Technical note on seasonal adjustment for Wholesale price index

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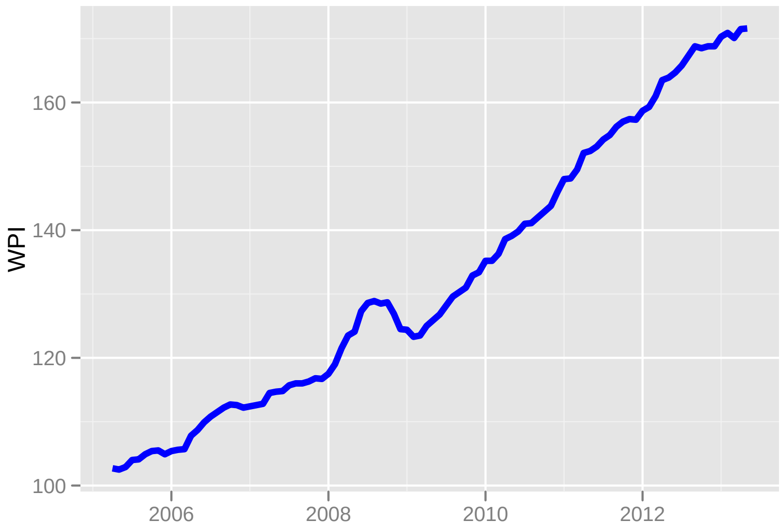
1 Wholesale price index

We analyse the monthly data for WPI with the new base year from April, 2005 onwards. Figure 1 shows the original plot of the series. The plot does not show clear seasonal pattern. In the subsequent sections we investigate the presence of seasonality in WPI.

Figure 1 Wholesale price index (Non seasonal adjusted)



2 Steps in the seasonal adjustment procedure

A visually appealing way of looking at the raw data and detecting seasonal pattern is to plot the growth rates in each of the months across the years, for instance the growth of April over March in each of the years from 2005 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

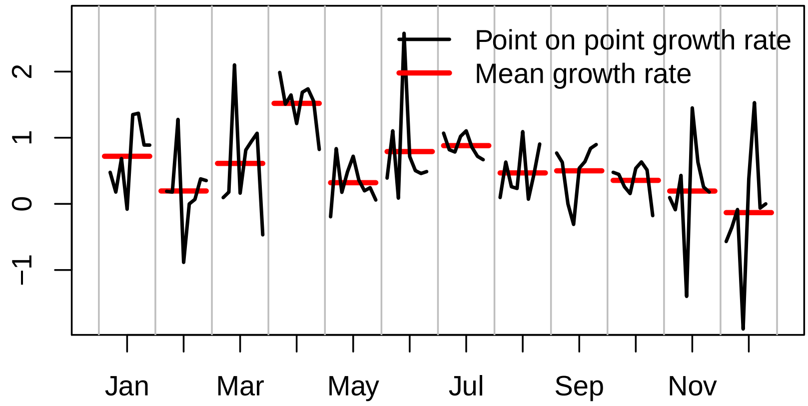


Figure 2 shows growth rates in each of the months across the years. The plot shows a broadly uniform pattern across the growth rates for the months across the years. The monthly means of the growth rates do not differ significantly. This, again is an indication of low level of seasonality in the series.

2.1 Pre-adjustment analysis: Seasonal dummy regression

The simplest approach to testing the presence of seasonality in the series is to apply seasonal dummy regression. In this approach, the series is regressed on monthly dummies to check for seasonal pattern. We can estimate:

$$y_t = \beta_0 + \beta_1 \text{Jan}_t + \beta_2 \text{Feb}_t + \beta_3 \text{Mar}_t + \beta_4 \text{May}_t + \beta_5 \text{Jun}_t$$
$$+\beta_6 \text{Jul}_t + \beta_7 \text{Aug}_t + \beta_8 \text{Sep}_t + \beta_9 \text{Oct}_t + \beta_{10} \text{Nov}_t + \beta_{11} \text{Dec}_t + \epsilon_t$$

where Jan_t, Feb_t .... Dec_t are dummy variables. In this formulation, April is the base month. The residual of the regression gives the seasonally adjusted series. For WPI, the dummies are not significant, which gives an indication that the series does not have significant seasonal pattern.

