26.03.2021

# ZAMAN SERİLERİ ANALİZİ

## ÇİFTLİ HAREKETLİ ORTALAMA

yılı çift zamana bölerek yapılan ortalamadır. 2, 4, 6, 8... gibi

$$x^*_{t+0.5} = \frac{\sum_{j=-s/2+1}^{s/2} x_{t+j}}{s} \qquad (t = s/2, \dots n-s/2)$$

$$x^*_t = \frac{x^*_{t-0.5} + x^*_{t+0.5}}{2} \qquad (t = s/2+1, \dots, n-s/2)$$

$s=4$ $n=7$ olduğunu varsayalım.

$$x^*_{t+0.5} = \frac{\sum_{j=-4/2+1}^{4/2} x_{t+j}}{4} = \frac{\sum_{j=-1}^{2} x_{t+j}}{4} = \frac{x_{t-1} + x_t + x_{t+1} + x_{t+2}}{4}$$

$x_{t-1} = x_1 \Rightarrow t-1=1 \quad t=2$ olmalı

$$x^*_{2,5} = \frac{\sum_{j=-1}^{2} x_{2+j}}{4} = \frac{x_1 + x_2 + x_3 + x_4}{4}$$

$$x^*_{3,5} = \frac{\sum_{j=-1}^{2} x_{3+j}}{4} = \frac{x_2 + x_3 + x_4 + x_5}{4}$$

$$x^*_{4,5} = \frac{\sum_{j=-1}^{2} x_{4+j}}{4} = \frac{x_3 + x_4 + x_5 + x_6}{4}$$

$$x^*_{5.5} = \frac{\sum_{j=-1}^{2} x_{5+j}}{4} = \frac{x_4 + x_5 + x_6 + x_7}{4}$$

$n=7$ olduğundan $x^*_{6,5}$'i hesaplayamayız

Çünkü $x^*_{6.5} = \frac{x_5 + x_6 + x_7 + x_8}{4}$ olur. $x_8$ verisi yok!

2

| | x | y | |
|---|---|---|---|
| 2019 | 1 | 3 | |
| | | 5 | |
| | 2 | | → 2.5 |
| | | 6 | → 4,75 |
| | 3 | | → 7 |
| | | 8 | → 7.25 |
| | 4 | | → 7.5 |
| 2020 | | 9 | → 7.5 |
| | 1 | | → 7.5 |
| | | 7 | → 7.125 |
| | 2 | | → 6.75 |
| | | 6 | → 6.625 |
| | 3 | | → 6.5 |
| | | 5 | → 6.75 |
| | 4 | | → 7 |
| 2021 | | 8 | → 7.5 |
| | 1 | | → 8 |
| | | 9 | → 8.75 |
| | 2 | | → 9.5 |
| | | 10 | |
| | 3 | | |
| | | 11 | |
| | 4 | | |

Varlıklar olsun burada $S=4$ $n=12$ olur.

$$x^*_{t+0.5} = \frac{\sum_{j=-S/2+1}^{S/2} x_{t+j}}{S} = \frac{\sum_{j=-1}^{2} x_{t+j}}{4} = \frac{x_{t-1}+x_t+x_{t+1}+x_{t+2}}{4}$$

$t-1=1$ $t=2$ olur.

$$x^*_{2,5} = \frac{x_1+x_2+x_3+x_4}{4} \qquad x^*_{3,5} = \frac{x_2+x_3+x_4+x_5}{4}$$

$$x^*_{4,5} = \frac{x_3+x_4+x_5+x_6}{4} \qquad x^*_{5,5} = \frac{x_4+x_5+x_6+x_7}{4}$$

$$x^*_{6.5} = \frac{x_5+x_6+x_7+x_8}{4} \qquad x^*_{7,5} = \frac{x_6+x_7+x_8+x_9}{4}$$

$$x^*_{7,5} = \frac{x_7+x_8+x_9+x_{10}}{4} \qquad x^*_{8,5} = \frac{x_8+x_9+x_{10}+x_{11}}{4}$$

3

$$x^*_{9.5} = \frac{x_9 + x_{10} + x_{11} + x_{12}}{4}$$

$x^*_{2.5} = 2.5$ $x^*_{3.5} = 7$ $x^*_{4.5} = 7.5$ $x^*_{5.5} = 7.5$ $x^*_{6.5} = 6.75$

