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METHODOLOGICAL NOTE:

Seasonal adjustment of food and beverages

Methodological note on the seasonal adjustment of food and beverages

This document provides a brief explanation of the seasonal adjustment of food and beverages, at both current and constant prices.

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-month or length-of-quarter, trading day, leap year and Easter effects.

X-12-ARIMA is a seasonal adjustment program developed at the United States Census Bureau. It incorporates regression techniques and also ARIMA modelling to improve estimation of the different time series components. Further information is available at the following link: <https://www.census.gov/topics/research/seasonal-adjustment.html>.

Indirect seasonal adjustment was applied for total food and beverages statistics while the direct approach was adopted for the three main components. The period from August 2005 to March 2021 was used to identify the parameters.

The parameters will be revised every one year to two years, or as necessary.

Table 1 below shows metadata for the individual components for food and beverages statistics at both constant and current prices. For each component the following are given in the table below: decomposition scheme, ARIMA model, presence of seasonality, Easter, length-of-month and trading effects, Henderson and seasonal moving average filters, and outliers.

Table 1: Metadata for food and beverages statistics for the period August 2005 to March 2021

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)
Restaurants and coffee shops – sales at current prices									
Food sales	Aug05	Multiplicative	(0,1,1)(0,1,1)	Present	Not Present	Not Present	13	3x5	AO01APR2020D AO01MAY2020D AO01JUN2020D AO01JUL2020D AO01AUG2020D AO01SEP2020D AO01OCT2020D AO01NOV2020D AO01DEC2020D AO01JAN2021D AO01FEB2021D AO01MAR2021D AOMAR2020
Bar sales	Aug05	Multiplicative	(0,1,1)(0,1,1)	Present	Not Present	Not Present	23	3x5	AO01APR2020D AO01MAY2020D AO01JUN2020D AO01JUL2020D AO01AUG2020D AO01SEP2020D AO01OCT2020D AO01NOV2020D AO01DEC2020D AO01JAN2021D AO01FEB2021D TCJUN2006 LSMAR2007 TCJUN2008 AONOV2008 AODEC2009 TCJUN2010 AODEC2012 AOMAR2020
Other income	Aug05	Multiplicative	(0,1,1)(0,1,1)	Present	Not Present	Not Present	13	3x5	AO01APR2020D AO01MAY2020D AO01JUN2020D AO01JUL2020D AO01AUG2020D AO01SEP2020D AO01OCT2020D AO01NOV2020D AO01DEC2020D AO01JAN2021D AO01FEB2021D AO01MAR2021D LSMAY2008

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)
Takeaway and fast-food outlets – sales at current prices									
Food sales	Aug05	Multiplicative	(2,1,0)(1,1,1)	Present	Easter(8)	TDNOLPYEAR	13	3x5	AO01APR2020D AO01MAY2020D AO01JUN2020D AO01JUL2020D AO01AUG2020D AO01SEP2020D AO01OCT2020D AO01NOV2020D AO01DEC2020D AO01JAN2021D AO01FEB2021D AO01MAR2021D AOSEP2006 AOMAR2008 TCDEC2008 LSMAR2020
Bar sales	Aug05	Multiplicative	(0,1,1)(0,1,1)	Present	Not Present	Not Present	13	3x5	AO01APR2020D AO01MAY2020D AO01JUN2020D AO01JUL2020D AO01AUG2020D AO01SEP2020D AO01OCT2020D AO01NOV2020D AO01DEC2020D AO01JAN2021D AO01FEB2021D AO01MAR2021D LSNOV2005 TCFEB2006 LSOCT2006 TCOCT2007 TCAPR2009 TCJUN2009 LSSEP2009 AODEC2009 TCJUN2012 TCAUG2013 TCAPR2019 LSMAR2020
Other income	Aug05	Multiplicative	(0,1,2)(0,0,0)	Not Present	EASTER(8)	Not Present	13	3x5	

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)
Catering services – sales at current prices									
Food sales	Aug05	Multiplicative	(0,1,1)(0,1,1)	Present	Easter(1)	Not Present	13	3x5	AO01APR2020D AO01MAY2020D AO01JUN2020D AO01JUL2020D AO01AUG2020D AO01SEP2020D AO01OCT2020D AO01NOV2020D AO01DEC2020D AO01JAN2021D AO01FEB2021D AO01MAR2021D AOJAN2009 AOMAR2009 LSJUL2009 AONOV2019 LSMAR2020
Bar sales	Aug05	Multiplicative	(0,1,1)(0,1,1)	Present	Not Present	Not Present	13	3x5	AO01APR2020D AO01MAY2020D AO01JUN2020D AO01JUL2020D AO01AUG2020D AO01SEP2020D AO01OCT2020D AO01NOV2020D AO01DEC2020D AO01JAN2021D AO01FEB2021D AO01MAR2021D AODEC2005 LSJAN2008 LSAUG2012 AODEC2019 LSMAR2020
Other income	Aug05	Multiplicative	(0,1,1)(0,1,1)	Present	Not Present	Not Present	13	3x5	AO01APR2020D O01MAY2020D AO01JUN2020D AO01JUL2020D AO01AUG2020D AO01SEP2020D AO01OCT2020D AO01NOV2020D AO01DEC2020D AO01JAN2021D AO01FEB2021D AO01MAR2021D LSNOV2005 AOMAY2008 LSJAN2009 LSSEP2009 LSMAR2020

