STATS SA
STATISTICS SOUTH AFRICA

METHODOLOGICAL NOTE:

Seasonal adjustment of quarterly financial statistics for municipalities

December 2016 to September 2017

Methodological note for the seasonal adjustment of quarterly financial statistics for municipalities

This document provides a brief explanation of the seasonal adjustment of quarterly financial statistics for municipalities. Monthly and quarterly time series are often characterised by considerable seasonal variation, which may 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) or length of quarter (LOQ), trading day (TD) and Easter effects.

The time series for quarterly financial statistics for municipalities did not show any calendar effects, except Purchases and Sales of electricity which showed the presence of TD without a leap year effect (TDNOLPYEAR). Adjustment was done for these effects as shown in Table 1.

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 quarterly financial statistics for municipalities was September 2007 to September 2016. Direct seasonal adjustment method was applied. 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 the quarterly financial statistics for municipalities. For each variable the following is given in the table below: decomposition scheme, ARIMA model, presence of seasonality, Henderson and Seasonal moving average filters; outliers and presence of TD, LOQ and Easter effects.

Table 1: Metadata for quarterly financial statistics for municipalities (September 2007 to September 2016)

Variable	Decomposition scheme	ARIMA model	Presence of seasonality	Presence of Easter effect	Presence of LOQ and TD effects	Henderson filter	Seasonal Moving Average filter	Outliers (AO, TC, LS) [1]
Purchases of electricity	Multiplicative	(1,0,1)(0,1,0)	Present	Not significant	TDNOLPYEAR	5	3x3	TC2008Q4
Purchases of water	Multiplicative	(1,1,2)(1,0,0)	Present	Not significant	Not significant	5	3x5	None
Sales of electricity	Multiplicative	(1,1,0)(0,1,0)	Present	Not significant	TDNOLPYEAR	5	3x5	None
Sales of water	Multiplicative	(2,1,0)(0,1,1)	Present	Not significant	Not significant	5	3x5	None

[1] Various economic reasons were provided for the existence of all outliers listed on 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 + (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 – Effects from holidays that are not always on the same day of a month. The most important moving holiday in South Africa is Easter since it can occur in March or April and at different periods of a month. These factors may consequently result in an increased level of shopping in weeks prior to or following Easter. Furthermore, this effect can give rise to monthly variations that may not reflect a true growth or fall in economic activity, but instead indicate a shift.

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 aggregated (totals) raw 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 regards 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.