



stats sa

Department:
Statistics South Africa
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METHODOLOGICAL NOTE:

Seasonal adjustment of retail trade sales

Dipalopalo tsa Aforikaborwa • Dipalopalo tsa Aforika Borwa • Ezazibalo zaseNingizimu Afrika • Tshitatistika Afrika Tshipembe • Tinkhlayo Afrika-Dzonga

Statistieke Suid-Afrika • Dipalopalo tša Aforika Borwa • Telubalo zaseNingizimu Afrika • EzeeNkcukacha maNani zoMzantsi Afrika • Iimbalobalo zeSewula Afrika

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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 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. Further information is available at the following link:

<https://www.census.gov/topics/research/seasonal-adjustment.html>.

The span for the retail trade sales series used in identifying the parameters was split into two intervals:

- January 2002 to December 2011; and
- January 2012 to July 2022.

For retail trade sales at constant 2019 prices:

- direct seasonal adjustment was applied to the total only for the period January 2002 to December 2007; and
- indirect seasonal adjustment was applied by seasonally adjusting the components and then aggregating them to the total from January 2008 onwards.

For retail trade sales at current prices:

- direct seasonal adjustment was applied to the total only for the period January 2002 to August 2004; and
- indirect seasonal adjustment was applied by seasonally adjusting the components and then aggregating them to the total from September 2004 onwards.

Adjustments for Black Friday and Cyber Monday were made from January 2012 onwards.

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

Table 1 shows metadata for the individual components for retail trade sales. 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 retail trade sales time series at current and constant prices for the period January 2002 to July 2022

	Decomposition scheme	ARIMA model	Presence of seasonality	Presence of Easter effect	Presence of length-of-month and trading day effects	Henderson filter	Seasonal moving average filter	Outliers (AO, TC, LS)
Total retail trade (sales at constant prices)	Multiplicative	(3,1,1)(0,1,1)	Present	Not significant	Not present	13	3x5	AO APR2020 TC APR2020 TC JUL2021
General dealers (sales at constant prices)	Multiplicative	(0,1,1)(0,1,0)	Present	Easter(15)	Not present	13	3x3	AO MAR2020 AO APR2020 AO JUN2021
Food, beverages and tobacco in specialised stores (sales at constant prices)	Multiplicative	(0,1,1)(0,1,1)	Present	Easter(15)	Not present	23	3x5	TC APR2020 AO JAN2021 AO JUL2021
Pharmaceuticals and medical goods, cosmetics and toiletries (sales at constant prices)	Multiplicative	(0,1,1)(0,1,1)	Present	Not present	Not present	13	3x5	AO FEB2008 LS FEB2010 AO MAR2020 AO APR2020 TC SEP2020
Textiles, clothing, footwear and leather goods (sales at constant prices)	Multiplicative	(0,1,1)(1,1,1)	Present	Easter(15)	TDNOLPYEAR	13	3x5	AO MAR2020 AO APR2020
Household furniture, appliances and equipment (sales at constant prices)	Multiplicative	(0,1,1)(1,1,1)	Present	Not present	Not present	13	3x5	AO MAR2020 AO APR2020 AO MAY2020 TC MAY2020
Hardware, paint and glass (sales at constant prices)	Multiplicative	(0,1,1)(0,1,1)	Present	Not present	LPYEAR	13	3x5	AO APR2020
All other retailers (sales at constant prices)	Multiplicative	(0,1,1)(0,1,1)	Present	Easter(1)	LPYEAR	13	3x5	AO APR2020 TC APR2020

	Decomposition scheme	ARIMA model	Presence of seasonality	Presence of Easter effect	Presence of length-of-month and trading day effects	Henderson filter	Seasonal moving average filter	Outliers (AO, TC, LS)
Total retail trade (sales at current prices)	Multiplicative	(3,1,1)(0,1,1)	Present	Not present	Not present	13	3x5	TC JAN2004 AO APR2020 TC APR2020 TC JUL2021
General dealers (sales at current prices)	Multiplicative	(3,1,1)(0,1,0)	Present	Easter(1)	Not present	9	3x3	AO MAR2020 TC APR2020 AO JUN2021
Food, beverages and tobacco in specialised stores (sales at current prices)	Multiplicative	(0,1,1)(0,1,1)	Present	Not present	Not present	13	3x5	TC APR2020 AO JAN2021 AO JUL2021
Pharmaceuticals and medical goods, cosmetics and toiletries (sales at current prices)	Multiplicative	(0,1,1)(0,1,1)	Present	Not present	Not present	13	3x3	TC APR2005 TC SEP2005 AO JUN2006 AO SEP2007 AO FEB2008 AO MAR2020 AO APR2020 TC SEP2020 AO JAN2021
Textiles, clothing, footwear and leather goods (sales at current prices)	Multiplicative	(0,1,1)(1,1,1)	Present	Easter(15)	TDNOLPYEAR	13	3x5	AO MAR2020 AO APR2020
Household furniture, appliances and equipment (sales at current prices)	Multiplicative	(0,1,1)(1,1,1)	Present	Not present	Not present	13	3x5	LS JUN2007 AO MAR2020 TC MAR2020 AO APR2020 AO MAY2020
Hardware, paint and glass (sales at current prices)	Multiplicative	(0,1,1)(0,1,1)	Present	Easter(1)	Not present	13	3x5	AO APR2020
All other retailers (sales at current prices)	Multiplicative	(2,1,0)(0,1,1)	Present	Easter(1)	LPYEAR	13	3x5	AO SEP2005 AO APR2020 TC MAY2020 TC JUL2021

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.