
DMAIC Regresión

AUTOPISTA

- Objetivo
 - Conocer el método de regresión.
 - Identificar grados y tipos de correlación.
 - Calcular ecuaciones de predicción.

- Aplicaciones
 - Establecer correlaciones.
 - Definir modelos matemáticos para distintos fenómenos.
 - Simplificación de modelos matemáticos.

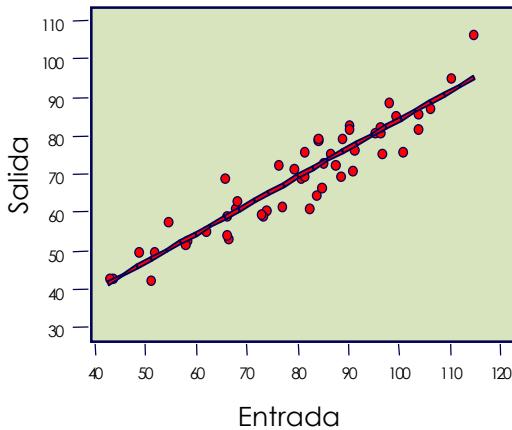
- La regresión es una ecuación que puede predecir matemáticamente a “Y” dado cualquier número “X”.

$$y = f(x)$$

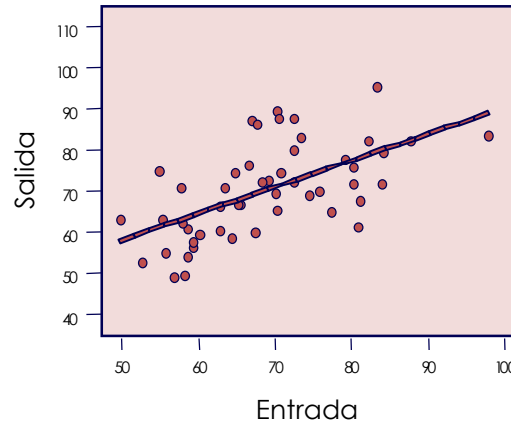
- Hay diferentes ecuaciones de predicción:
 - Lineal
 - Cuadrática
 - Cúbica
 - Exponencial
- Nota: Para cada ecuación se calcula también la calidad de regresión para saber si el modelo es aceptable.

- Tipos de correlación:

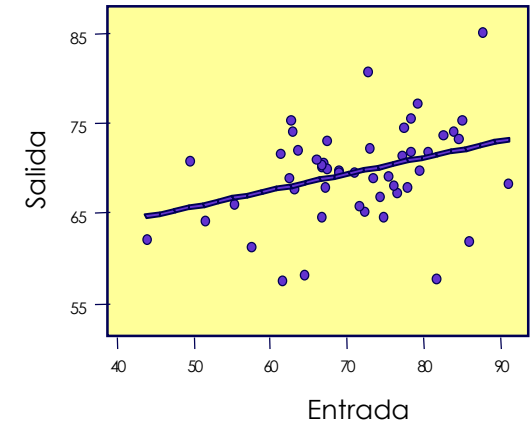
Fuerte Correlación



Correlación moderada



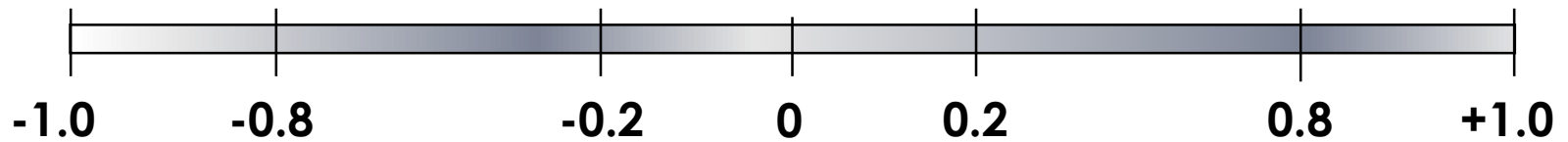
Poca correlación



Correlación negativa

No correlación

Correlación positiva



Nota: correlación no significa la causa.

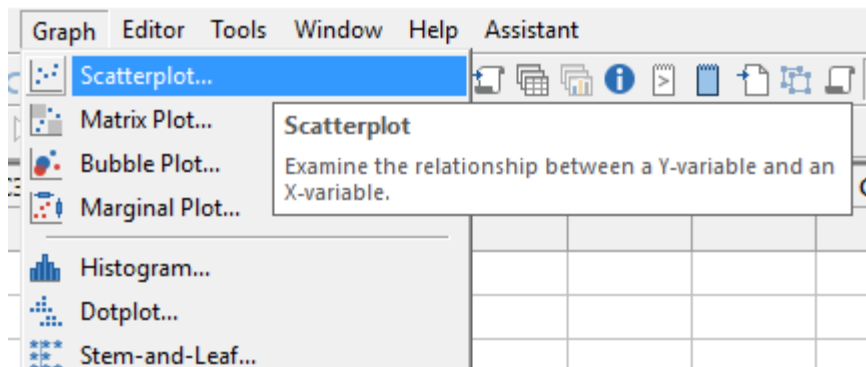
$$r = \frac{\sum (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum (x_i - \bar{x})^2 \sum (y_i - \bar{y})^2}}$$

Ejemplo de regresión

1. Crear gráfica (scatterplot)
2. Determinar la correlación
3. Aproximar curva (fitted line plot)
4. Evaluar calidad de la regresión
5. Repetir pasos 3 y 4 hasta conseguir llegar a un óptimo nivel.
6. Analizar residuos

1. Gráfica

↓	C1	C2
	X	Y
1	2,0	0,2
2	4,5	1,1
3	5,0	1,6
4	7,0	0,7
5	8,5	8,1
6	12,0	7,9
7	15,0	8,6
8	10,0	3,3
9	11,0	7,0
10	25,0	28,7
11	40,0	69,2
12	32,5	49,2
13	35,0	61,9
14	30,0	37,2
15	27,5	38,2
16	22,5	24,7



1. Gráfica

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	X	Y
1	2,0	0,2
2	4,5	1,1
3	5,0	1,6
4	7,0	0,7
5	8,5	8,1
6	12,0	7,9
7	15,0	8,6
8	10,0	3,3
9	11,0	7,0
10	25,0	28,7
11	40,0	69,2
12	32,5	49,2
13	35,0	61,9
14	30,0	37,2
15	27,5	38,2
16	22,5	24,7

The image shows a software interface with a menu and a dialog box. The menu is open to the 'Graph' option, with 'Scatterplot...' selected. A tooltip for 'Scatterplot' is visible, stating 'Examine the relative X-variable.' The dialog box, titled 'Scatterplots', offers several options: 'Simple', 'With Groups', 'With Regression', 'With Regression and Groups', 'With Connect Line', and 'With Connect and Groups'. At the bottom of the dialog are 'Help', 'OK', and 'Cancel' buttons.

