MRLM

Repaso viñedos

Ejercicio MRLM

Se cree que la calidad (Y) del vino Pinot Noir se relaciona con sus propiedades de aroma, cuerpo, sabor y fuerza. En un estudio realizado para confirmar esta hipótesis, se recolecto información de 38 viñedos y se calificó cada una de estas propiedades.

Datos

	calidad	aroma	cuerpo	sabor	fuerza
1	9.8	3.3	2.8	3.1	4.1
2	12.6	4.4	4.9	3.5	3.9
3	11.9	3.9	5.3	4.8	4.7
4	11.1	3.9	2.6	3.1	3.6
5	13.3	5.6	5.1	5.5	5.1
6	12.8	4.6	4.7	5.0	4.1
7	12.8	4.8	4.8	4.8	3.3
8	12.0	5.3	4.5	4.3	5.2
9	13.6	4.3	4.3	3.9	2.9
10	13.9	4.3	3.9	4.7	3.9
11	14.4	5.1	4.3	4.5	3.6
12	12.3	3.3	5.4	4.3	3.6
13	16.1	5.9	5.7	7.0	4.1
14	16.1	7.7	6.6	6.7	3.7
15	15.5	7.1	4.4	5.8	4.1
16	15.5	5.5	5.6	5.6	4.4
17	13.8	6.3	5.4	4.8	4.6
18	13.8	5.0	5.5	5.5	4.1
19	11.3	4.6	4.1	4.3	3.1
20	7.9	3.4	5.0	3.4	3.4
21	15.1	6.4	5.4	6.6	4.8
22	13.5	5.5	5.3	5.3	3.8
23	10.8	4.7	4.1	5.0	3.7
24	9.5	4.1	4.0	4.1	4.0
25	12.7	6.0	5.4	5.7	4.7
26	11.6	4.3	4.6	4.7	4.9
27	11.7	3.9	4.0	5.1	5.1
28	11.9	5.1	4.9	5.0	5.1
29	10.8	3.9	4.4	5.0	4.4
30	8.7	4.5	3.7	2.9	3.9
31	10.7	5.2	4.3	5.0	6.0
32	9.1	4.2	3.8	3.0	4.7
33	12.1	3.3	3.5	4.3	4.5
34	14.9	6.8	5.0	6.0	5.2
35	13.5	5.0	5.7	5.5	4.8
36	12.2	3.5	4.7	4.2	3.3
37	10.3	4.3	5.5	3.5	5.8
38	13.2	5.2	4.8	5.7	3.5

Resumen

```
Call:
lm(formula = calidad ~ aroma + cuerpo + sabor + fuerza)

Residuals:
    Min      1Q  Median      3Q     Max
-2.6948 -0.6921  0.1608  0.5812  1.7574

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  6.31728    1.47280   4.289 0.000147 ***
aroma        0.57974    0.26632   2.177 0.036746 *
cuerpo       0.09958    0.30884   0.322 0.749150
sabor        1.13948    0.30593   3.725 0.000730 ***
fuerza      -0.60758    0.26620  -2.282 0.029042 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 1.169 on 33 degrees of freedom
Multiple R-squared:  0.706,     Adjusted R-squared:  0.6703
F-statistic: 19.81 on 4 and 33 DF,  p-value: 2.141e-08
```

