

## MENGHITUNG TREND SEKULER :

### 1. Metode Setengah Rata-rata (MSR), lebih sederhana perhitungannya, tapi pemakaiannya terbatas hanya untuk jumlah data tertentu (hanya jumlah genap).

1. Punya Data, pastikan jumlah data (n/2)-nya GENAP atau GANJIL.
2. Membandingkan RT1 dg RT2 → arah TREND SEKULER → NAIK (bila RT1<RT2) atau TURUN (bila RT1>RT2).
3. Pers.  $y = a_0 + b.X$  → menentukan TREND AWAL TAHUN → Forecasting/ramalan.
4. Dilengkapi dg Grafik yg terdiri atas 2 data (Data asli & data Trend Awal Tahun)

#### Metode Setengah Rata-rata menentukan Trend Sekuler ( n/2 genap )

No.	Tahun	Produksi	Semi Total	Setengah Rata-rata	Selisih Tahun X	Trend Awal Tahun
01	1993	3,179	ST1 : 60,937.00	Rt1 : 10,156.17	-3	2,061.17
02	1994	9,311			-2	4,759.50
03	1995	14,809			-1	7,457.83
04	1996	12,257			0	10,156.17
05	1997	10,238			1	12,854.50
06	1998	11,143			2	15,552.83
07	1999	23,732	ST2 : 158,077.00	Rt2 : 26,346.17	3	18,251.17
08	2000	23,986			4	20,949.50
09	2001	18,164			5	23,647.83
10	2002	26,670			6	26,346.17
11	2003	28,464			7	29,044.50
12	2004	37,061			8	31,742.83
DATA dari Survei			PENGOLAHAN DATA			

#### Analisa :

1 Bila  $Rt1 < Rt2$  maka Trend Sekuler "N A I K"

2 Menentukan Trend Awal Tahun : dg pers.  $Y = a_0 + b.X$

$$a_0 = Rt1 \text{ tahun dasar} \quad 10,156.17$$

$$b = (Rt2 - Rt1)/(n/2) \quad 2,698.33$$

$$X = \text{selisih tahun thd tahun dasar} \quad = \text{tahun} - 1996$$

$$\text{Misal : } TAT_{1999} = 10,156.17 + 2,698.33 \cdot (1999-1996) = \boxed{18,251.17}$$

#### Metode Setengah Rata-rata menentukan Trend Sekuler ( n/2 ganjil )

No.	Tahun	Produksi	Semi Total	Setengah Rata-rata	Selisih Tahun	Trend Awal Tahun
01	1993	3,179	ST1 : 49,794.00	Rt1 : 9,958.80	-2.5	4,568.70
02	1994	9,311			-1.5	6,724.74
03	1995	14,809			-0.5	8,880.78
04	1996	12,257			0.5	11,036.82
05	1997	10,238			1.5	13,192.86
06	1998	11,143	ST2 : 103,695.00	Rt2 : 20,739.00	2.5	15,348.90
07	1999	23,732			3.5	17,504.94
08	2000	23,986			4.5	19,660.98
09	2001	18,164			5.5	21,817.02
10	2002	26,670			6.5	23,973.06
DATA			PENGOLAHAN DATA			

#### Analisa :

TAT --> Forecasting/meramal

1 Bila  $Rt1 < Rt2$  maka Trend Sekuler "N A I K"

2 Menentukan Trend Awal Tahun : dg pers.  $Y = a_0 + b.X$

Produksi 2005 ?

