METHODOLOGICAL NOTE:

Seasonal adjustment of retail trade sales

February 2016 to January 2017

Methodological note on the seasonal adjustment of retail trade sales

This document provides a brief explanation of the seasonal adjustment of retail trade sales.

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 trading day (TD), length-of-month (LOM) and Easter effects.

The time series for retail trade sales at current and constant prices were adjusted as shown in Table 1 below.

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 components. The span used in identifying the parameters for retail trade sales is January 2002 to February 2016.

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

Tables 1 below shows metadata for retail trade sales. For each component (both current and constant prices) the following is given in the tables below: decomposition scheme, ARIMA model, presence of seasonality, Henderson and seasonal moving average filters, outliers, presence of trading day and Easter effects.

Table 1: Metadata for retail trade sales (January 2002 to February 2016)

Component	Decomposition scheme	ARIMA model	Presence of seasonality	Henderson filter	Seasonal moving average filter	Outliers (AO, TC, LS)	Presence of TD or LOM effect	Presence of Easter effect
Retail trade sales (at current prices)	Multiplicative	((3,1,1)(0,1,1))	Significant	13	3x5	None	LOM	Not significant
Retail trade sales (at constant prices)	Multiplicative	((2,1,0)(0,1,1))	Significant	13	3x5	None	LOM	Not significant

*Both components were further adjusted for residual TD.

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 + (K + S) + I, where T = trend, K = Calendar 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 * (K * 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 – 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 – 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.