Análisis de varianza

```
Tabla ANOVA Modelo de Regresion
            SumSq Df    MeanSq      FO  P.value
Modelo 108.19148  4 27.047870 19.808 2.14e-08
Error    45.06115 33  1.365489
```
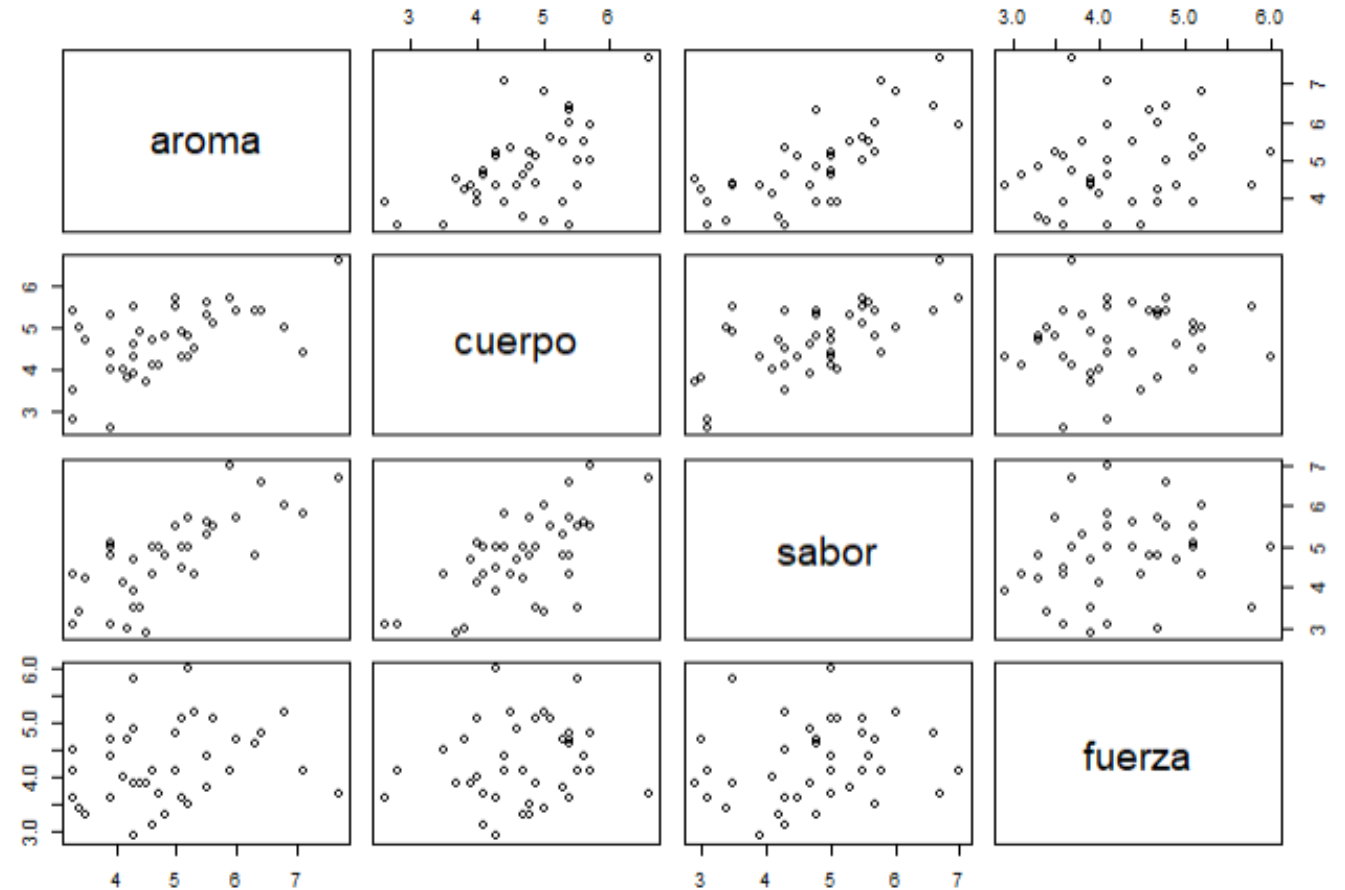
Tabla de todas las regresiones posibles

	NoOfVars	R2	adjR2	SSE	Cp	MSE	Variables.in.model
1	1	0.6228	0.6123	57.80886	8.3356	1.60580	sabor
2	1	0.5041	0.4903	75.99638	21.6550	2.11101	aroma
3	1	0.3006	0.2812	107.18441	44.4952	2.97734	cuerpo
4	1	0.0024	-0.0254	152.89134	77.9682	4.24698	fuerza
5	2	0.6603	0.6408	52.06667	6.1304	1.48762	sabor fuerza
6	2	0.6590	0.6395	52.25698	6.2698	1.49306	aroma sabor
7	2	0.6253	0.6038	57.42952	10.0578	1.64084	cuerpo sabor
8	2	0.5424	0.5163	70.12441	19.3548	2.00355	aroma fuerza
9	2	0.5401	0.5138	70.48310	19.6175	2.01380	aroma cuerpo
10	2	0.3184	0.2795	104.45298	44.4949	2.98437	cuerpo fuerza
11	3	0.7050	0.6790	45.20312	3.1040	1.32950	aroma sabor fuerza
12	3	0.6637	0.6341	51.53192	7.7388	1.51564	cuerpo sabor fuerza
13	3	0.6596	0.6295	52.17451	8.2094	1.53454	aroma cuerpo sabor
14	3	0.5824	0.5455	64.00469	16.8731	1.88249	aroma cuerpo fuerza
15	4	0.7060	0.6703	45.06115	5.0000	1.36549	aroma cuerpo sabor fuerza