1. Gráfica

↓	C1	C2
	X	Y
1	2,0	0,2
2	4,5	1,1
3	5,0	1,6
4	7,0	0,7
5	8,5	8,1
6	12,0	7,9
7	15,0	8,6

Graph Editor Tools Window Help

Scatterplots

Scatterplot...
Matrix Plot...
Bubble Plot...
Marginal Plot...
Histogram...
Dotplot...
Stem-and-Leaf...

Scatterplot
Examine the relative relationship between two variables.

Simple With Groups With Regression With Regression and Groups

With Connect Line With Connect and Groups

Scatterplot: Simple

C1 X
C2 Y

	Y variables	X variables
1	Y	X
2		
3		
4		
5		
6		
7		

Scale... Labels... Data View...
Multiple Graphs... Data Options...

Select

Help

OK Cancel

1. Gráfica



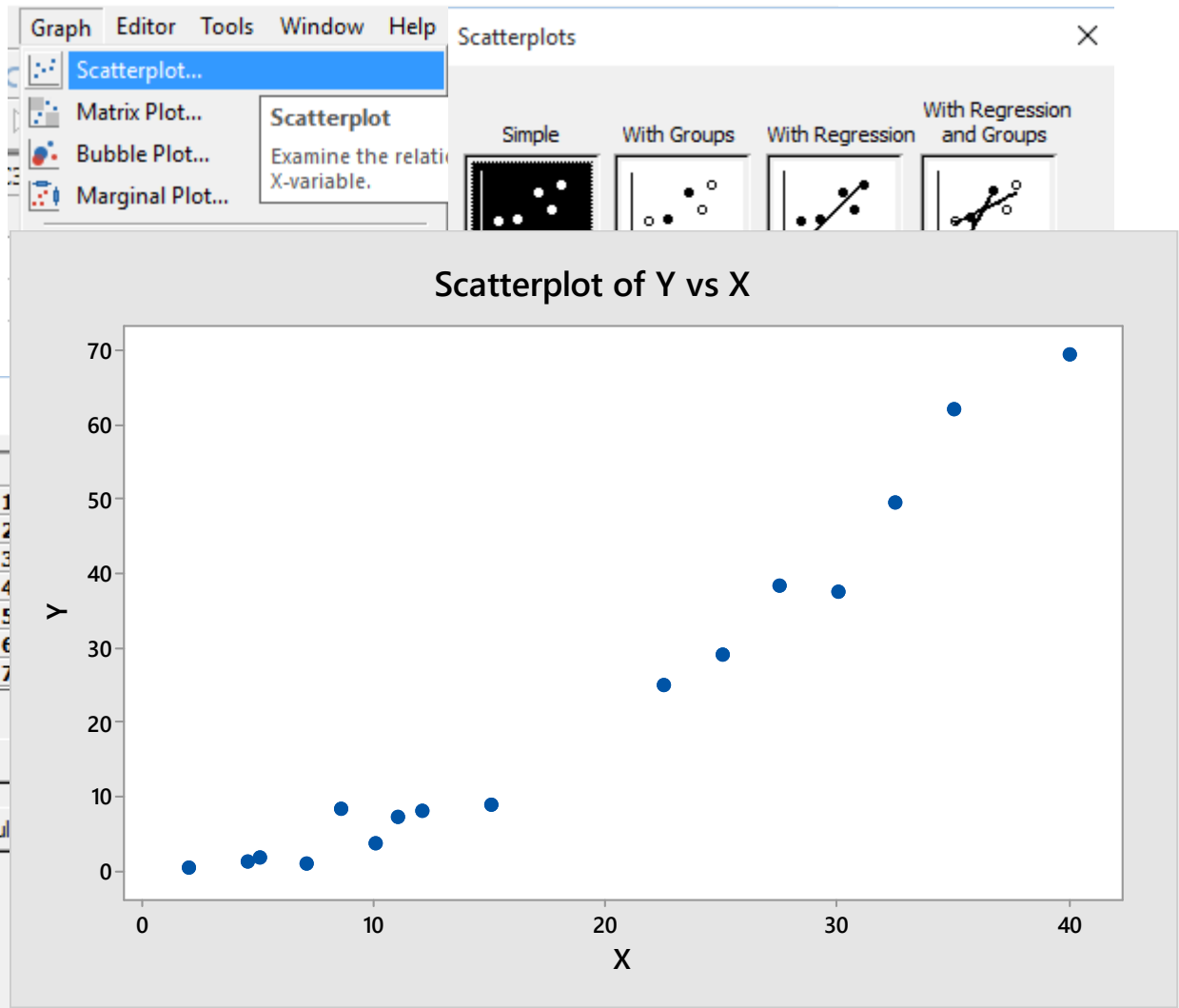
↓	C1	C2
	X	Y
1	2,0	0,2
2	4,5	1,1
3	5,0	1,6
4	7,0	0,7
5	8,5	8,1
6	12,0	7,9
7	15,0	8,6

Scatterplot: Simple

C1 X
C2 Y

Select

Help



2. Determinar correlación



The screenshot shows the Minitab software interface. The 'Stat' menu is open, and 'Correlation...' is selected. A tooltip for 'Correlation' is displayed, explaining its function: 'Correlation Measure the strength and direction of the linear relationship between two variables.'