2.2 Seasonal adjustment of WPI with X-12-ARIMA

We apply the X-12-ARIMA seasonal adjustment procedure to check whether seasonal adjustment removes noise from the series. In other words, whether the adjusted series distinctively differs from the raw series

Figure 3 Wholesale price index (NSA and SA)

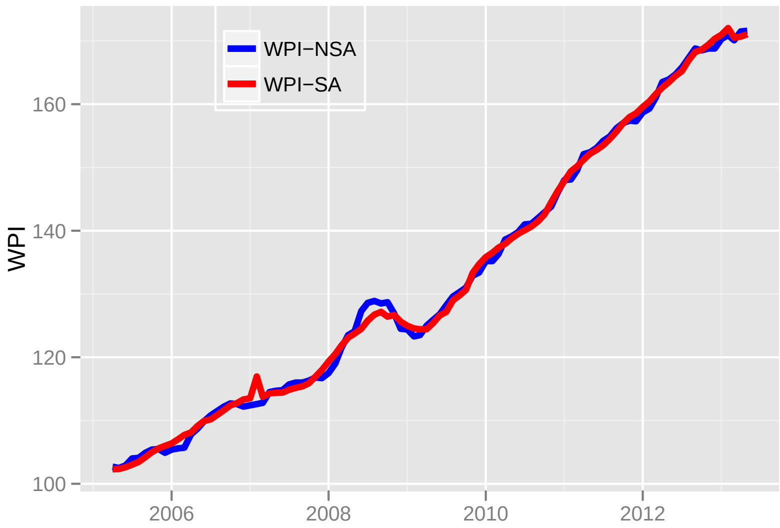


Figure 3 shows the non-seasonally and seasonally adjusted WPI. The blue line shows the non-seasonally adjusted WPI and the red line shows the seasonally adjusted one. There is not much difference in the two plots.

We look at the plots of the growth rates to see the extent of noise reduction after adjustment.

Figure 4 WPI (NSA and SA- point on point growth rates)

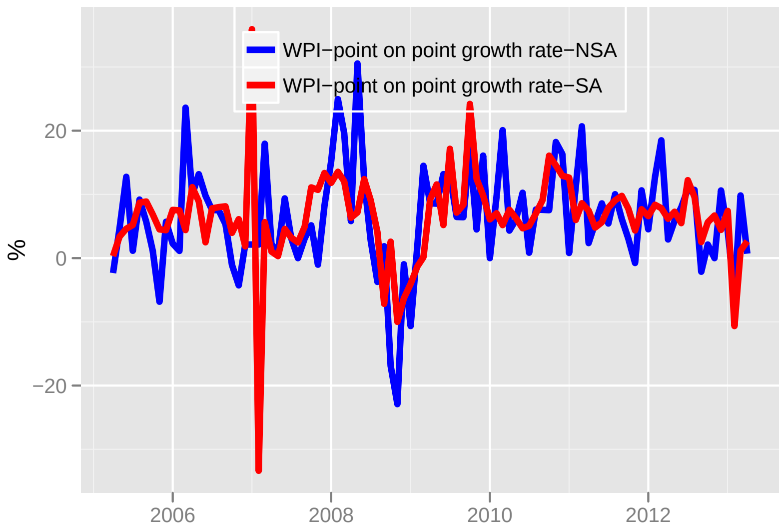


Figure 4 shows the point on point growth of the raw and seasonally adjusted series. The standard deviation of the growth rate of the raw series is 8.1 and that of the adjusted series is 7.23. There is not much difference in the standard deviation of the growth rate of the unadjusted and adjusted series.

2.3 Diagnostic checks

After seasonal adjustment, a series of diagnostic checks are performed to test for the presence of identifiable seasonality in the series.

2.3.1 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 1 is desirable to show identifiable seasonality in the series.

The value of M7 for WPI is 0.3

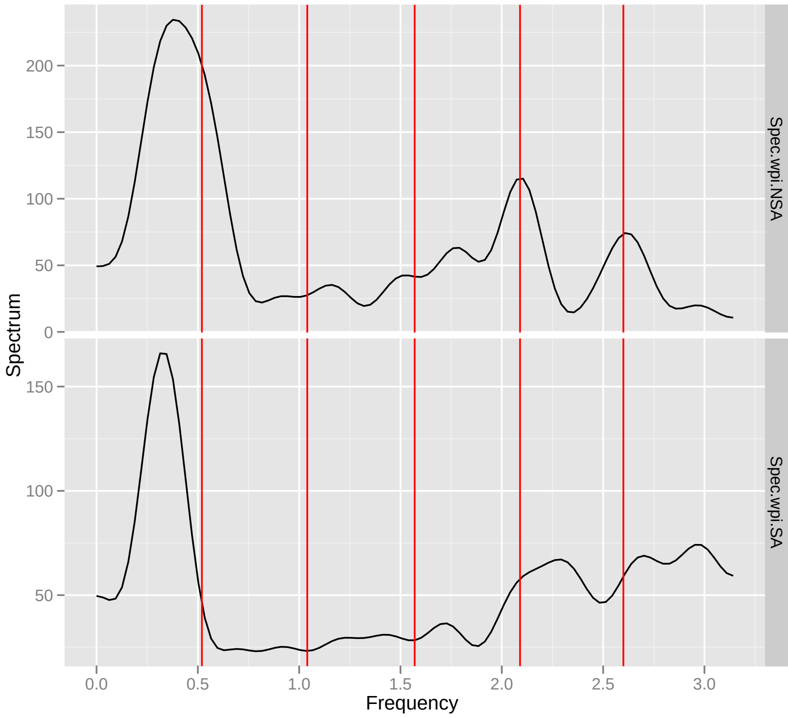
2.3.2 Spectral representation

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 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 peak at 1.04 correspond to 6 months which is eliminated after seasonal adjustment. Other peaks seen in the lower panel of the figure are not at seasonal frequencies.