Multicolinealidad

Relaciones lineales entre predictoras

Matriz de correlaciones


```
            aroma     cuerpo       sabor      fuerza
aroma   1.0000000  0.5489102   0.7365612   0.2016444
cuerpo  0.5489102  1.0000000   0.6466592   0.1521059
sabor   0.7365612  0.6466592   1.0000000   0.1797605
fuerza  0.2016444  0.1521059   0.1797605   1.0000000
```

VIF- numero de condición- índice de condición- proporción de descomposición de varianza

```
> miscoeficientes(modelo,datos)
Coeficientes estimados, sus I.C, Vifs y Coeficientes estimados estandarizados
              Estimación Limites.2.5.. Limites.97.5..       Vif   Coef.Std
(Intercept)  6.31728167     3.3208443      9.31371903 0.000000  0.0000000
aroma        0.57973887     0.0379129      1.12156485 2.251883  0.3083520
cuerpo       0.09958397    -0.5287573      0.72792527 1.755426  0.0403261
sabor        1.13948408     0.5170651      1.76190307 2.680128  0.5755782
fuerza      -0.60757616    -1.1491635     -0.06598887 1.045892 -0.2203316
> misDiagnostcolin(modelo)
Diagnósticos Multicolinealidad - Intercepto incluído
 índices de Condici?n y Proporciones de Varianza
   Val.propio Ind.Cond Pi..Intercept.       Pi.aroma     Pi.cuerpo       Pi.sabor   Pi.fuerza
1 4.919509344  1.00000    0.0006751541 0.0008351763 0.0006804811 0.0006578010 0.00109801
2 0.040990753 10.95514    0.0558633092 0.1045093949 0.0069431805 0.0779131360 0.29117483
3 0.017939797 16.55969    0.0938636930 0.3227924883 0.4018040070 0.0003835803 0.27882369
4 0.011830689 20.39182    0.4781170752 0.3885753532 0.0384983593 0.3600001152 0.33122058
5 0.009729418 22.48627    0.3714807685 0.1832875873 0.5520739721 0.5610453676 0.09768289
> misDiagnostcolin(modelo,Inter =F)
Diagn?sticos Multicolinealidad - Intercepto ajustado
 índices de Condición y Proporciones de Varianza
   Val.propio Ind.Cond     Pi.aroma    Pi.cuerpo     Pi.sabor   Pi.fuerza
1 3.93659133  1.00000 0.001316909 0.001281864 0.001031410 0.002787309
2 0.03604738 10.45017 0.081033055 0.004331653 0.062652787 0.875461033
3 0.01684641 15.28645 0.464483442 0.701837862 0.000727898 0.086794539
4 0.01051488 19.34897 0.453166594 0.292548622 0.935587904 0.034957118
```
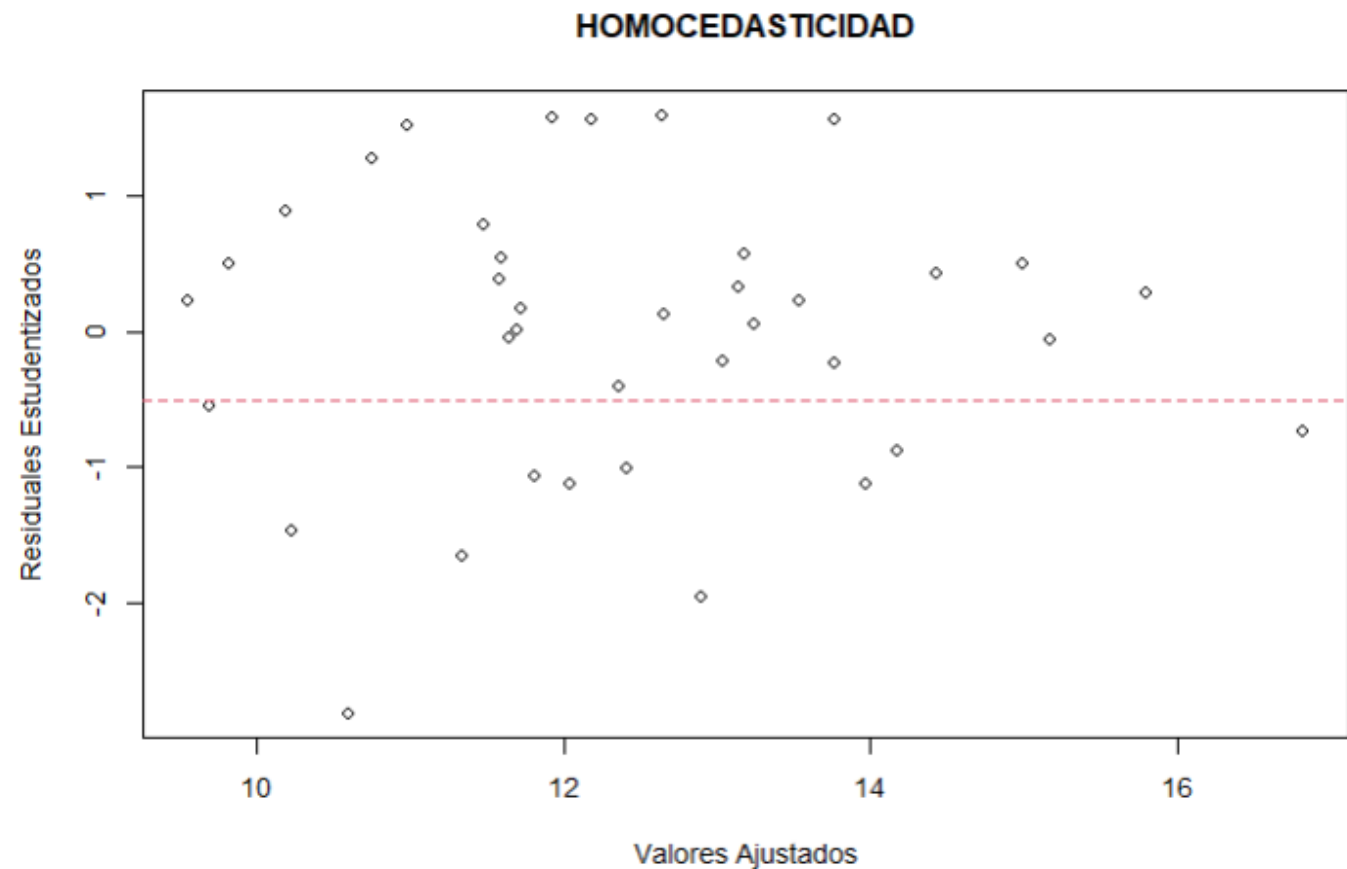
Evaluación de supuestos