	6	C7	C8
8	10,0		
9	11,0		
10	25,0		
11	40,0		
12	32,5		
13	35,0		
14	30,0		
15	27,5		

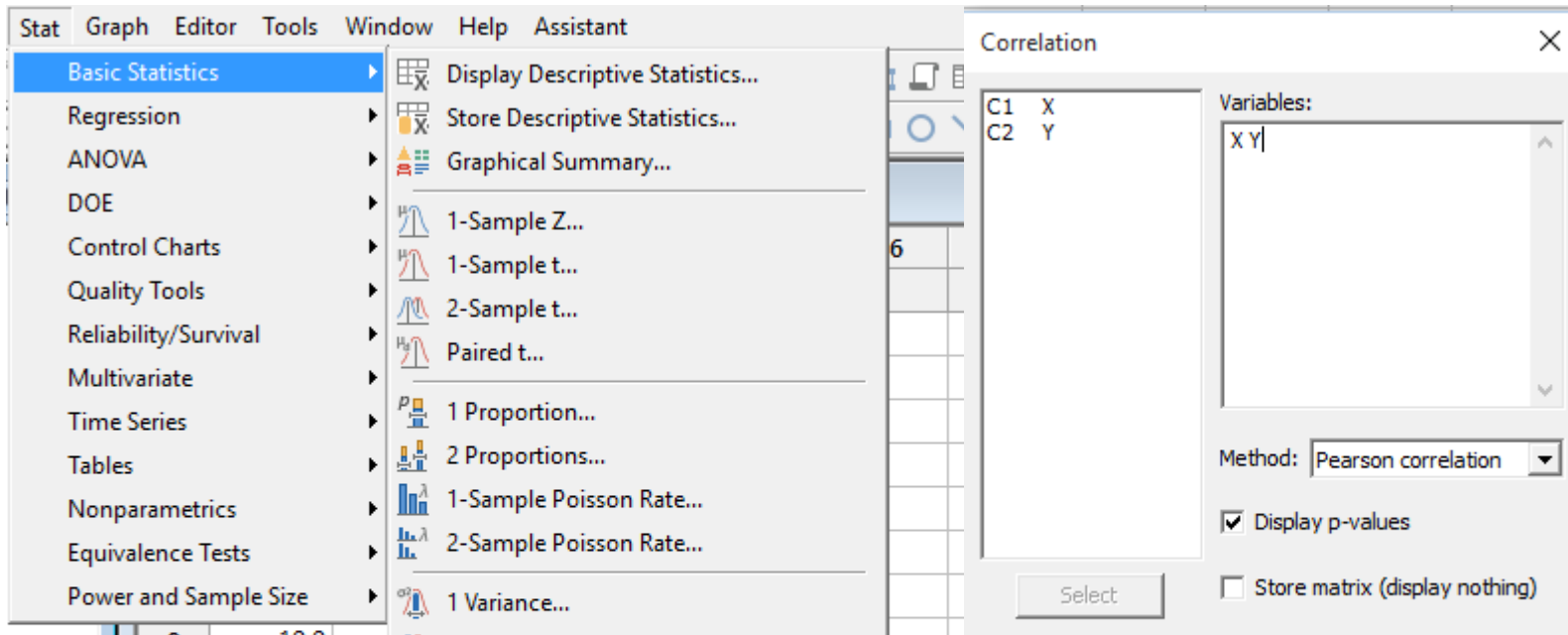
2. Determinar correlación



The screenshot shows the Minitab software interface. The 'Stat' menu is open, and the 'Correlation...' option is selected. The 'Correlation' dialog box is displayed, showing the variables 'C1 X' and 'C2 Y' selected. The 'Method' is set to 'Pearson correlation', and the 'Display p-values' checkbox is checked. A tooltip for the 'Correlation' option is also visible, stating: 'Correlation Measure the strength and direction of the linear relationship between two variables.'

Row	Value
8	10,0
9	11,0
10	25,0
11	40,0
12	32,5
13	35,0
14	30,0
15	27,5

2. Determinar correlación



The screenshot shows the Minitab software interface. The 'Stat' menu is open, and the 'Basic Statistics' option is selected. The 'Correlation' dialog box is open, showing the following settings:

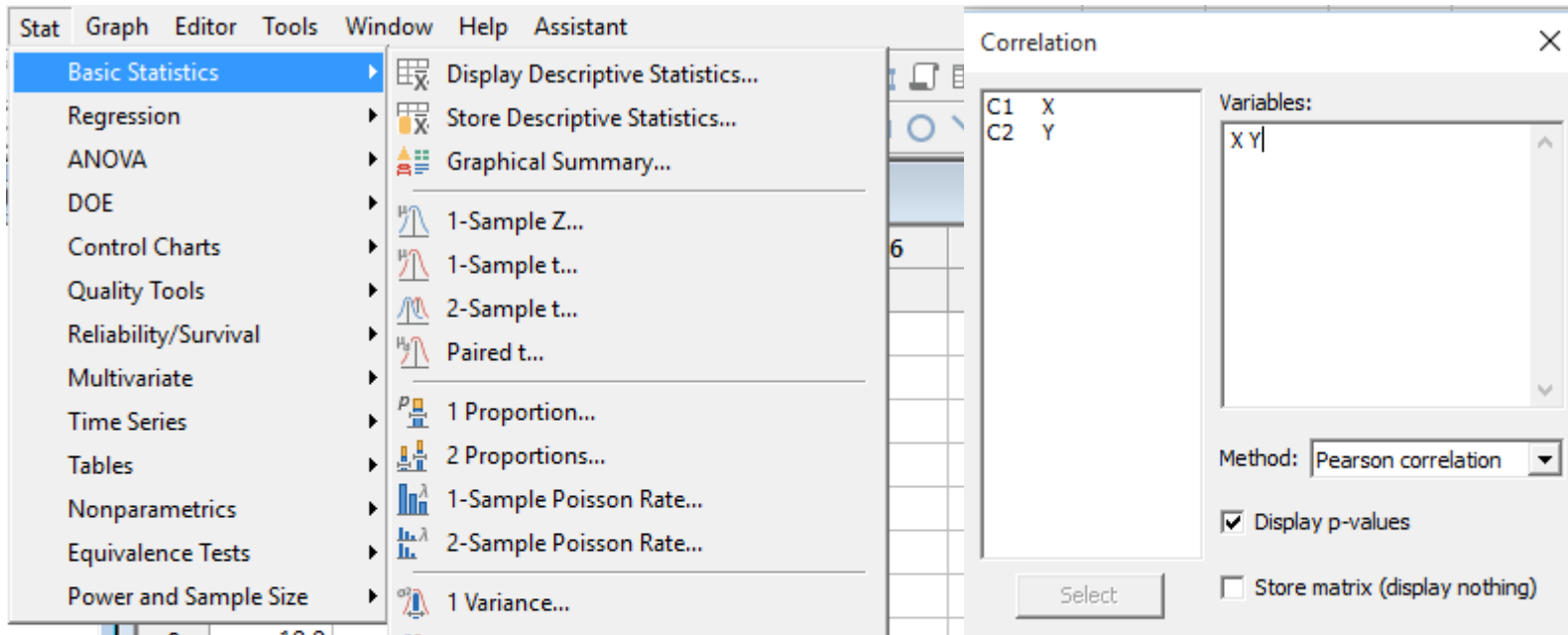
- Variables: X Y
- Method: Pearson correlation
- Display p-values
- Store matrix (display nothing)

Correlation: X; Y

Pearson correlation of X and Y = 0,973

P-Value = 0,000

2. Determinar correlación



Stat Graph Editor Tools Window Help Assistant

Basic Statistics

- Display Descriptive Statistics...
- Store Descriptive Statistics...
- Graphical Summary...
- 1-Sample Z...
- 1-Sample t...
- 2-Sample t...
- Paired t...
- 1 Proportion...
- 2 Proportions...
- 1-Sample Poisson Rate...
- 2-Sample Poisson Rate...
- 1 Variance...