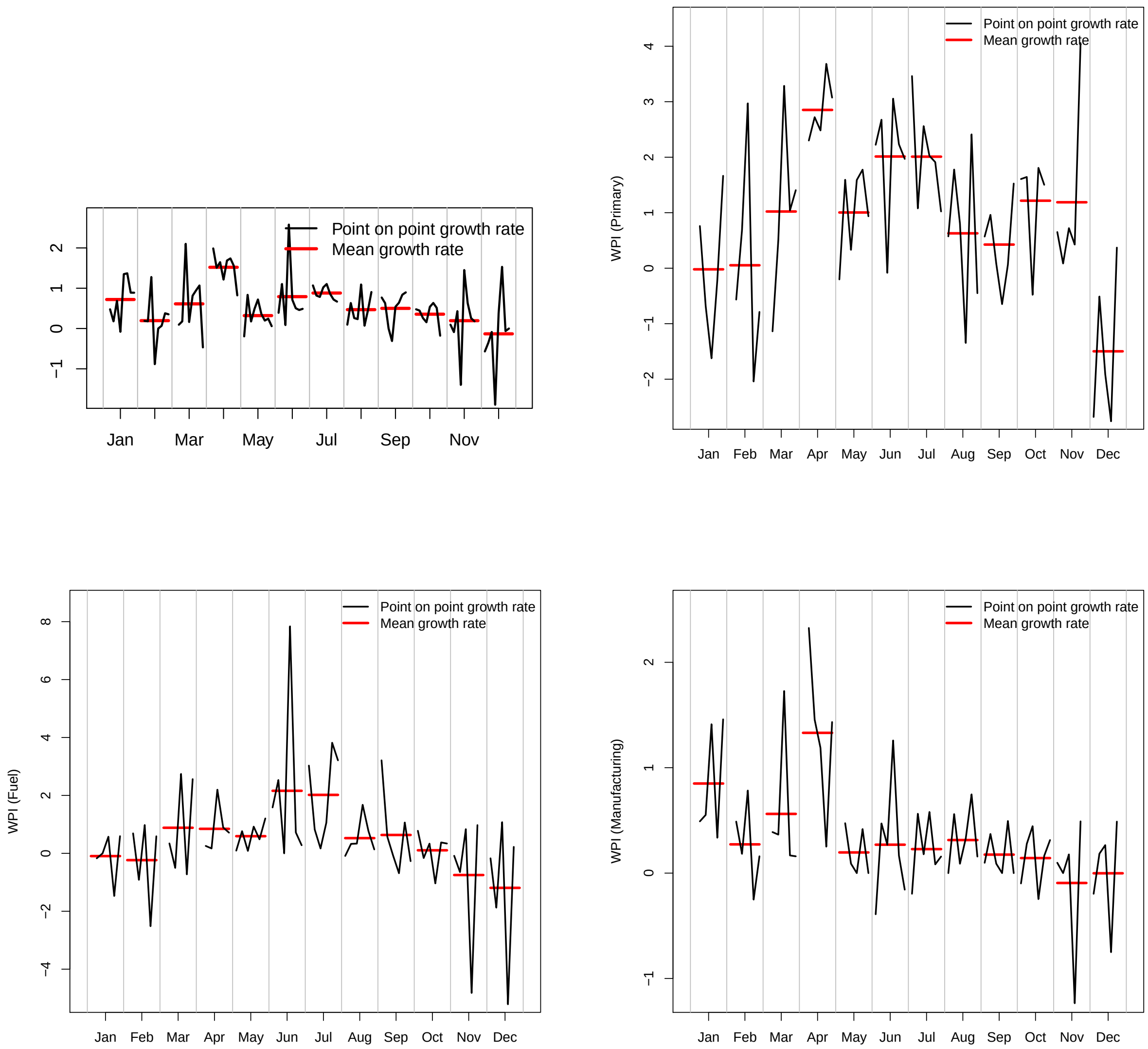
Figure 5 WPI Spectral plot (NSA and SA)



0.52 = pi/6 (annual seasonality), 1.04 = pi/3,
1.57 = pi/2, 2.09 = 2pi/3, 2.6 = 5 pi/6

Figure 5 does not show prominent peaks at the seasonal frequencies. The spectral representation of the series show that adjustment should not be performed for WPI.

Figure 6 Monthly growth rates of WPI and its components across the years



The overall WPI series does not show prominent seasonal fluctuations. We now look at the components of WPI to examine seasonal fluctuations in these series. Figure 6 show the growth rates of each month across the years for WPI and its components: WPI (Primary), WPI (Manufacturing) and WPI (Fuel). A component-wise analysis show that WPI (Primary) and WPI (Manufacturing) have moderate seasonality.