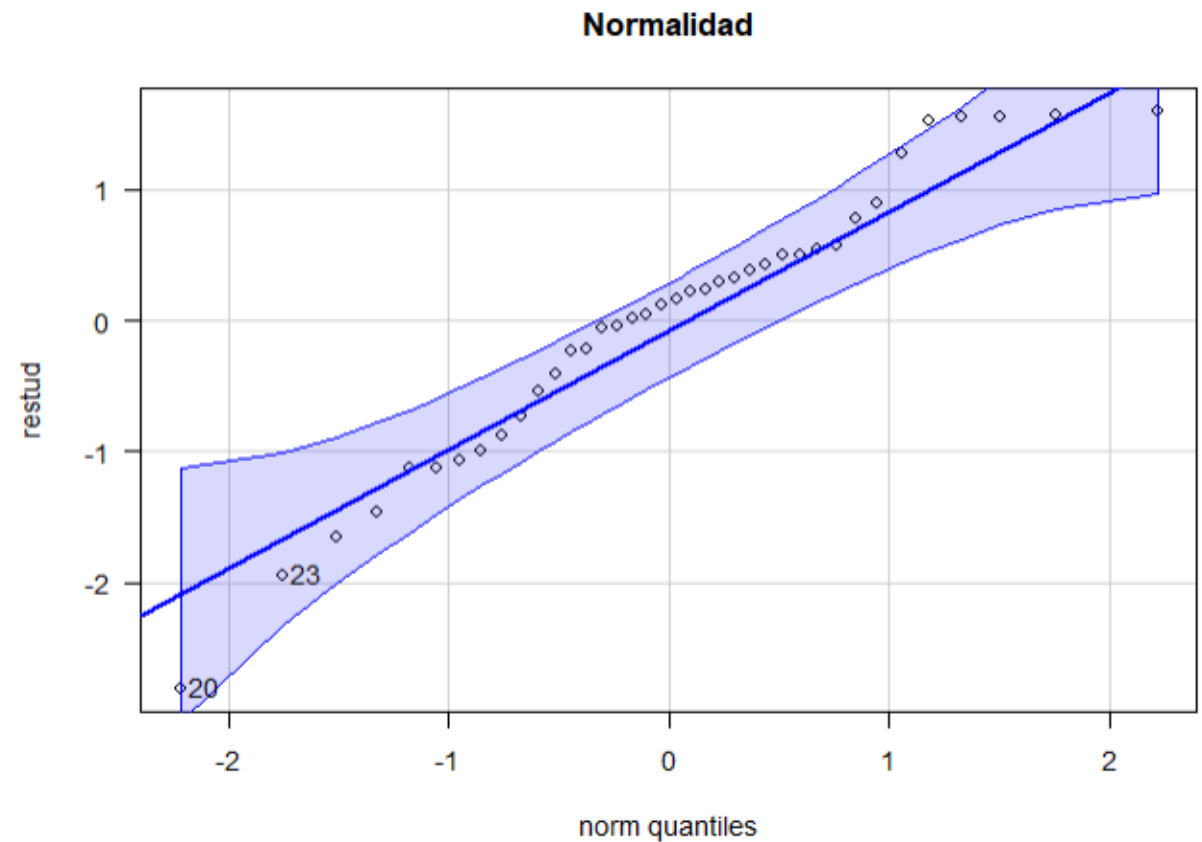Homocedasticidad- Normalidad- Independencia - linealidad