Correlation

C1 X
C2 Y

Variables:
X Y

Method: Pearson correlation

Display p-values

Store matrix (display nothing)

Select

Correlation: X; Y

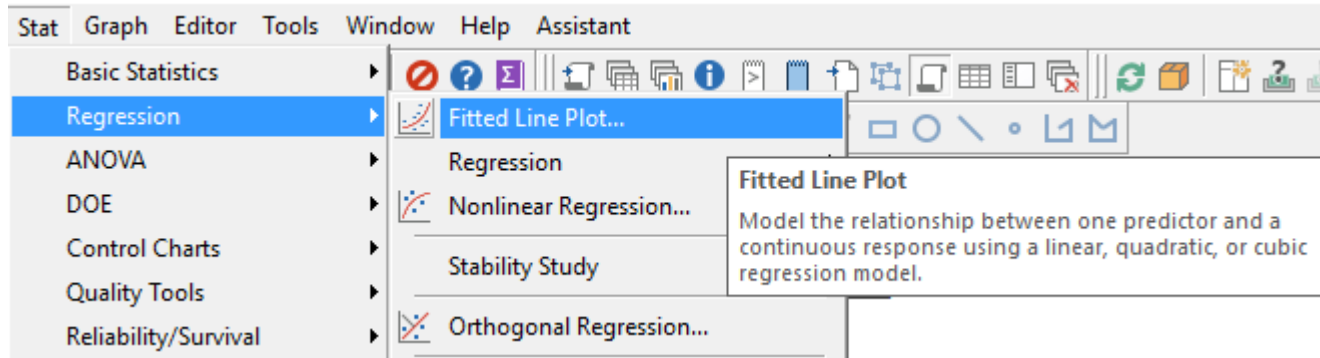
P-Value > 0.05, H_0 : No correlación

P-Value < 0.05, H_a : Correlación

Pearson correlation of X and Y = 0,973

P-Value = 0,000

3. Aproximar la curva y 4. Evaluar calidad



3. Aproximar la curva y 4. Evaluar calidad

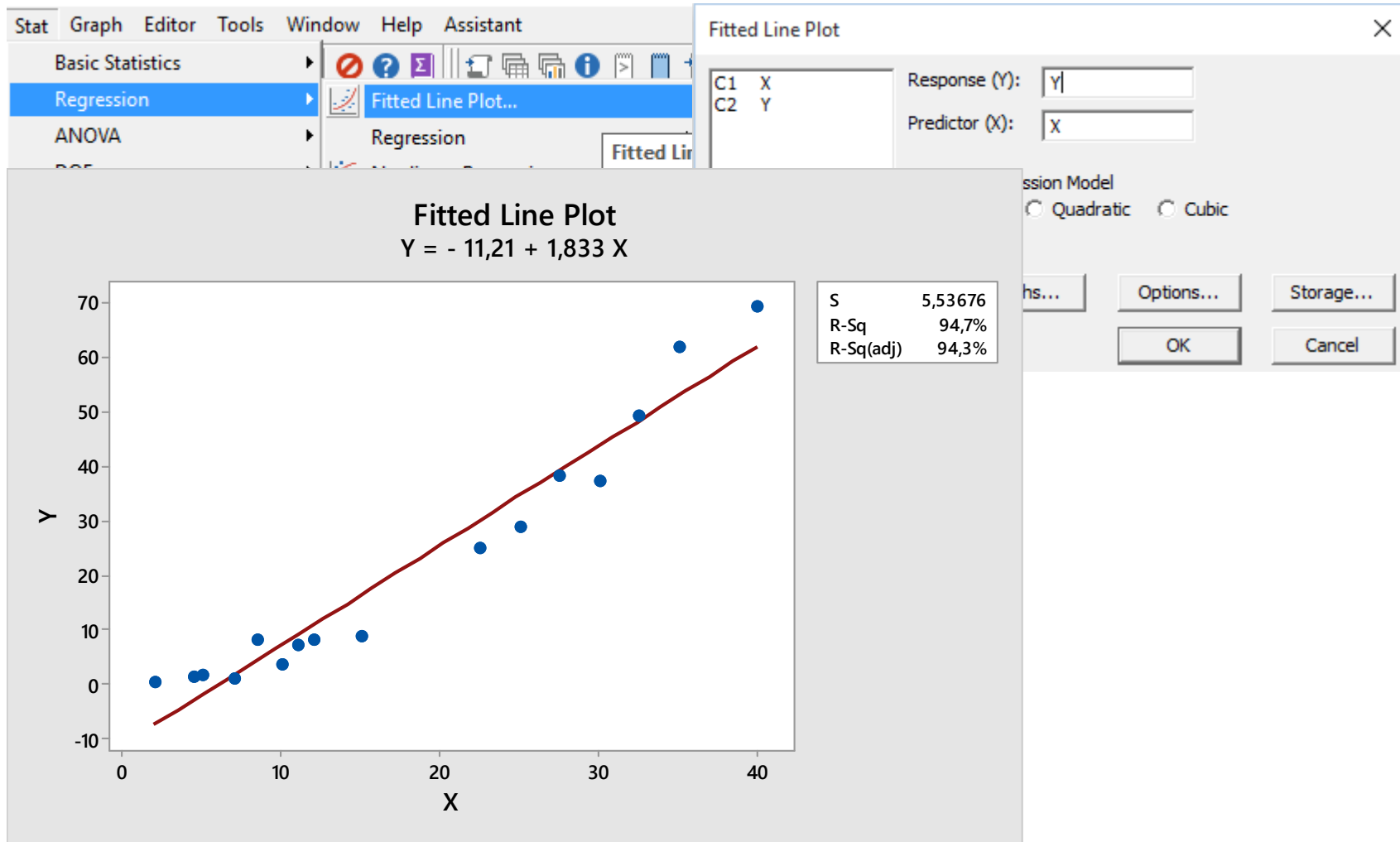


The screenshot shows the Minitab software interface. The 'Stat' menu is open, and the 'Regression' option is selected. The 'Fitted Line Plot...' option is highlighted. The 'Fitted Line Plot' dialog box is open, showing the following settings:

