and point on point growth rates	8

1 Imports

We analyse the monthly data for imports in Rs.crore from April, 1994 onwards. Figure 1 shows the original plot. The plot shows seasonal variations 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 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

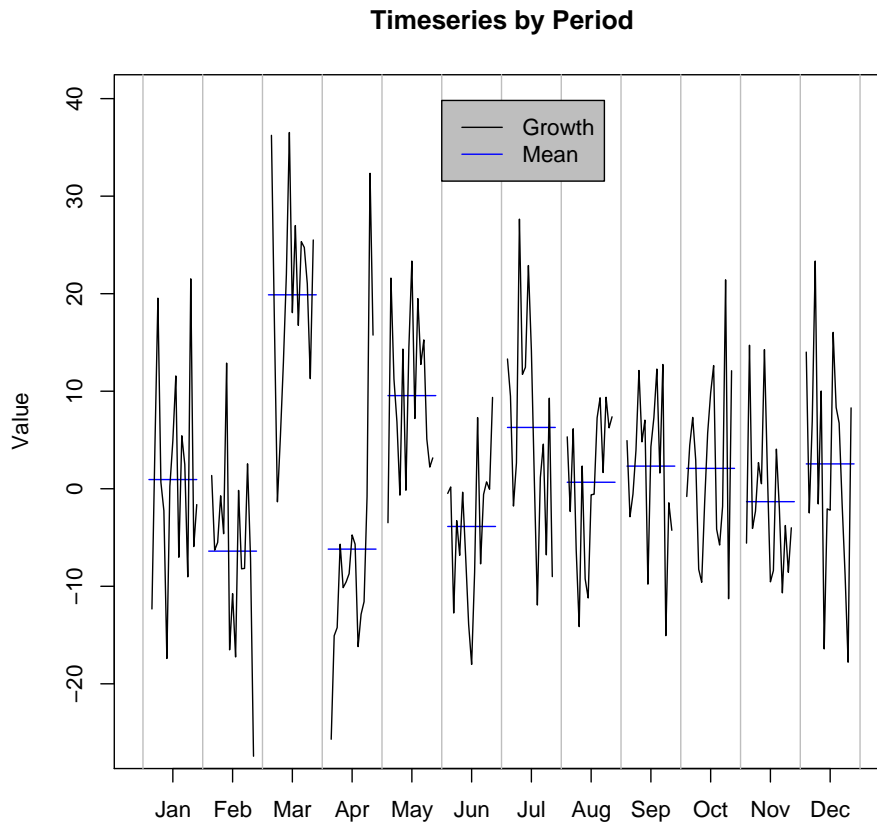


Figure 2 shows that the mean growth rate of imports is higher in the month of March across all the years.

2.1 Tests for identifying the nature of seasonality

We test for the nature of seasonality using HEGY and Canova Hansen test.

Under the null hypothesis of the HEGY test, nonstationary unit root behavior exists not only

at the long run (or zero) frequency, but also at some or all of the seasonal frequencies. The Canova Hansen test takes the opposite approach. The null hypothesis is stationarity with deterministic seasonality.

Table 1 HEGY test statistics

	Stat.	p-value
tpi_1	3.12	0.10
tpi_2	-3.06	0.02
Fpi_3:4	14.62	0.10
Fpi_5:6	9.07	0.10
Fpi_7:8	0.38	0.01
Fpi_9:10	9.55	0.10
Fpi_11:12	2.73	0.01
Fpi_2:12	12.88	
Fpi_1:12	15.75	

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 Canova & Hansen test
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Null hypothesis: Stationarity.

Alternative hypothesis: Unit root.

Frequency of the tested cycles: $\pi/6$, $\pi/3$, $\pi/2$, $2\pi/3$, $5\pi/6$, π ,

L-statistic: 1.786

Lag truncation parameter: 14

Critical values:

0.10 0.05 0.025 0.01

2.49 2.75 2.99 3.27

The test results are indicative of deterministic seasonality in imports.

2.2 Seasonal adjustment of imports with X-12-ARIMA

Seasonal adjustment is done with X-12-ARIMA method. Seasonal dummy is added in the specification of the RegARIMA model on the basis of the results of HEGY and Canova Hansen tests.

Figure 3 Imports (NSA and SA)