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)
Restaurants and coffee shops – sales at constant prices									
Food sales	Jan08	Multiplicative	(0,1,1)(0,1,1)	Present	Not Present	TDNOLPYEAR	13	3x5	AO01APR2020D AO01MAY2020D AO01JUN2020D AO01JUL2020D AO01AUG2020D AO01SEP2020D AO01OCT2020D AO01NOV2020D AO01DEC2020D AO01JAN2021D AO01FEB2021D AO01MAR2021D LSDEC2008 LSAPR2009 AODEC2009 AOJUN2010 TCDEC2017 AOMAR2019 LSMAR2020
Bar sales	Jan08	Multiplicative	(0,1,1)(0,1,1)	Present	Not Present	Not Present	13	3x5	AO01APR2020D AO01MAY2020D AO01JUN2020D AO01JUL2020D AO01AUG2020D AO01SEP2020D AO01OCT2020D AO01NOV2020D AO01DEC2020D AO01JAN2021D AO01FEB2021D AO01MAR2021D TCAPR2009 TCJUN2009 LSSEP2009 AODEC2009 TCJUN2012 TCAUG2013 TCAPR2019 AOMAR2020
Other income	Jan08	Multiplicative	(0,1,1)(0,1,1)	Present	Not Present	Not Present	13	3x5	AO01APR2020D AO01MAY2020D AO01JUN2020D AO01JUL2020D AO01AUG2020D AO01SEP2020D AO01OCT2020D AO01NOV2020D AO01DEC2020D AO01JAN2021D AO01FEB2021D AO01MAR2021D LSMAY2008 TCSEP2011

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)
Takeaway and fast-food outlets – sales at constant prices									
Food sales	Jan08	Multiplicative	(3,0,0)(0,1,1)	Present	Not Present	Not Present	23	3x5	AO01APR2020D AO01MAY2020D AO01JUN2020D AO01JUL2020D AO01AUG2020D AO01SEP2020D AO01OCT2020D AO01NOV2020D AO01DEC2020D AO01JAN2021D AO01FEB2021D AO01MAR2021D AOMAR2008 TCDEC2008 AOMAR2020
Bar sales	Jan08	Multiplicative	(0,1,1)(0,1,1)	Present	Not Present	Not Present	13	3x5	AO01APR2020D AO01MAY2020D AO01JUN2020D AO01JUL2020D AO01AUG2020D AO01SEP2020D AO01OCT2020D AO01NOV2020D AO01DEC2020D AO01JAN2021D AO01FEB2021D AO01MAR2021D TCAPR2009 TCJUN2009 LSSEP2009 AODEC2009 TCJUN2012 TCAUG2013 TCAPR2019 AOMAR2020
Other income	Jan08	Multiplicative	(0,1,1)(0,1,1)	Not Present	Not Present	Not Present	13	3x5	

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)
Catering services – sales at constant prices									
Food sales	Jan08	Multiplicative	(0,1,1)(0,1,1)	Present	Easter(1)	Not Present	13	3x5	AO01APR2020D AO01MAY2020D AO01JUN2020D AO01JUL2020D AO01AUG2020D AO01SEP2020D AO01OCT2020D AO01NOV2020D AO01DEC2020D AO01JAN2021D AO01FEB2021D AO01MAR2021D LSAPR2008 TCDEC2008 TCJAN2009 AOMAR2009 LSJUL2009 LSAPR2010 TCNOV2013 AONOV2019 LSJAN2020 LSMAR2020
Bar sales	Jan08	Multiplicative	(0,1,1)(0,1,1)	Present	Not Present	Not Present	13	3x9	AO01APR2020D AO01MAY2020D AO01JUN2020D AO01JUL2020D AO01AUG2020D AO01SEP2020D AO01OCT2020D AO01NOV2020D AO01DEC2020D AO01JAN2021D AO01FEB2021D AO01MAR2021D LSOCT2008 LSDEC2009 LSAUG2012 LSAUG2013 LSJUN2014 LSAPR2017 AODEC2019 AOMAR2020
Other income	Jan08	Multiplicative	(0,1,1)(0,1,1)	Present	Not Present	Not Present	13	3x5	AO01APR2020D AO01MAY2020D AO01JUN2020D AO01JUL2020D AO01AUG2020D AO01SEP2020D AO01OCT2020D AO01NOV2020D AO01DEC2020D AO01JAN2021D AO01FEB2021D AO01MAR2021D AOMAY2008 LSSEP2008 LSJAN2009 LSSEP2009 AOMAR2020

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.