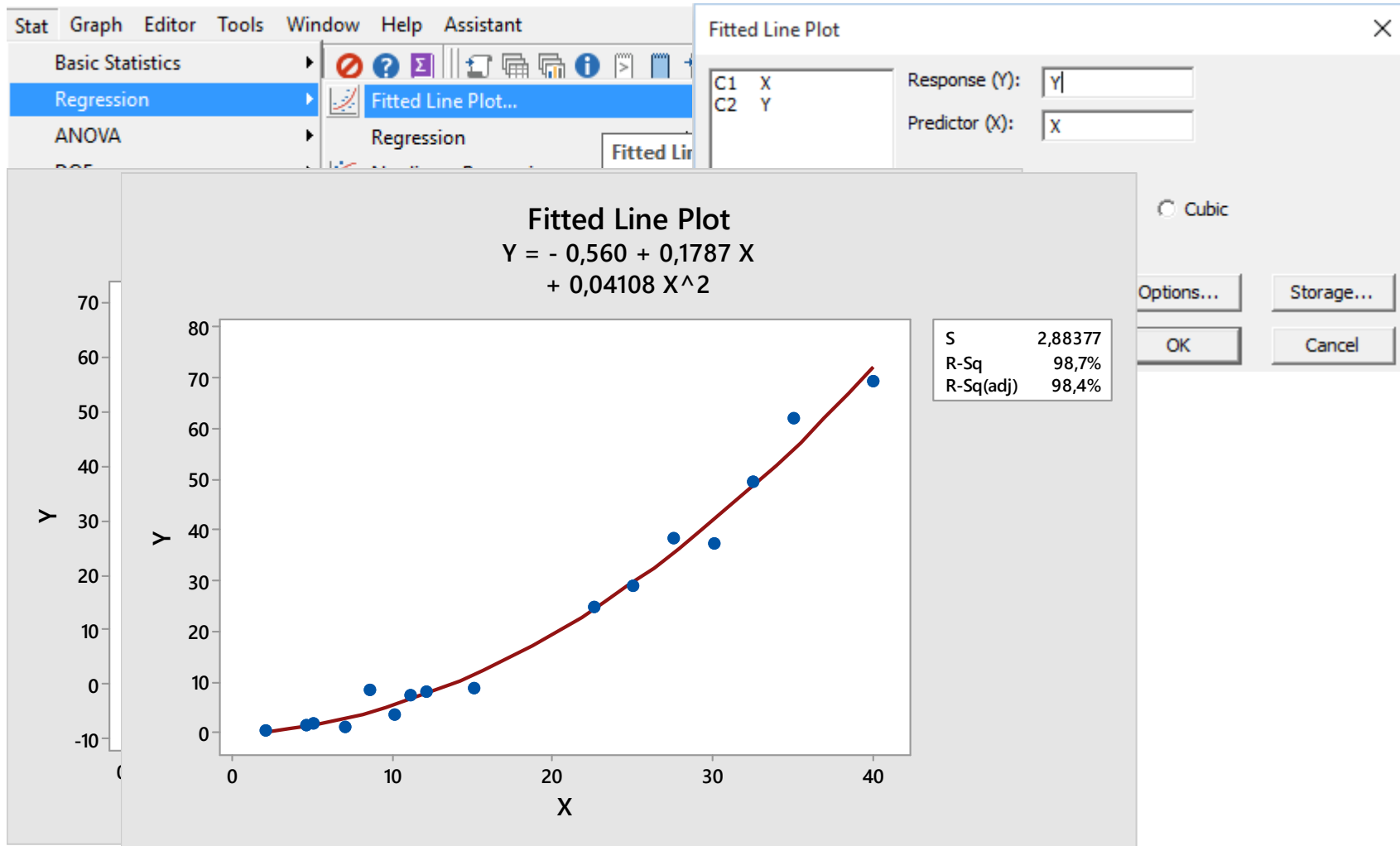
- Response (Y): Y
- Predictor (X): X
- Type of Regression Model: Linear, Quadratic, Cubic

Buttons at the bottom of the dialog box include: Select, Graphs..., Options..., Storage..., Help, OK, and Cancel.

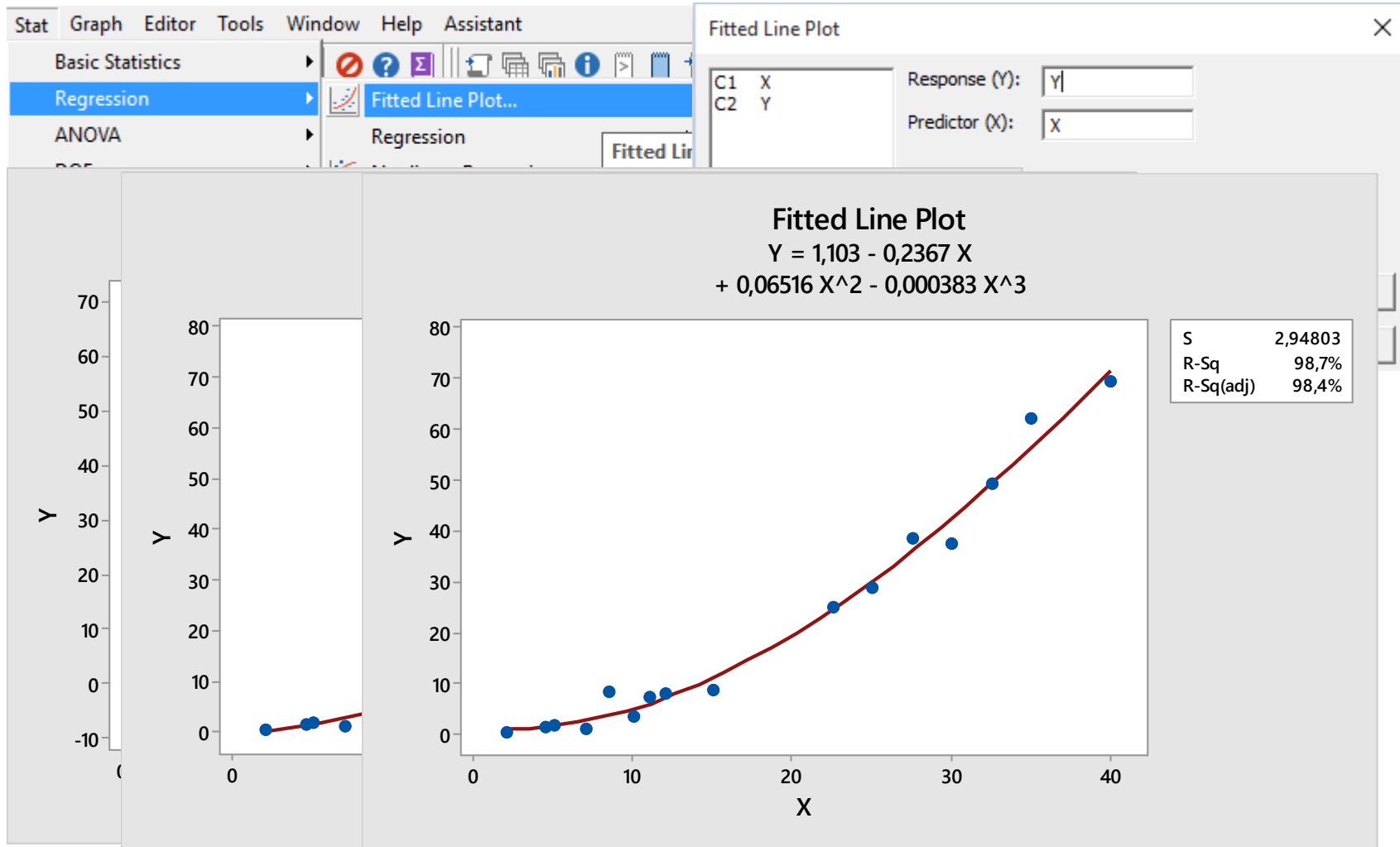
3. Aproximar la curva y 4. Evaluar calidad