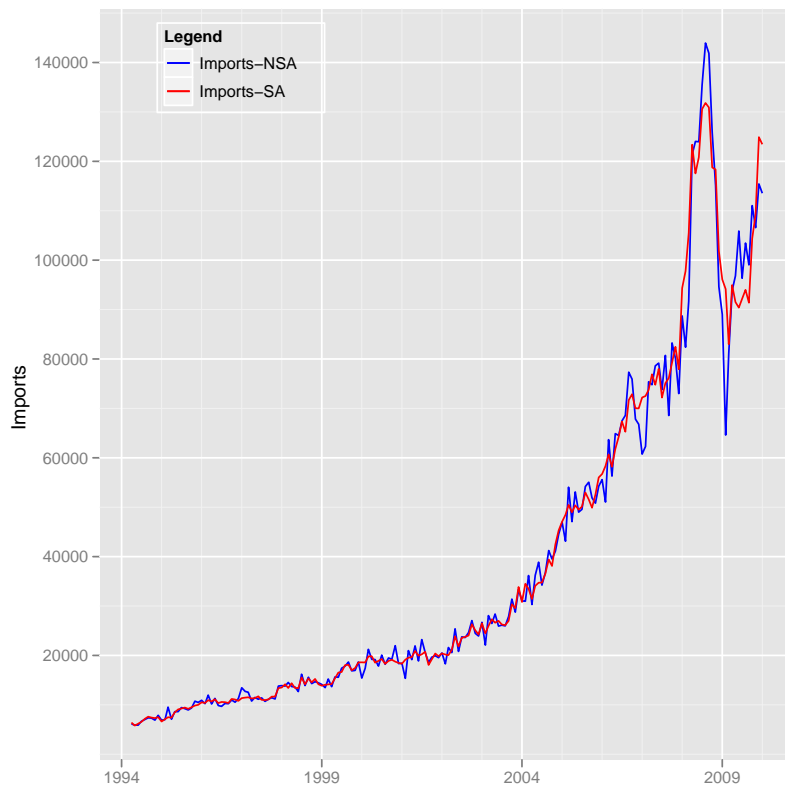


Figure 3 shows the non-seasonally and seasonally adjusted imports. The seasonal peaks are dampened after seasonal adjustment.

2.2.1 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 M7 statistic for imports is 0.88

M7 statistic shows that moving seasonality is quite high relative to stable seasonality.

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.

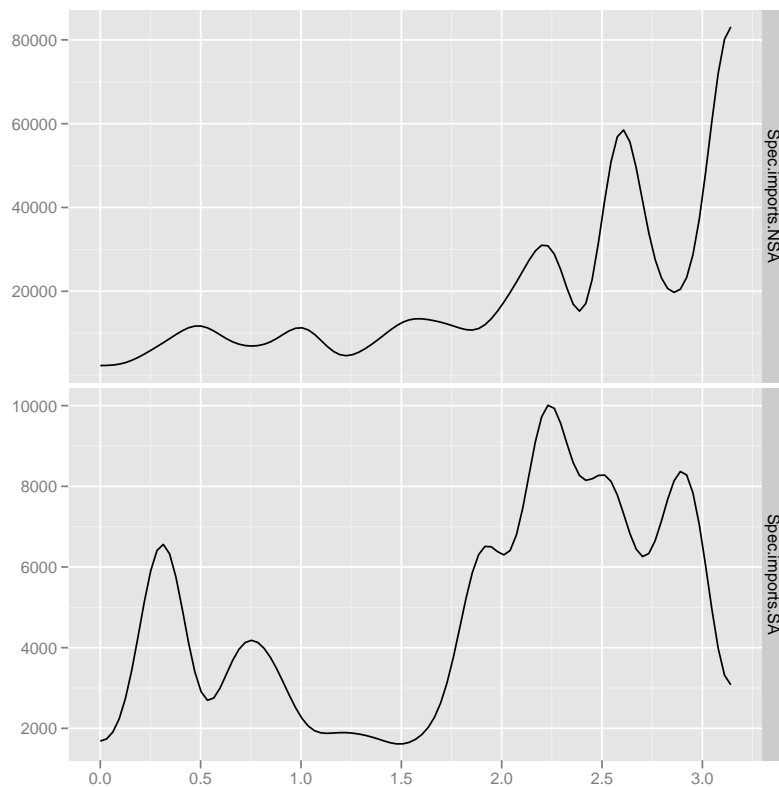
Table 2 shows the year on year growth and seasonally adjusted annualized rate in percent, point on point.

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 of the series contributed by cycles of different frequencies.

Since the series does not have a very high degree of distinct seasonality, the figure for non seasonally adjusted growth rate does not show distinct peaks at the seasonal frequencies.

Figure 4 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 imports A% is 14.6 and MM% is 14.7. Both the statistics are within the permissible range for the series.

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 imports.

Table 2 Year on year and point on point growth rates

	Y.o.Y.growth	Point.on.point.growth
2006 Jan	18.33	14.80
2006 Feb	18.39	33.94
2006 Mar	17.82	46.87
2006 Apr	19.56	-50.10
2006 May	22.23	71.31
2006 Jun	31.66	47.44
2006 Jul	36.11	56.33
2006 Aug	26.57	-37.13
2006 Sep	40.44	112.39
2006 Oct	46.35	19.64
2006 Nov	33.47	-47.78
2006 Dec	23.12	-0.49
2007 Jan	9.29	37.30
2007 Feb	22.05	4.88
2007 Mar	18.41	20.27
2007 Apr	32.84	50.45
2007 May	21.14	-33.52
2007 Jun	22.71	50.47
2007 Jul	9.39	-92.76
2007 Aug	17.69	47.43
2007 Sep	-11.33	16.27
2007 Oct	9.63	48.38
2007 Nov	18.10	47.50
2007 Dec	9.32	-67.97
2008 Jan	46.03	229.60
2008 Feb	32.24	42.94
2008 Mar	21.61	91.19
2008 Apr	62.24	187.56
2008 May	57.79	-57.82
2008 Jun	56.60	32.88
2008 Jul	83.58	93.18
2008 Aug	78.32	11.30
2008 Sep	106.92	-8.32
2008 Oct	51.20	-116.77
2008 Nov	43.67	-4.26
2008 Dec	29.62	-180.21
2009 Jan	0.34	-69.63
2009 Feb	-21.58	-24.66
2009 Mar	-11.56	-151.29
2009 Apr	-22.65	161.59
2009 May	-21.94	-44.20
2009 Jun	-14.58	-14.96
2009 Jul	-28.88	23.57
2009 Aug	-28.13	23.34
2009 Sep	-30.18	-33.70
2009 Oct	-11.79	159.42
2009 Nov	-7.38	55.54
2009 Dec	21.98	159.82
2010 Jan	27.56	-13.99
