METHODOLOGICAL NOTE:

Seasonal adjustment of food and beverages

April 2017 to March 2018

Methodological note on the seasonal adjustment of food and beverages

This document provides a brief explanation of the seasonal adjustment of food and beverages statistics.

Monthly and quarterly time series are often characterised by considerable seasonal variations, which might complicate their interpretation. Such time series are therefore subjected to a process of seasonal adjustment in order to remove the effects of these seasonal fluctuations.

Statistics South Africa (Stats SA) uses X-12-ARIMA to estimate trend, seasonal and irregular components as well as length of the month (LOM), trading day (TD) and Easter effects.

The time series for food and beverages show LOM, TD and Easter effects; and therefore adjustment was done for these effects as shown in Table 1. As can be seen in Table 1, some components were adjusted for TD without a leap year effect (TDNOLPYEAR) while others were adjusted for TD with a leap year effect (TD).

X-12-ARIMA is a seasonal adjustment program developed at the United States Bureau of Census. The program is based on the Bureau's X11 algorithm. It incorporates regression techniques and also ARIMA modelling to improve estimation of the different time series. The following periods were used to identify the parameters:

- August 2005 to March 2017 (for current prices)
- January 2008 to March 2017 (constant prices)

The identified parameters will be fixed for a period of one year and revised on an annual basis or as necessary.

Table 1 shows metadata for food and beverages subcomponents. For each component the following is given in the tables below: decomposition scheme, ARIMA model, presence of seasonality, Henderson and seasonal moving average filters, outliers and presence of TD, LOM and Easter effects.

The seasonal adjusted data of the subcomponents were used to derive the aggregates (totals) at both current and constant prices. The aggregates did not have residual

seasonality and calendar effects, except the aggregates of food and beverages income for catering services at both current and constant prices, which had a residual Easter effect.

Table 1: Metadata for food and beverages time series i.e. for both current and constant prices

Description	Start date	Decomposition scheme	ARIMA model	Presence of Seasonality	Presence of Easter	Presence of TD or LOM effect	Henderson Filter	Seasonal Moving Average Filter	Outliers (AO, LS, TC)*
Food sales at current prices - restaurants and bar sales	Aug05	Multiplicative	(0,1,1)(0,1,1)	Present	Easter(15)	TDNOLPYEAR	13	3x5	TCNOV2006 LSOCT2007 TCSEP2008 LS JAN2009 AOMAR2009 TC DEC2009 AO JUN2010
Bar sales at current prices - restaurants and coffee shops	Aug05	Multiplicative	(0,1,1)(0,1,1)	Present	Easter(1)	TDNOLPYEAR	13	3x5	AONOV2008 AOJUN2010 TCDEC2012
Other income at current prices - restaurants and coffee shops	Aug05	Multiplicative	(0,1,1)(0,1,1)	Present	Not Present	LOM	13	3x5	TCSEP2005 LSMAY2008 AOFEB2011 LSAPR2011 TCSEP2011
**Food sales at current prices - takeaway and fast-food outlets	Aug05	Multiplicative	(0,1,1)(0,1,1)	Present	Easter(15)	TDNOLPYEAR	9	3x5	AOSEP2006 AOMAR2008 TCDEC2008
Bar sales at current prices - takeaway and fast-food outlets	Aug05	Multiplicative	(3,1,1)(0,1,1)	Present	Easter(1)	TDNOLPYEAR	13	3x9	LSDEC2005 TCFEB2006 LS OCT2006 TC APR2009 LSSEP2009 LS AUG2013
Other income at current prices - takeaway and fast-food outlets	Aug05	Multiplicative	(0,1,1)(0,1,1)	Not Present	Not Present	TDNOLPYEAR	13	3x5	