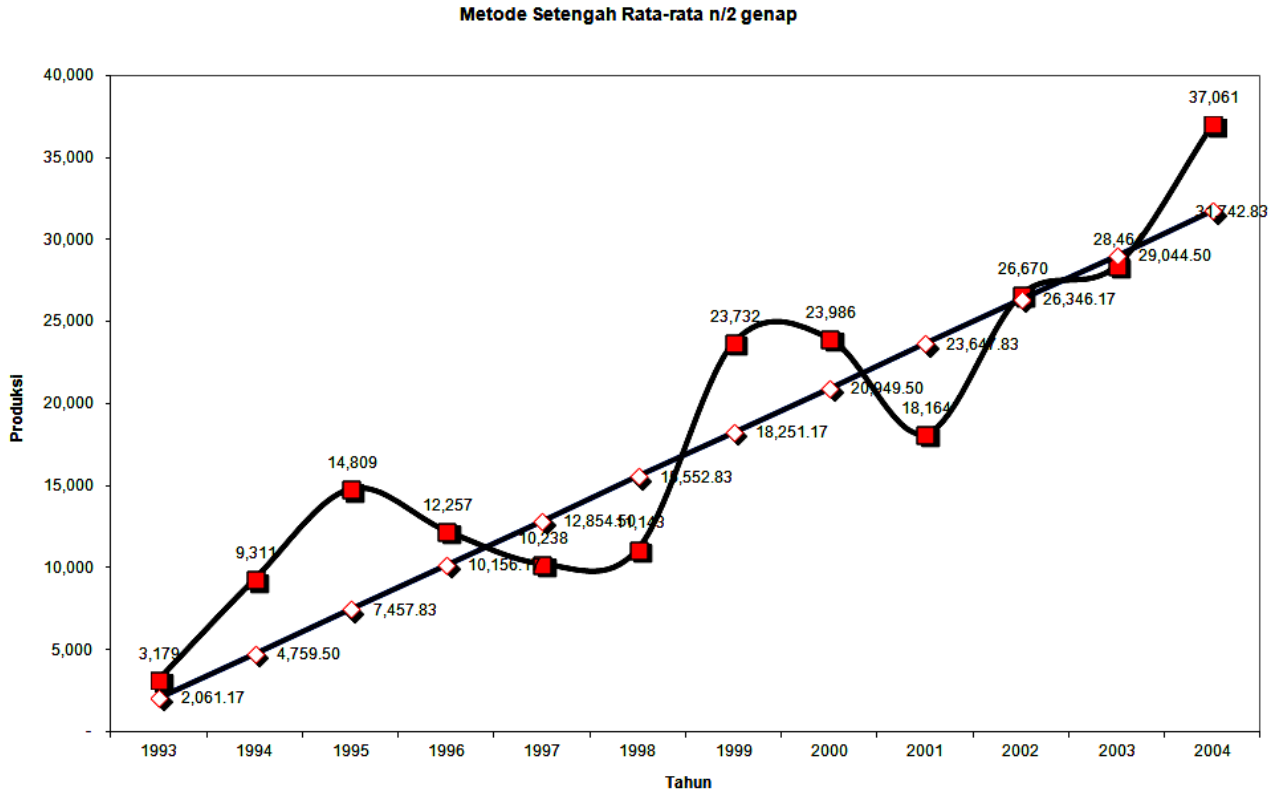
$$a_0 = Rt1 \text{ tahun dasar} \quad 9,958.80$$

$$b = (Rt2 - Rt1)/(n/2) \quad 2,156.04$$

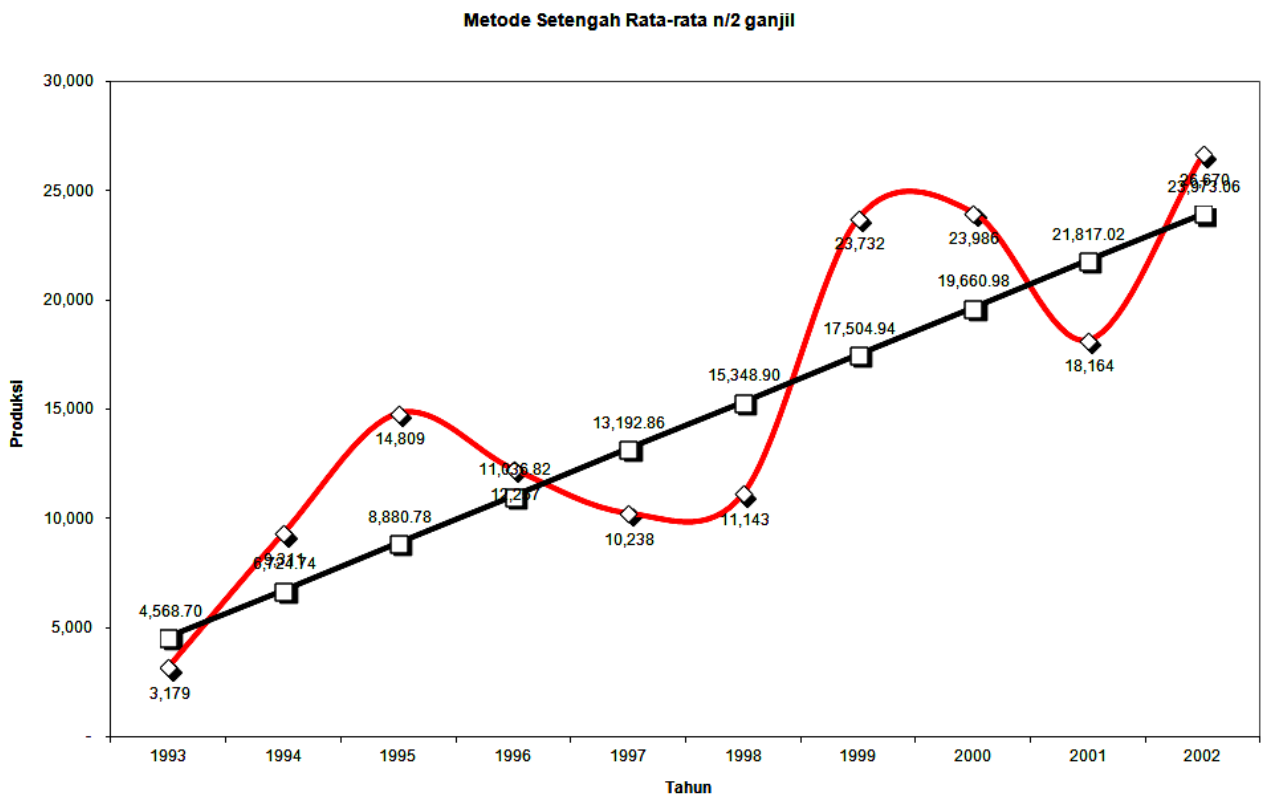
$$X = \text{selisih tahun thd tahun dasar} - 0.5 \quad = \text{tahun} - 1995 - 0.5$$