$x^*_{7.5} = 6.5$ $x^*_{8.5} = 7$ $x^*_{9.5} = 8$ $x^*_{10.5} = 9.5$

$$x^*_3 = \frac{x^*_{2.5} + x^*_{3.5}}{2} = \frac{9.5}{2} = 4.75 \qquad x^*_4 = \frac{x^*_{3.5} + x^*_{4.5}}{2} = 7.25$$

$$x^*_5 = \frac{x^*_{4.5} + x^*_{5.5}}{2} = \frac{7.5+7.5}{2} = 7.5 \qquad x^*_6 = \frac{x^*_{5.5} + x^*_{6.5}}{2} = \frac{7.5+6.75}{2} = 7.125$$

$$x^*_7 = \frac{x^*_{6.5} + x^*_{7.5}}{2} = \frac{6.75+6.5}{2} = 6.625 \qquad x^*_8 = \frac{x^*_{7.5} + x^*_{8.5}}{2} = \frac{6.5+7}{2} = 6.75$$

$$x^*_9 = \frac{x^*_{8.5} + x^*_{9.5}}{2} = \frac{7+8}{2} = \frac{15}{2} = 7.5$$

$$x^*_{10} = \frac{x^*_{9.5} + x^*_{10.5}}{2} = \frac{8+9.5}{2} = 8.75$$

x'ler y alınmalı

Bazı hareketli ortalama Tekli:

$$y'_t = \frac{y_{t-(s-1)/2} + \dots + y_{t-1} + y_t + y_{t+1} + \dots + y_{t+(s-1)/2}}{s}$$

Çiftli için

$$y'_t = \frac{\frac{1}{2}y_{t-s/2} + \dots + y_{t-1} + y_t + y_{t+1} + \dots + \frac{1}{2}y_{t+s/2}}{s}$$

Şeklinde de olabilir.

4

2019

1 ⟶ 5

2 ⟶ 8 → 8.333

3 ⟶ 12 → 10

$$y'_t = \frac{y_{t-\frac{(3-1)}{2}} + y_t + y_{t+1}}{3}$$

$$y'_t = \frac{y_{t-1} + y_t + y_{t+1}}{3}$$

2020

1 ⟶ 10 → 10.33

2 ⟶ 9 → 10

3 ⟶ 11 → 10.33

$t-1=1$ olmalı $t=2$ olmalı

$$y'_2 = \frac{y_1+y_2+y_3}{3} = 8.333$$

2021

1 ⟶ 11 → 11.66

2 ⟶ 13 → 11.33

3 ⟶ 10

$$y'_3 = \frac{y_2+y_3+y_4}{3} = 10$$

$$y'_4 = \frac{y_3+y_4+y_5}{3} = 10.33$$

$$y'_5 = \frac{y_4+y_5+y_6}{3} = 10$$

$$y'_6 = \frac{y_5+y_6+y_7}{3} = 10.33$$

$$y'_7 = \frac{y_6+y_7+y_8}{3} = 11.66$$

$$y'_8 = \frac{y_7+y_8+y_9}{3} = 11.33$$

2019

1 ⟶ 3

2 ⟶ 5

3 ⟶ 6

4 ⟶ 8

2020

1 ⟶ 9

2 ⟶ 7

3 ⟶ 6

4 ⟶ 5

2021

1 ⟶ 8

2 ⟶ 9

3 ⟶ 10

4 ⟶ 11

$$y'_t = \frac{\frac{1}{2}y_{t-\frac{5}{2}} + y_{t-2} + y_{t-1} + y_t + y_{t+1} + \cdots + \frac{1}{2}y_{t+\frac{5}{2}}}{5}$$

$$y'_t = \frac{\frac{1}{2}y_{t-2} + y_{t-1} + y_t + y_{t+1} + \frac{1}{2}y_{t+2}}{4}$$

5

$t-2=1 \quad t=3$

$$y_3' = \frac{\frac{1}{2}y_1 + y_2 + y_3 + y_4 + \frac{1}{2}y_5}{4} = 6.25$$

$$y_4' = \frac{\frac{1}{2}y_2 + y_3 + y_4 + y_5 + \frac{1}{2}y_6}{4} = 7.25$$

$$y_5' = \frac{\frac{1}{2}y_3 + y_4 + y_5 + y_6 + \frac{1}{2}y_7}{4} = 7.5$$

$$y_6' = \frac{\frac{1}{2}y_4 + y_5 + y_6 + y_7 + \frac{1}{2}y_8}{4} = 7.175$$

$Y/T \times 100$

1986
1 8.2
2 11.6 → 36.5 → 73.5 (9.187) → 101.2
3 9.3 → 37 → 74.8 (9.35) → 79.14
4 7.4 → 37.8 → 76.4 (955) → 91.099

1987
1 8.7 → 38.6 → 78.6 (9.825) → 126.2
2 12.4 → 40 → 80.4 (10.05) → 100.5
3 10.1 → 40.4 → 83 (10.375) → 84.8
4 8.8 → 42.6 → 86.2 (10.775) → 84.45

1988
1 9.1 → 43.6 → 87.1 (10.88) → 134.19
2 14.6 → 43.5 → 87.5 (10.93) → 101.55
3 11.1 → 44 → 88.8 (11.1) → 78.37
4 8.7 → 44.8 → 90.6 (11.325) → 84.76

1984
1 9.6 → 45.8 → 92 (11.5) → 133.9
2 15.4 → 46.2 → 93.6 (11.7) → 101.41
3 12.1 → 47.4 → 96 (12) → 75.83
4 9.1 → 48.6 → 98.2 (12.275) → 82.98