Homocedasticidad

HOMOCEDASTICIDAD

studentized Breusch-Pagan test

data: modelo
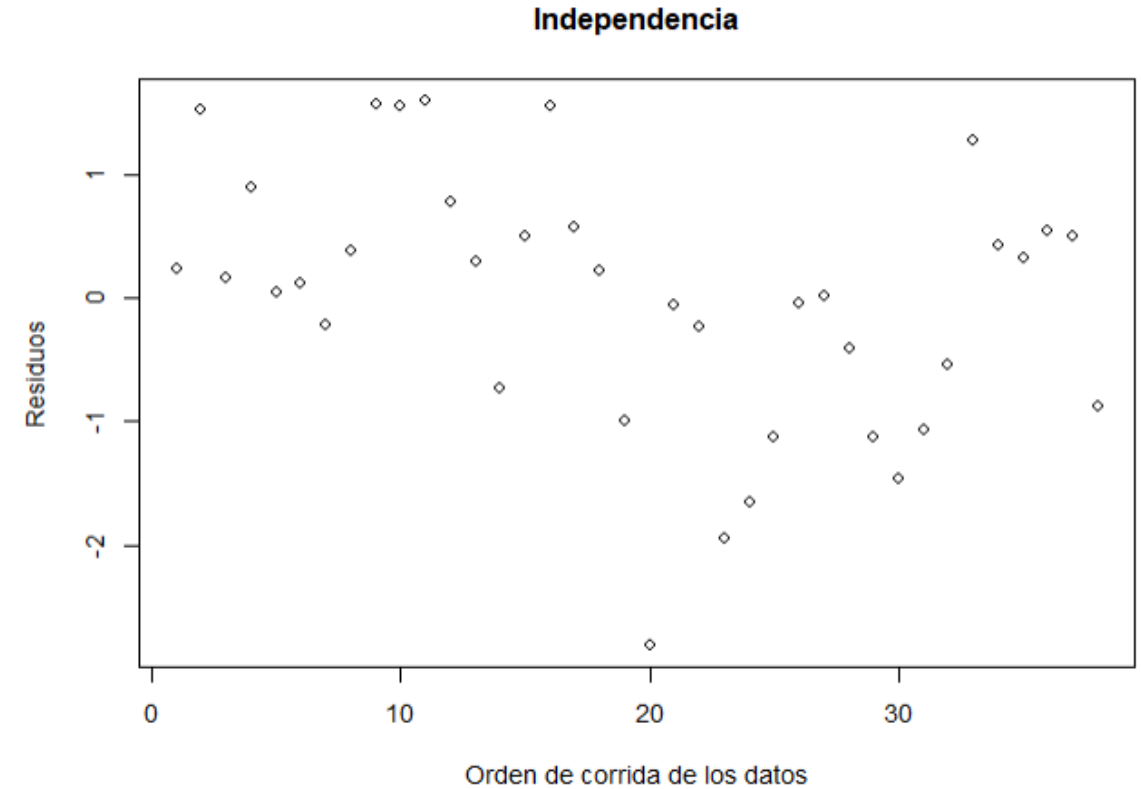BP = 8.4455, df = 4, p-value = 0.07656

