stats sa

Department:
Statistics South Africa
REPUBLIC OF SOUTH AFRICA

METHODOLOGICAL NOTE:

Seasonal adjustment of mining production and sales

Methodological note on the seasonal adjustment of mining production and sales

This document provides a brief explanation of the seasonal adjustment of mining production and 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 components. Further information is available at the following link: https://www.census.gov/topics/research/seasonal-adjustment.html.

The period from January 2003 to March 2021 was used to identify the parameters.

For **mining production,** from January 2003 to December 2014, direct seasonal adjustment was applied for the mineral groups and minerals and total mining. For January 2015 onwards, indirect seasonal adjustment was applied for total mining, while the direct approach was adopted for the mineral groups and minerals.

For **mineral sales**, from January 2003 onwards, direct seasonal adjustment was applied for total mineral sales.

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

Tables 1 and 2 below show metadata for the individual components for mining production and sales, respectively. 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 mining production for the period January 2003 to March 2021

Component	Decomposition scheme	ARIMA model	Presence of seasonality	Presence of Easter effect	Presence of length-of-month and trading day effects	Henderson filter	Seasonal movement average filter	Outliers (AO,LS,TC)
Total mining production	Multiplicative	(1,0,1)(0,1,1)	Present	Easter(1)	Not significant	13	3x5	AOOCT2012 AOMAR2020 TCAPR2020
Gold	Multiplicative	(0,1,1)(0,1,1)	Present	Not significant	Not significant	13	3x5	TCOCT2012 AOJAN2015 TCDEC2018 TCAPR2020 AOJAN2021
Iron ore	Multiplicative	(0,1,1)(0,1,1)	Present	Not significant	Not significant	13	3x5	AOOCT2012 LSFEB2020 TCAPR2020
Chromium	Multiplicative	(0,1,1)(0,1,1)	Present	Not significant	TDNOLPYEAR	13	3x5	AOJUN2005 LSDEC2008 TCJAN2009 LSMAR2009 TCAPR2020
Copper	Multiplicative	(1,1,1)(0,0,0)	Not Present	Not significant	Not significant	13	3x5	None
Manganese ore	Multiplicative	(0,1,1)(0,1,1)	Present	Not significant	TDNOLPYEAR	13	3x5	LSJAN2009 LSNOV2015 TCDEC2019 TCAPR2020
PGMs	Multiplicative	(1,0,0)(0,1,1)	Present	Not significant	Not significant	23	3x5	AOJAN2003 AOFEB2012 TCMAR2014 TCMAY2014 TCAPR2020
Nickel	Multiplicative	(0,1,1)(0,1,1)	Not Present	Not significant	Not significant	23	3x5	None
Other metallic minerals	Multiplicative	(0,1,1)(0,1,1)	Not Present	Not significant	Not significant	13	3x5	None
Diamonds	Multiplicative	(0,1,1)(0,1,1)	Not Present	Not significant	Not significant	23	3x5	None
Coal	Multiplicative	(1,0,1)(0,1,1)	Present	Easter(1)	TDNOLPYEAR LPYEAR	13	3x5	TCAPR2020
Building materials	Multiplicative	(0,1,1)(0,1,1)	Present	Easter(1)	TDNOLPYEAR	13	3x5	TCDEC2018 AOMAR2020 TCAPR2020 TCAPR2020
Other non-metallic minerals	Multiplicative	(0,1,1)(0,1,1)	Present	Not significant	TDNOLPYEAR	13	3x5	AOMAR2004 LSJUL2004 TCOCT2006 TCOCT2009 TCAPR2020

Mining: Production and sales

Table 2: Metadata for mineral sales at current prices for the period January 2003 to March 2021

Component	Decomposition scheme	ARIMA model	Presence of seasonality	Presence of Easter effect	Presence of length-of-month and trading day effects	Henderson filter	Seasonal movement average filter	Outliers (AO,LS,TC)
Total mineral sales	Multiplicative	(0,1,1)(0,1,1)	Present	Not significant	Not significant	13	3x5	LSDEC2008 TCAPR2020

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.

Mining: Production and sales