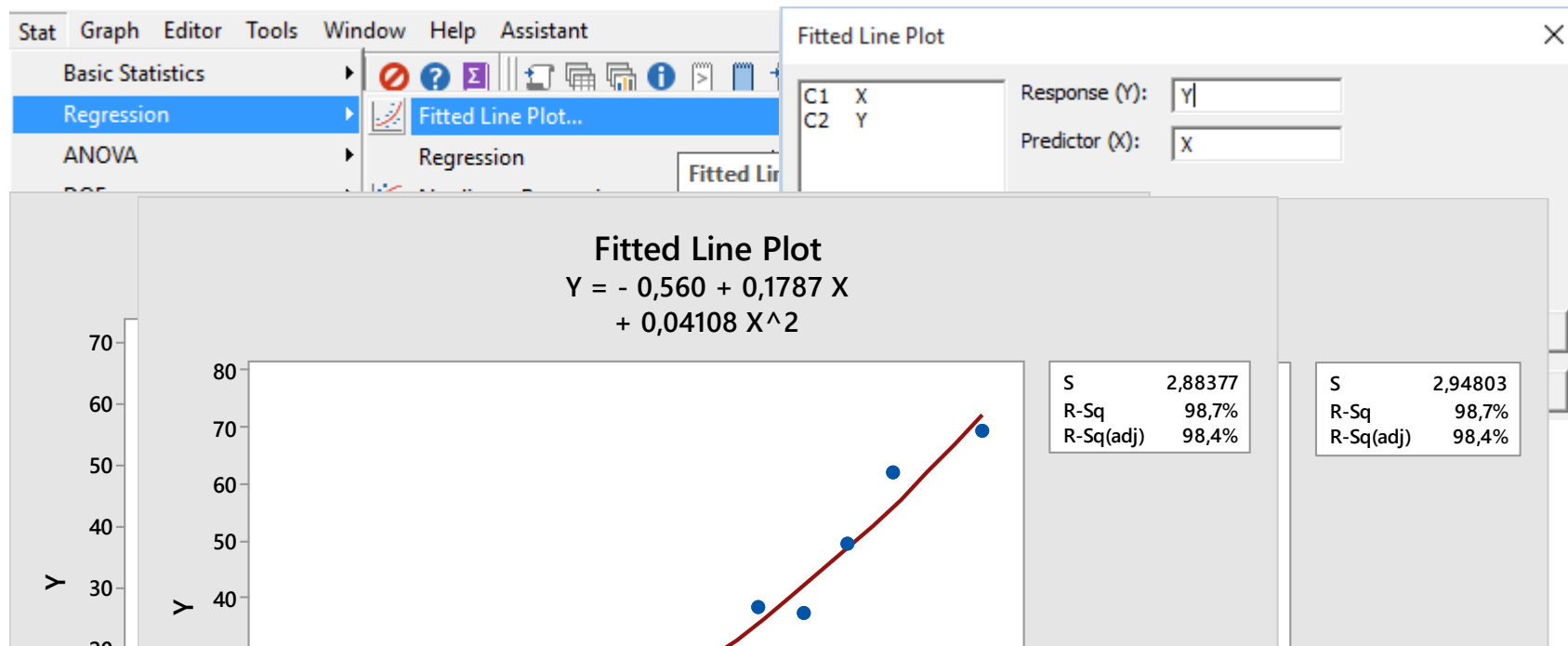
3. Aproximar la curva y 4. Evaluar calidad



3. Aproximar la curva y 4. Evaluar calidad



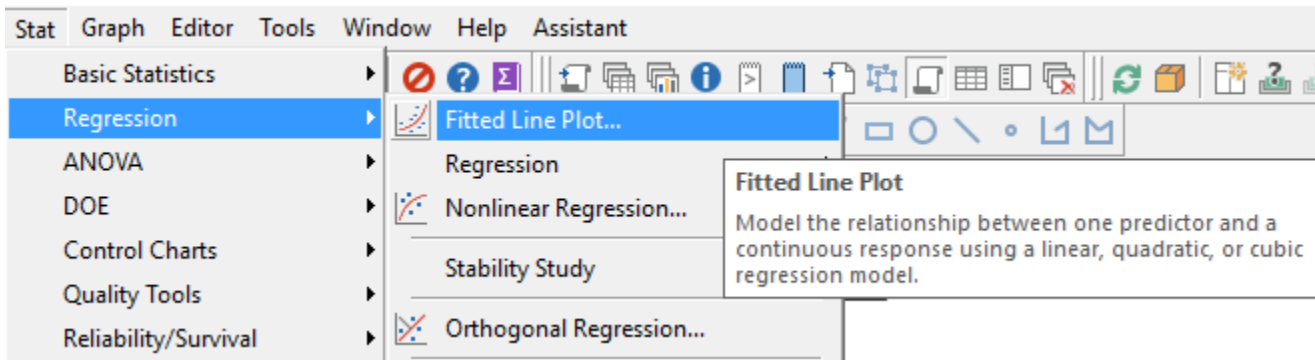
3. Aproximar la curva y 4. Evaluar calidad