Normalidad

Normalidad

Shapiro-Wilk normality test

data: restud
W = 0.96083, p-value = 0.202
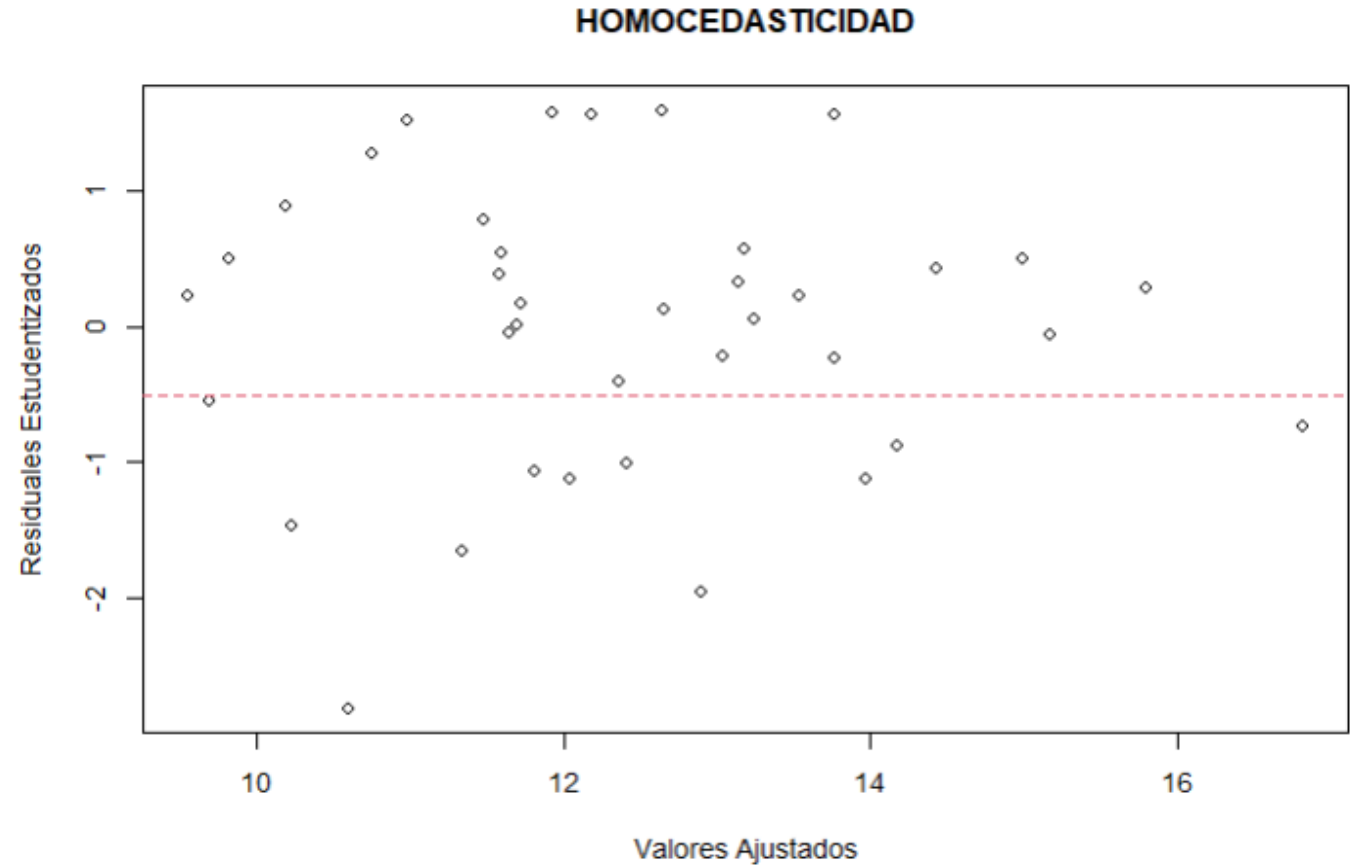
Independencia

