Excluding the effect of the general trend
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There are two cases for excluding the effect of the general trend, which are:

First: Excluding the effect of the general trend in the case of data governed by a multiplicative model: استبعاد اثر الاتجاه العام في حالة البيانات يحكمها نموذج ضربي

The effect of the general trend is excluded in this case by dividing the value of the original phenomenon by the trend value of the phenomenon, which is the theoretical value calculated for the time series. Thus, we obtain the original values attributed to their trend values. When this percentage is multiplied by one hundred, we obtain the percentages of the original values attributed to their trend values, i.e.:

$$y^* = \frac{y}{\hat{y}} \times 100$$

Where: y^*: represents a percentage of the value of the phenomenon, excluding the effect of the general trend.

يتم استبعاد اثر الاتجاه العام في هذه الحالة بقسمة قيمة الظاهرة الاصلية على القيمة الاتجاهية للظاهرة وهي القيمة النظرية المحسوبة للسلسلة الزمنية وبذلك نحصل على القيم الاصلية منسوبة الى قيمها الاتجاهية وعندما تضرب هذه النسبة في مئة نحصل على النسب المئوية للقيم الاصلية منسوبة ال قيمها الاتجاهية

Example: If you have the following time series data, you are required to find the equation of the trend line using the least squares method and then eliminate the effect of the general trend, assuming that the data is governed by a multiplicative model.

Years	y	t	t*y	t^2	$\hat{y}$	$y^* = \frac{y}{\hat{y}} \times 100$
1980	10.0	-4	-40.0	16	10.134	98.678 %
81	12.7	-3	-38.1	9	11.006	115.392 %
82	12.4	-2	-24.8	4	11.878	104.395 %
83	11.9	-1	-11.9	1	12.750	93.333 %
84	12.5	0	0.0	0	13.622	91.763 %
85	13.0	1	13.0	1	14.494	89.692 %
86	14.9	2	29.8	4	15.366	96.967 %
87	16.5	3	49.5	9	16.238	101.613 %
88	18.7	4	74.8	16	17.110	109.293 %
Sum	$\sum_{i=1}^{n} y_i = 122.6$	$\sum_{i=1}^{n} t_i = 0$	$\sum_{i=1}^{n} y_i t_i = 52.3$	$\sum_{i=1}^{n} t_i^2 = 60$		

$$\hat{y} = \hat{a} + \hat{b}t$$

$$\hat{a} = \frac{\sum_{i=1}^{n} y_i}{n} = \frac{122.6}{9} = 13.622$$

$$\hat{b} = \frac{\sum_{i=1}^{n} y_i t_i}{\sum_{i=1}^{n} t_i^2} = \frac{52.3}{60} = 0.872$$

$$\hat{y}_i = 13.622 + 0.872t$$

$$\hat{y}_1 = 13.622 + 0.872(-4) = 10.134$$

$$\hat{y}_2 = 13.622 + 0.872(-3) = 11.006$$

Thus, the rest of the directional values are calculated until reaching the ninth value.

$$\hat{y}_9 = 13.622 + 0.872(4) = 17.110$$

The values from which the general trend is excluded are calculated as follows:

$$\boldsymbol{y_1^* = \frac{y_1}{\hat{y}_1} \times 100 = \frac{10}{10.134} \times 100 = 98.678\%}$$

$$\boldsymbol{y_2^* = \frac{y_2}{\hat{y}_2} \times 100 = \frac{12.7}{11.006} \times 100 = 115.392\%}$$

Thus, the rest of the values are calculated until reaching the ninth value.

$$\boldsymbol{y_9^* = \frac{y_9}{\hat{y}_9} \times 100 = \frac{18.7}{17.11} \times 100 = 109.293\%}$$

<u>Second:</u> Excluding the effect of the general trend in the case of data governed by a collective model: **استبعاد اثر الاتجاه العام في حالة البيانات يحكمها نموذج جمعي**

The value of the phenomenon can be found stripped of the effect of the general trend in the case of data governed by a collective model by subtracting the effect of the general trend from the value of the phenomenon, where

The value of the phenomenon = the effect of the general trend + the effect of seasonal changes + the effect of cyclical changes + the effect of random changes.

Accordingly, the value of the phenomenon stripped of the effect of the general trend is calculated as follows:

$$y^* = y - \hat{y}$$

This can be illustrated by taking the previous example in the case of the multiplication model, assuming that the time series model used is the addition model as follows:

Years	y	t	t*y	t^2	$\hat{y}$	$y^* = y - \hat{y}$
1980	10.0	-4	-40.0	16	10.134	-0.134
81	12.7	-3	-38.1	9	11.006	1.694
82	12.4	-2	-24.8	4	11.878	0.522
83	11.9	-1	-11.9	1	12.750	-0.85
84	12.5	0	0.0	0	13.622	-1.122
85	13.0	1	13.0	1	14.494	-1.494
86	14.9	2	29.8	4	15.366	-0.466
87	16.5	3	49.5	9	16.238	0.262
88	18.7	4	74.8	16	17.110	1.59
Sum	$\sum_{i=1}^{n} y_i = 122.6$	$\sum_{i=1}^{n} t_i = 0$	$\sum_{i=1}^{n} y_i t_i = 52.3$	$\sum_{i=1}^{n} t_i^2 = 60$		

$$\hat{y} = \hat{a} + \hat{b}t$$

$$\hat{a} = \frac{\sum_{i=1}^{n} y_i}{n} = \frac{122.6}{9} = 13.622$$

$$\hat{b} = \frac{\sum_{i=1}^{n} y_i t_i}{\sum_{i=1}^{n} t_i^2} = \frac{52.3}{60} = 0.872$$

$$\hat{y}_i = 13.622 + 0.872t$$

$$\hat{y}_1 = 13.622 + 0.872(-4) = 10.134$$

$$\hat{y}_2 = 13.622 + 0.872(-3) = 11.006$$

Thus, the rest of the directional values are calculated until reaching the ninth value.

$$\hat{y}_9 = 13.622 + 0.872(4) = 17.110$$

The values from which the general trend is excluded are calculated as follows:

$$\boldsymbol{y_1^* = y_1 - \hat{y}_1 = 10 - 10.134 = -0.134}$$

$$\boldsymbol{y_2^* = y_2 - \hat{y}_2 = 12.7 - 11.006 = 1.694}$$

Thus, the rest of the values are calculated until reaching the ninth value.

$$\boldsymbol{y_9^* = y_9 - \hat{y}_9 = 18.7 - 17.11 = 1.59}$$