$$\text{Misal : } TAT_{1999} = 9,958.80 + 2,156.04 \cdot (1999-1995-0.5) = \boxed{17,504.94}$$

**Grafik MSR n/2 Genap :**



**Grafik MSR n/2 Ganjil :**



2. **Metode Linier Regresi (LR), lebih banyak perhitungannya, tapi lebih luas pemakaiannya. Dua cara : perhitungan manual/kalkulator & MS Excel**

1. **Regresi (Regresi Linier) :**

$y = A + B.x$  ; A = konstanta Regresi = intercept (Excel), B = koefisien Regresi = slope (Excel)

$$b = \frac{n \sum XY - \sum X \sum Y}{n \sum X^2 - (\sum X)^2} \qquad a = \frac{\sum Y - b \cdot \sum X}{n}$$

Ilustrasi :

**HOW TO FIND THE EQUATION OF THE LEAST-SQUARES LINE**

$$\hat{y} = a + bx$$

- Using the data pairs, compute  $\sum x$ ,  $\sum y$ ,  $\sum x^2$ ,  $\sum y^2$ , and  $\sum xy$ . Then compute the sample means  $\bar{x}$  and  $\bar{y}$ .
- With  $n =$  sample size,  $\sum x$ ,  $\sum y$ ,  $\sum x^2$ ,  $\sum y^2$ ,  $\sum xy$ ,  $\bar{x}$ , and  $\bar{y}$ , you are ready to compute the slope  $b$  and intercept  $a$  using the computation formulas

Slope: 
$$b = \frac{n \sum xy - (\sum x)(\sum y)}{n \sum x^2 - (\sum x)^2} \qquad (3)$$

Intercept: 
$$a = \bar{y} - b\bar{x} \qquad (4)$$

Be careful! The notation  $\sum x^2$  means first square  $x$  and then calculate the sum, whereas  $(\sum x)^2$  means first sum the  $x$  values, then square the result.

- The equation of the least-squares line computed from your sample data is

$$\hat{y} = a + bx \qquad (5)$$

Contoh :

$x$	$y$	$x^2$	$y^2$	$xy$
30	66	900	4356	1980
34	79	1156	6241	2686
27	70	729	4900	1890
25	60	625	3600	1500
17	48	289	2304	816
23	55	529	3025	1265
20	60	400	3600	1200
$\Sigma x = 176$	$\Sigma y = 438$	$\Sigma x^2 = 4628$	$\Sigma y^2 = 28,026$	$\Sigma xy = 11,337$

**SOLUTION:** Table 10-7 gives the data values  $x$  and  $y$  along with the values  $x^2$ ,  $y^2$ , and  $xy$ . First compute the sample means.

$$\bar{x} = \frac{\sum x}{n} = \frac{176}{7} \approx 25.14 \quad \text{and} \quad \bar{y} = \frac{\sum y}{n} = \frac{438}{7} \approx 62.57$$

Next compute the slope  $b$ .

$$b = \frac{n \sum xy - (\sum x)(\sum y)}{n \sum x^2 - (\sum x)^2} = \frac{7(11,337) - (176)(438)}{7(4628) - (176)^2} = \frac{2271}{1420} \approx 1.60$$

Use the values of  $b$ ,  $\bar{x}$ , and  $\bar{y}$  to compute the y-intercept  $a$ .

$$a = \bar{y} - b\bar{x} \approx 62.57 - 1.60(25.14) \approx 22.35$$

B + → TrendSekuler Naik, B - → TrendSekuler Turun

2. **Korelasi :**

r = koefisien korelasi = - 1.0 <= r <= + 1.0 →

r + → TrendSekuler Naik, r - → TrendSekuler Turun.

the correlation coefficient

$$r = \frac{n\sum XY - \sum X \sum Y}{\sqrt{(n\sum X^2 - (\sum X)^2)(n\sum Y^2 - (\sum Y)^2)}}$$

Perhitungan : minimal 2 → B & r → menentukan Trend Sekuler,

Perhitungan y = A + B.x untuk menentukan Trend Awal Tahun atau Forecasting

Ilustrasi :

**HOW TO COMPUTE THE SAMPLE CORRELATION COEFFICIENT *r***

Obtain a random sample of *n* data pairs (*x*, *y*). The data pairs should have a *bivariate normal distribution*. This means that for a fixed value of *x*, the *y* values should have a normal distribution (or at least a mound-shaped and symmetric distribution), and for a fixed *y*, the *x* values should have their own (approximately) normal distribution.

