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METHODOLOGICAL NOTE:

Seasonal adjustment of motor trade sales

August 2017 to July 2018

Methodological note on the seasonal adjustment of motor trade sales

This document provides a brief explanation of the seasonal adjustment of motor 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 length of month (LOM), trading day (TD) and Easter effects.

The time series for motor trade sales shows TD and Easter effects. 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.

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:

- January 1998 to May 2005 (direct seasonal adjustment was applied to the total only),
- June 2005 to July 2017 (indirect seasonal adjustment was applied by adjusting the subcomponents and then aggregating them to the total).

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

Table 1 shows metadata for motor trade sales components. 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.

Table 1: Metadata for the motor trade sales time series (June 2005 to June 2017)

Description	Decomposition scheme	ARIMA model	Presence of seasonality	Presence of Easter effect	Presence of TD or LOM effect	Henderson Filter	Seasonal Movement Average Filter	Outliers (AO, LS, TC)*
Sales of accessories	Multiplicative	(0,1,1)(0,1,1)	Present	Easter(1)	TDNOLPYEAR	13	3x5	AOMAR2006
Convenience store sales	Additive	(1,1,2)(0,1,1)	Present	Easter(8)	TD	13	3x5	AOJUN2005 TCNOV2006 AOJAN2008 LSAPR2008 AONOV2008 LSJAN2009 LSAPR2015
Fuel sales	Additive	(0,1,1)(0,1,1)	Present	Not Present	Not Present	13	3x5	AOMAR2015
New vehicle sales	Additive	(1,1,0)(0,1,1)	Present	Easter(1)	TD	13	3x5	
Used vehicle sales	Additive	(0,1,1)(1,1,1)	Present	Easter(1)	TD	13	3x5	
Workshop income	Additive	(0,1,1)(0,1,1)	Present	Easter(1)	TD	13	3x5	TCSEP2006

* 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.

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.