Appendix 5 Details of seasonal adjustment with X-12-ARIMA

1 Specification file

The specification file (from the release of the December 2016 result for Japan (Note 1)), set in X-12-ARIMA for calculating the seasonally adjusted indices of the 2015-base CPI, is shown below.

series{start=2010.01	Start of data: January 2010
span=(2010.1,2016.12)	Period of data: January 2010 to December 2016(Note 1)
period=12	Type of data: Monthly data
}	
transform{function=log}	Log transformation of data
regression{variables=(LS2014.4)}	Prior adjustment of outliers (see the next page for details)
x11{	(X-11 part)
sigmalim=(2 3)	Singular term management limit : 2σ to 3σ
seasonalma=X11default	X-11 default used for moving average
appendfcst=yes	Output of prediction period of Reg-ARIMA model
save=(d10 d11)}	Storage of seasonal and seasonally adjusted indices in the file(Note 2)
arima{ model=(p d q)(P D Q)}	ARIMA model setting (see the next page for details)
estimate{ }	Default estimation of Reg-ARIMA model

(Note 1) The seasonally adjusted indices are revised every year when the December result for Japan is compiled. For example, when the December 2016 result for Japan is created, the seasonal indices from January 2010 to December 2016 will be calculated with "span = (2010.1, 2016.12)," as well as the estimated seasonal indices from January to December 2017. Based on the seasonal indices calculated here, the seasonally adjusted indices from January 2010 to December 2016 will be recalculated. The seasonally adjusted indices from January to November 2017 (to preliminary figure in December for the Ku-area of Tokyo) given by the estimated seasonal indices calculated here are the first published figures.

(Note 2) The "original series before rounding off the fraction" is divided by the "(estimated) seasonal index before rounding the fraction" to calculate the seasonally adjusted indices for the 2015-base CPIs.

2 ARIMA model setting and prior adjustment of outliers

The table below shows the ARIMA model and prior adjustment of outliers for each grouping.

(1) Japan

Group	After the release of the December 2016 result for Japan		(Reference) Before the release of the December 2016 result for Japan	
	ARIMA model (p d q)(P D Q)	Outlier setting	ARIMA model (p d q)(P D Q)	Outlier setting
All items	(0 1 1)(1 1 1)	LS2014.4	(0 1 1)(1 0 1)	LS2014.4
All items, less imputed rent				
All items, less fresh food	(1 1 0)(0 1 1)	LS2014.4		
All items, less imputed rent and fresh food				
All items, less food (less alcoholic beverages) and energy			(2 1 2)(2 0 2)	LS2014.4
Goods	(1 1 0)(0 1 2)	LS2014.4	(1 1 0)(1 1 1)	LS2014.4
Goods, less fresh food	(2 1 0)(0 1 1)	LS2014.4	(0 1 1)(0 1 1)	LS2014.4
Semi-durable goods	(0 1 0)(1 1 0)	LS2014.4	(0 1 0)(1 1 0)	LS2014.4 LS2015.1

(2) Ku-area of Tokyo

Group	After the release of the January 2017 result for the Ku-area of Tokyo		(Reference) Before the release of the December 2016 result for the Ku-area of Tokyo	
	ARIMA model (p d q)(P D Q)	Outlier setting	ARIMA model (p d q)(P D Q)	Outlier setting
All items	(0 1 0)(0 1 1)	LS2014.4	(0 1 0)(0 1 1)	LS2014.4
All items, less imputed rent				
Goods				
All items, less fresh food	(2 1 2)(0 1 1)	LS2014.4	(2 1 2)(0 1 1)	LS2014.4
All items, less imputed rent and fresh food				
Goods, less fresh food				
All items, less food (less alcoholic beverages) and energy	(2 1 2)(1 1 0)	LS2014.4	(2 1 1)(0 1 2)	LS2014.4
Semi-durable goods	(0 1 1)(0 1 1)	LS2014.4	(0 1 2)(0 1 1)	LS2014.4 LS2015.1

On the release of the December 2016 result for Japan, ARIMA model is reselected by following steps with the data from January 2010 to November 2016 (to preliminary figure in December 2016 for the Ku-area of Tokyo).

ARIMA models which combine (0 to 2 1 0 to 2)(0 to 2 1 0 to 2) were compared with

using AIC to select the ARIMA model which has smallest AIC. In addition to that, nonseasonal-AR, MA and seasonal-AR, MA were verified by statistical significance.

In terms of the impact of changes in the index level due to the consumption tax rate revised in April 2014, and the effect of linking both old and new indices whose weights are different because of the 2015-Base Revision of the Consumer Price Index in January 2015, LS2014.4 and LS2015.1 were verified by statistical significance as well. On the December 2016 revision, the former was still significant in all groupings but the latter was not significant in any grouping.

The seasonality of each grouping depends on the degree of effect of fresh food, whose price is considered to be affected by season and weather, clothes (semi-durable goods) whose price tends to drop as the change of season comes closer, and energy which is considered to be easily affected by the factors abroad, and the most appropriate model may also vary depending on the grouping.