1. Using the data pairs, compute  $\sum x$ ,  $\sum y$ ,  $\sum x^2$ ,  $\sum y^2$ , and  $\sum xy$ .
2. With *n* = sample size,  $\sum x$ ,  $\sum y$ ,  $\sum x^2$ ,  $\sum y^2$ , and  $\sum xy$ , you are ready to compute the sample correlation coefficient *r* using the computation formula

$$r = \frac{n\sum xy - (\sum x)(\sum y)}{\sqrt{n\sum x^2 - (\sum x)^2} \sqrt{n\sum y^2 - (\sum y)^2}} \tag{2}$$

Be careful! The notation  $\sum x^2$  means first square *x* and then calculate the sum, whereas  $(\sum x)^2$  means first sum the *x* values, then square the result.

Contoh :

x	y	x <sup>2</sup>	y <sup>2</sup>	xy
70	3	4900	9	210
115	45	13,225	2025	5175
105	21	11,025	441	2205
82	7	6724	49	574
93	16	8649	256	1488
125	62	15,625	3844	7750
88	12	7744	144	1056
$\overline{\sum x = 678}$	$\overline{\sum y = 166}$	$\overline{\sum x^2 = 67,892}$	$\overline{\sum y^2 = 6768}$	$\overline{\sum xy = 18,458}$

$$\begin{aligned} r &= \frac{n\sum xy - (\sum x)(\sum y)}{\sqrt{n\sum x^2 - (\sum x)^2} \sqrt{n\sum y^2 - (\sum y)^2}} \quad (2) \\ &= \frac{7(18,458) - (678)(166)}{\sqrt{7(67,892) - (678)^2} \sqrt{7(6768) - (166)^2}} \approx \frac{16,658}{(124.74)(140.78)} \approx 0.949 \end{aligned}$$

Saran :

Sangat baik menggunakan MS Excel, baik juga menggunakan fungsi yg ada di Kalkulator, atau paling tidak menghitung scr MANUAL.

**Linier Regresi 12 Periode :**

Data Tahun (x) vs Data Produksi (y) :

Rumus lihat Modul

	x	y	x ^ 2	y ^ 2	x . y
1	1993	3,179	3,972,049	10,106,041	6,335,747
2	1994	9,311	3,976,036	86,694,721	18,566,134
3	1995	14,809	3,980,025	219,306,481	29,543,955
4	1996	12,257	3,984,016	150,234,049	24,464,972
5	1997	10,238	3,988,009	104,816,644	20,445,286
6	1998	11,143	3,992,004	124,166,449	22,263,714
7	1999	23,732	3,996,001	563,207,824	47,440,268
8	2000	23,986	4,000,000	575,328,196	47,972,000
9	2001	18,164	4,004,001	329,930,896	36,346,164
10	2002	26,670	4,008,004	711,288,900	53,393,340
11	2003	28,464	4,012,009	810,199,296	57,013,392
12	2004	37,061	4,016,016	1,373,517,721	74,270,244
data mentah			proses pengolahan data		
Jumlah	23,982	219,014	47,928,170	5,058,797,218	438,055,216

a intercept(y,x)	=INTERCEPT(Y1:Y12;X1:X12)	-4,953,359.98	-4,953,359.98
b slope(y,x)	=SLOPE(Y1:Y12;X1:X12)	2,487.67	2,487.67
r koefisien korelasi	=CORREL(Y1:Y12;X1:X12)	0.913048011	0.9130

**Linier Regresi 10 Periode : [sengaja di kosongkan untuk Latihan Mandiri]**

	x	y	x ^ 2	y ^ 2	x . y
1	1993	3,179			
2	1994	9,311			
3	1995	14,809			
4	1996	12,257			
5	1997	10,238			
6	1998	11,143			
7	1999	23,732			
8	2000	23,986			
9	2001	18,164			
10	2002	26,670			

Jumlah

a intercept(y,x)	=INTERCEPT(C2:C13;B2:B13)
b slope(y,x)	=SLOPE(C2:C13;B2:B13)
r koefisien korelasi	=CORREL(C2:C13;B2:B13)