1990
1 10.8 → 49.6 → 100.5 (12.56) → 132.16
2 16.6 → 50.9
3 13.1
4 10.4

6

| | 1986 | 1987 | 1988 | 1989 | 1990 | Ard. ort. | Mev. İndeksi |
|---|---|---|---|---|---|---|---|
| 1. Dönem | | 91.099 | 84.45 | 84.76 | 87.98 | 87.07 | 87.09 |
| 2. Dönem | | 126.2 | 134.19 | 137.9 | 132.16 | 131.61 | 131.65 |
| 3. Dönem | 101.2 | 100.5 | 101.55 | 101.41 | | 101.66 | 101.69 |
| 4. Dönem | 79.14 | 84.8 | 78.37 | 75.83 | | 79.535 | 79.58 |
| | | | | | | 399.875 | 400.01 |

400 / 399.875 çarpanı ile Aritmetik ortalamalar çarpılarak

399.875 / 400

Sırasıyla 1.ci 2ci 3cü ve 4.dönemin mevsim indeksleri hesaplanır.

| | 1989 | MI | |
|---|---|---|---|
| 1 | 9.6 | 0.87 | 11.03 |
| 2 | 15.4 | 1.31 | 11.75 |
| 3 | 12.1 | 1.01 | 11.98 |
| 4 | 9.1 | 0.79 | 11.51 |

} mevsim etkisinden arındırılmış veriler.

$\frac{12.1}{15.4} = 0.785$ 3cü dönemde 2ci döneme göre 0.785 lik bir azalma var.

$\frac{11.9}{11.7} = 1.017$ 3cü dönemde 2ci döneme göre artma var. gerçeği yansıtmıyor.

7 Konjonktürü hesaplayalım.

$$K = \frac{y}{TM}$$

| | | | T | |
|---|---|---|---|---|
| 1 | 1. | 8.2 | 10.46 | A (5.5, 10.02) |
| 2 | 2 | 11.6 | 11.0372 | |
| 3 | 3 | 9.3 | 10.6531 | |
| 4 | 4 | 7.4 | 10.3358 | |
| 5 | 1 | 8.7 | 10.4694 | |
| 6 | 2 | 12.4 | 11.1 | |
| 7 | 3 | 10.1 | 10.78 | |
| 8 | 4 | 8.8 | 10.56 | |
| 9 | 1 | 9.1 | 10.61 | |
| 10 | 2 | 14.6 | 11.53 | |
| 11 | 3 | 11.1 | 10.95 | |
| 12 | 4 | 8.7 | 10.55 | |
| 13 | 1. | 9.6 | 10.7 | B (15.5, 11.69) |
| 14 | 2 | 15.4 | 11.67 | |
| 15 | 3 | 12.1 | 11.12 | |
| 16 | 4. | 9.1 | 10.61 | |
| 17 | 1. | 10.8 | 10,9 | |
| 18 | 2 | 16.6 | 11.8 | |
| 19 | 3 | 13,1 | 11.28 | |
| 20 | 4 | 10.4 | 10.83 | |

$\frac{10 \times 11}{2} = 55$

5.5

$\frac{210-55}{1}$

$\frac{20 \times 21}{2}$

$\frac{210-55}{155}$

$\frac{155}{10}$

$y - 10.02 = 0.167\,(x - 55)$

$y = 0.167x$

$m = \frac{1.67}{10} = 0.167$

$y - 10.2) = 0.167\,(x - 5.5)$

$y = 0.167x + 9.1$

$y =$

8

| x | y | T | M | $\frac{y}{T \times M} \times 10^4$ |
|---|---|---|---|---|
| 1 | 8.2 | 10.46 | 87.09 | 90.014 |
| 2 | 11.6 | 11.03 | 131.65 | 79.88 |
| 3 | 9.3 | 10.65 | 101.69 | 85.87 |
| 4 | 7.4 | 10.33 | 79.58 | 90.017 |
| 5 | 8.7 | 10.46 | 87.09 | 95.5 |
| 6 | 12.4 | 11.1 | 131.65 | 84.85 |
| 7 | 10.1 | 10.78 | 101.69 | 92.134 |
| 8 | 8.8 | 10.56 | 79.58 | 104.71 |
| 9 | 9.1 | 10.61 | 87.09 | 98.48 |
| 10 | 14.6 | 11.53 | 131.69 | 96.15 |
| 11 | 11.1 | 10.95 | 101.69 | 99.68 |
| 12 | 8.7 | 10.55 | 79.58 | 103.62 |
| 13 | 9.6 | 10.7 | 87.09 | 103.019 |
| 14 | 15.4 | 11.67 | 131.69 | 100.2 |
| 15 | 12.1 | 11.12 | 101.69 | 107.00 |
| 16 | 9.1 | 10.61 | 79.58 | 107.77 |
| 17 | 10.8 | 10.9 | 87.09 | 113.77 |
| 18 | 16.6 | 11.8 | 131.69 | 106.82 |
| 19 | 13.1 | 11.28 | 101.69 | 114.2 |
| 20 | 10.4 | 10.83 | 79.58 | 120.67 |