Food sales at current prices - catering services	Aug05	Additive	(0,1,1)(0,1,1)	Present	Easter(1)	TD	13	3x5	TCJAN2009 AOMAR2009 LSJUL2009
Bar sales at current prices - catering services	Aug05	Multiplicative	(0,1,2)(0,1,1)	Present	Not Present	Not Present	13	3x9	LSJAN2008 LSAUG2012
Other income at current prices - catering services	Aug05	Multiplicative	(0,1,1)(0,1,1)	Present	Not Present	Not Present	13	3x5	LSNOV2005 AOMAY2008 LSJAN2009 LSSEP2009
Food sales at constant prices - restaurants and bar sales	Jan08	Multiplicative	(0,1,1)(0,1,1)	Present	Easter(15)	TDNOLPYEAR	13	3x5	AOSEP2008 LSAPR2009 AODEC2009 AOJUN2010
Bar sales at constant prices - restaurants and coffee shops	Jan08	Multiplicative	(1,0,1)(1,1,0)	Present	Easter(8)	TDNOLPYEAR	13	3x5	AONOV2008 AODEC2009 TCJUN2010 TCDEC2012 AODEC2013
Other income at constant prices - restaurants and coffee shops	Jan08	Multiplicative	(0,1,1)(0,1,1)	Present	Not Present	LOM	13	3x5	LSMAY2008 AOFEB2011 LSAPR2011 TCSEP2011
**Food sales at constant prices - takeaway and fast-food outlets	Jan08	Multiplicative	(0,1,1)(0,1,1)	Present	Easter(1)	TDNOLPYEAR	13	3x5	AOMAR2008 TCDEC2008
Bar sales at constant prices - takeaway and fast-food outlets	Jan08	Additive	(0,1,1)(0,1,1)	Present	Not Present	Not Present	13	3x9	LSSEP2009 AODEC2009 TCAUG2013

Other income at constant prices - takeaway and fast-food outlets	Jan08	Multiplicative	(0,1,1)(0,0,0)	Not Present	Not Present	TDNOLPYEAR	13	3x5	
Food sales at constant prices - catering services	Jan08	Multiplicative	(0,1,1)(0,1,1)	Present	Easter(1)	TDNOLPYEAR	13	3x5	TCJAN2009 AOMAR2009
Bar sales at constant prices - catering services	Jan08	Multiplicative	(0,1,1)(0,1,1)	Present	Not Present	Not Present	13	3x9	LSAUG2012
Other income at constant prices - catering services	Jan08	Multiplicative	(0,1,1)(1,0,0)	Not Present	Not Present	Not Present	13	3x5	

* Note: Various economic reasons were provided for the existence of all outliers listed in the table above and hence no adjustment was done for them.
** Food sales at both current and constant prices (takeaway and fast-food outlets) were further adjusted for residual Easter (1) effects

Definitions:

Additive decomposition – An additive decomposition is appropriate if the magnitude of the seasonal fluctuations does not vary with the level of the series. Under the additive decomposition scheme, the original series (Y) is expressed as $Y = T + (TD + S) + I$, where T = trend, TD = trading day effect, S=seasonal component and I=irregular component.

Multiplicative decomposition – A multiplicative decomposition is usually appropriate for series of positive values where the size of the seasonal oscillations increases with the level of the series. The original series (Y) is expressed as $Y = T * (TD * S) * I$.

Additive Outlier (AO) – This refers to unusually high or low singular values in the time series.

Level Shift (LS) – This refers to an abrupt but sustained change in the level of the time series.

Transitory Changes (TC) – This refers to a series of outliers with transitory effects on the level of the series.

Easter effect – The Easter holidays may regularly affect economic activity before, during or after the holiday period. Unlike other public holidays which occur on the same date each year, the dates for Easter are not fixed and may occur in March or April. Such an effect, if it is present, is known as the Easter effect.

Trading day effect (TD) – An effect associated with the composition of the calendar. For example, different months have different numbers of working days and also the number of specific days of the week can occur in differing frequency in the same month over different years. Days of the week can have different levels of activity.

Length of month effect (LOM) – An effect arising from the fact that some months are longer than others e.g. 28, 29, 30 or 31 days.

Seasonal adjustment approaches – In seasonal adjustment, the direct approach refers to the adjustment of a total (aggregate of unadjusted components), and the indirect approach is the aggregation of seasonally adjusted components to obtain a total.

Trend component – An estimate of the local level of the series derived from the surrounding recent (a year or two) observations. The trend is generally fairly smooth and includes movements and cycles longer than a year.

Seasonal component – An estimate of effects that are reasonably stable in terms of annual timing, direction and magnitude. Possible causes include natural factors (the weather), administrative measures (starting and ending dates of the school year), and social/cultural/religious traditions (fixed holidays such as Christmas).

Irregular component – An estimate of any effect not included in the trend-cycle or the seasonal effects (or in estimated trading day or holiday effects). Its values are unpredictable with regard to timing, impact and duration. It can arise from sampling error, non-sampling error, unseasonal weather patterns, natural disasters, strikes, etc.

Parameters – This refers to the decomposition scheme, ARIMA model, seasonal moving average and Henderson filters, outliers and trading day, Easter and length of month regressors.