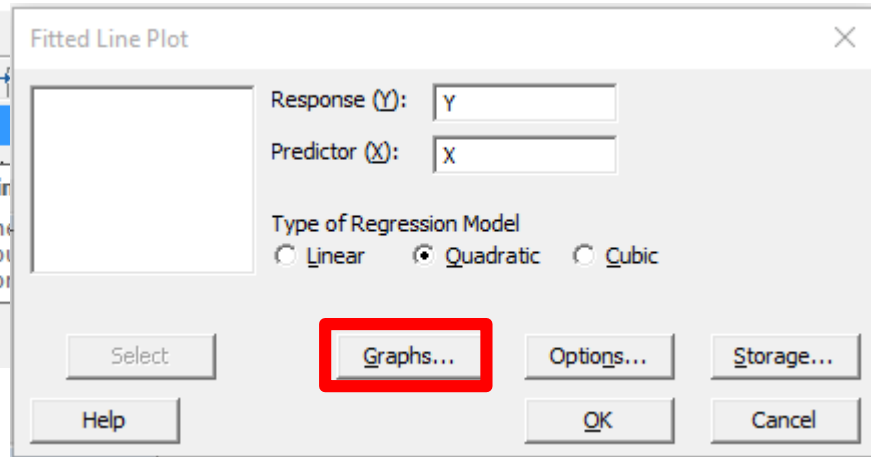
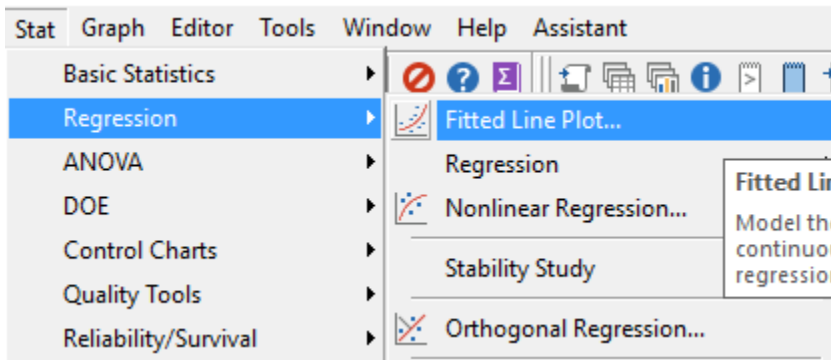
The regression equation is
$$Y = - 0,560 + 0,1787 X + 0,04108 X^2$$

$S = 2,88377$ $R-Sq = 98,7\%$ $R-Sq(adj) = 98,4\%$

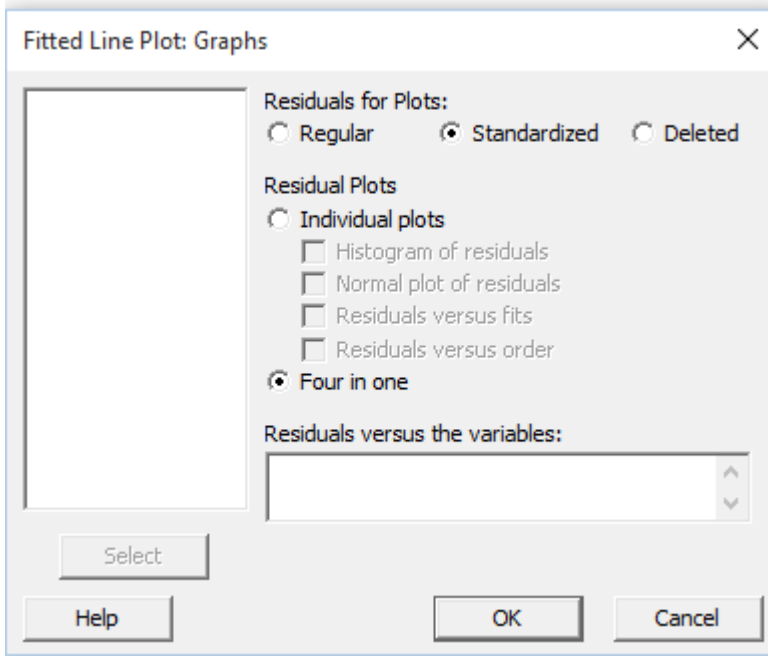
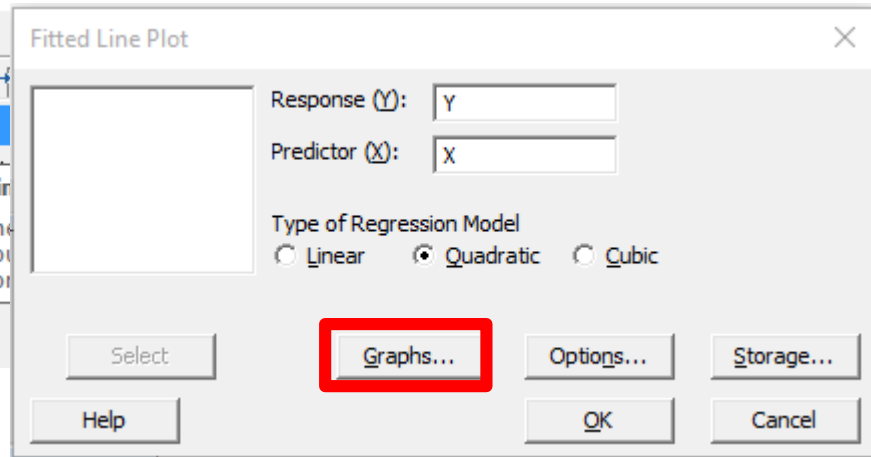
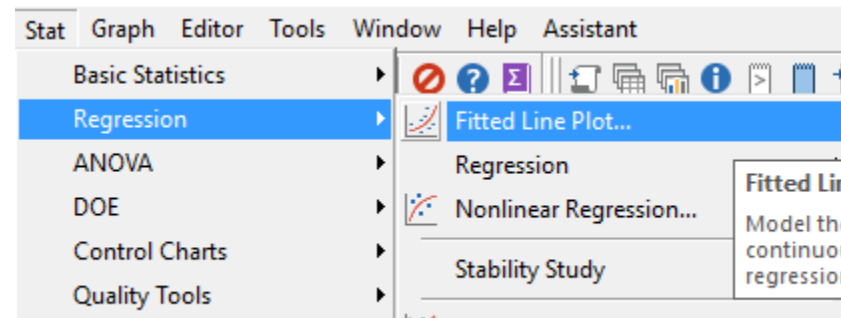
6. Analizar residuos