Linealidad

HOMOCEDASTICIDAD

Residuales Estudentizados

Valores Ajustados

Datos atípicos, influyentes y de balanceo

	calidad	yhat	se.yhat	residuals	res.estud	Cooks.D	hii.value	Dffits
1	9.8	9.550593	0.4814475	0.2494	0.2309	0.0022	0.1697	0.1044
2	12.6	10.974741	0.4239194	1.6253	1.5220	0.0675	0.1316	0.5925
3	11.9	11.719974	0.4106090	0.1800	0.1621	0.0008	0.1235	0.0608
4	11.1	10.182308	0.5530261	0.9177	0.8886	0.0459	0.2240	0.4774
5	13.3	13.240222	0.3079540	0.0598	0.0522	0.0000	0.0695	0.0143
6	12.8	12.658483	0.2280178	0.1415	0.1216	0.0001	0.0381	0.0242
7	12.8	13.042554	0.3197200	-0.2426	-0.2127	0.0008	0.0749	-0.0605
8	12.0	11.578411	0.3871608	0.4216	0.3774	0.0036	0.1098	0.1325
9	13.6	11.920387	0.4192720	1.6796	1.5740	0.0701	0.1287	0.6050
10	13.9	12.184564	0.3213387	1.7154	1.5597	0.0381	0.0756	0.4461
11	14.4	12.642565	0.3036790	1.7574	1.5934	0.0351	0.0675	0.4288
12	12.3	11.480681	0.5240244	0.8193	0.7798	0.0310	0.2011	0.3912
13	16.1	15.790696	0.5015826	0.3093	0.2890	0.0039	0.1842	0.1373
14	16.1	16.825037	0.6429764	-0.7250	-0.7379	0.0480	0.3028	-0.4863
15	15.5	14.989543	0.5691174	0.5105	0.4944	0.0156	0.2372	0.2757
16	15.5	13.771291	0.2870637	1.7287	1.5589	0.0299	0.0603	0.3951
17	13.8	13.182063	0.4527100	0.6179	0.5677	0.0116	0.1501	0.2386
18	13.8	13.539788	0.3043794	0.2602	0.2273	0.0008	0.0678	0.0613
19	11.3	12.408670	0.3757573	-1.1087	-1.0020	0.0232	0.1034	-0.3403
20	7.9	10.594801	0.5038611	-2.6948	-2.8104	0.2984	0.1859	-1.3431
21	15.1	15.169593	0.4084041	-0.0696	-0.0626	0.0001	0.1221	-0.0234
22	13.5	13.764117	0.2851170	-0.2641	-0.2297	0.0007	0.0595	-0.0578
23	10.8	12.899737	0.3268540	-2.0997	-1.9494	0.0595	0.0782	-0.5679
24	9.5	11.334127	0.2560490	-1.8341	-1.6501	0.0261	0.0480	-0.3706
25	12.7	13.972920	0.2955963	-1.2729	-1.1307	0.0173	0.0640	-0.2956
26	11.6	11.646697	0.2967584	-0.0467	-0.0407	0.0000	0.0645	-0.0107
27	11.7	11.689330	0.5022537	0.0107	0.0100	0.0000	0.1847	0.0047
28	11.9	12.360693	0.2910171	-0.4607	-0.4019	0.0022	0.0620	-0.1033
29	10.8	12.040518	0.3690954	-1.2405	-1.1233	0.0277	0.0998	-0.3740
30	8.7	10.229524	0.4970033	-1.5295	-1.4716	0.0924	0.1809	-0.6916
31	10.7	11.812098	0.5245728	-1.1121	-1.0673	0.0573	0.2015	-0.5362
32	9.1	9.693448	0.4550597	-0.5934	-0.5455	0.0109	0.1517	-0.2306
33	12.1	10.744653	0.4644759	1.3553	1.2760	0.0600	0.1580	0.5527
34	14.9	14.434934	0.4591855	0.4651	0.4274	0.0068	0.1544	0.1826
35	13.5	13.134402	0.3560850	0.3656	0.3240	0.0022	0.0929	0.1037
36	12.2	11.595244	0.4080355	0.6048	0.5464	0.0085	0.1219	0.2036
37	10.3	9.822123	0.6933373	0.4779	0.5023	0.0280	0.3520	0.3702
38	13.2	14.178470	0.3657377	-0.9785	-0.8786	0.0169	0.0980	-0.2895

Intervalos del 90%

X00=(1, 5.2, 4.3, 5.0, 6.0)

h00.value
0.2015224

y0hat.fit
11.81210