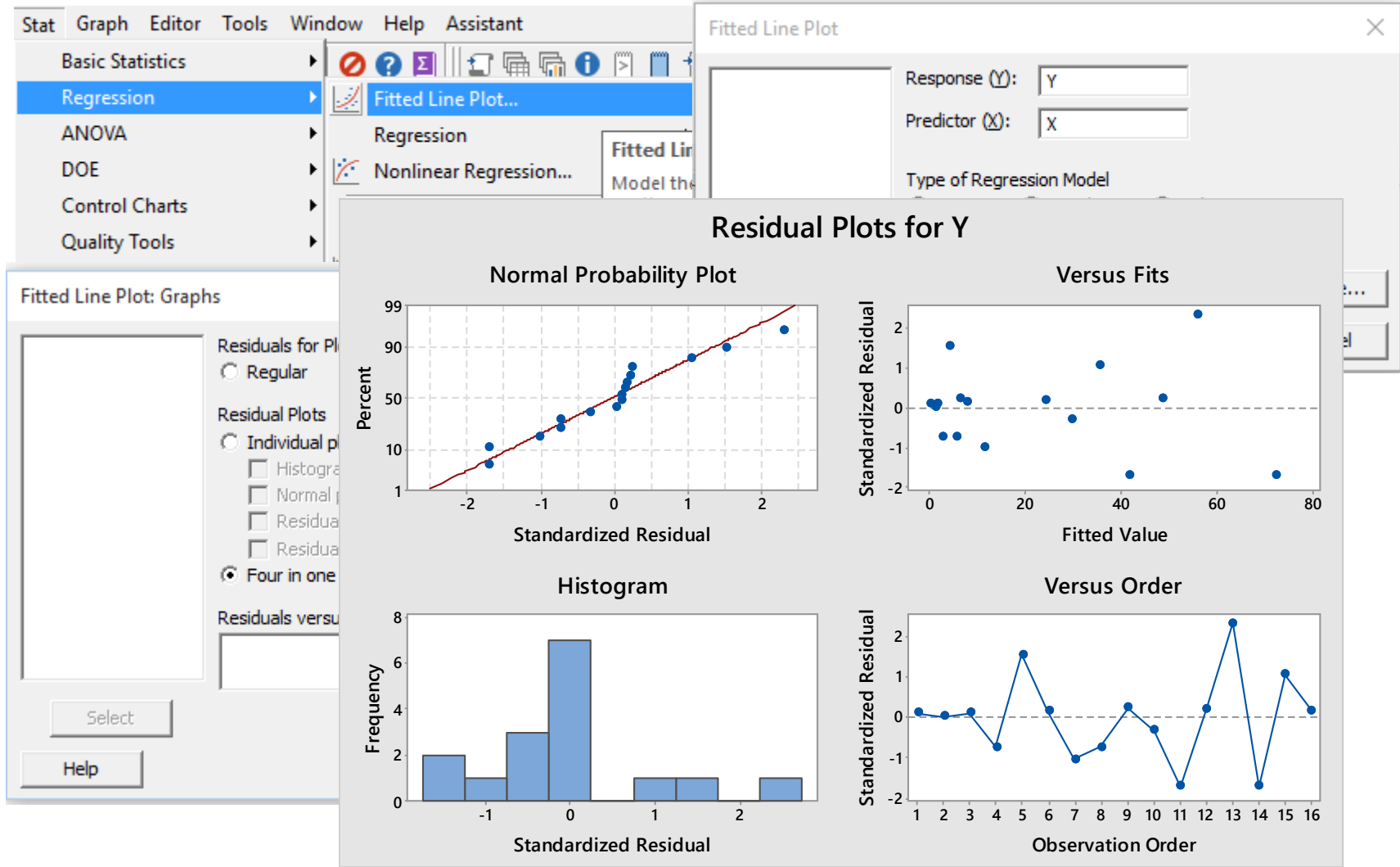
6. Analizar residuos



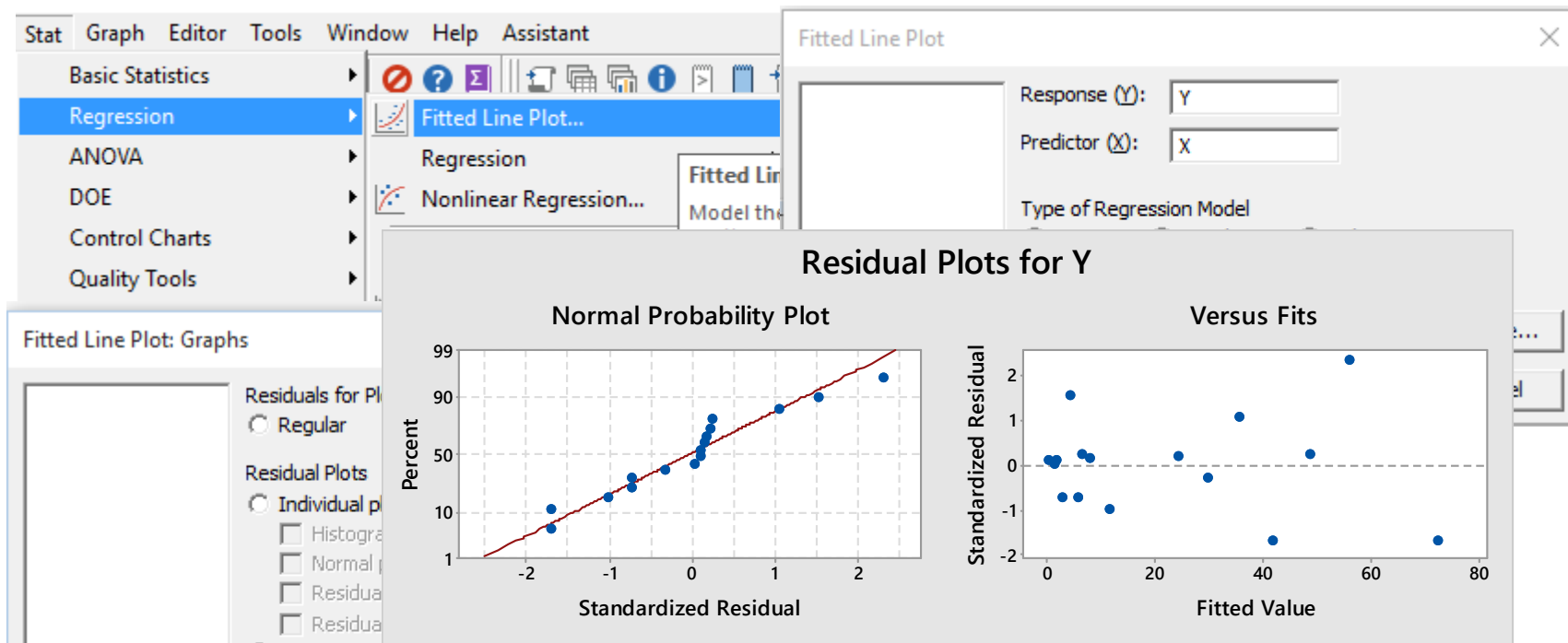
6. Analizar residuos



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6. Analizar residuos



The regression equation is

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$$S = 2,88377 \quad R\text{-Sq} = 98,7\% \quad R\text{-Sq}(\text{adj}) = 98,4\%$$