

## Chapter 9: The linear model (regression)

### Labcoat Leni's Real Research

#### Why do you like your lecturers?

##### Problem



Chamorro-Premuzic, T., et al. (2008). *Personality and Individual Differences*, 44, 965–976.

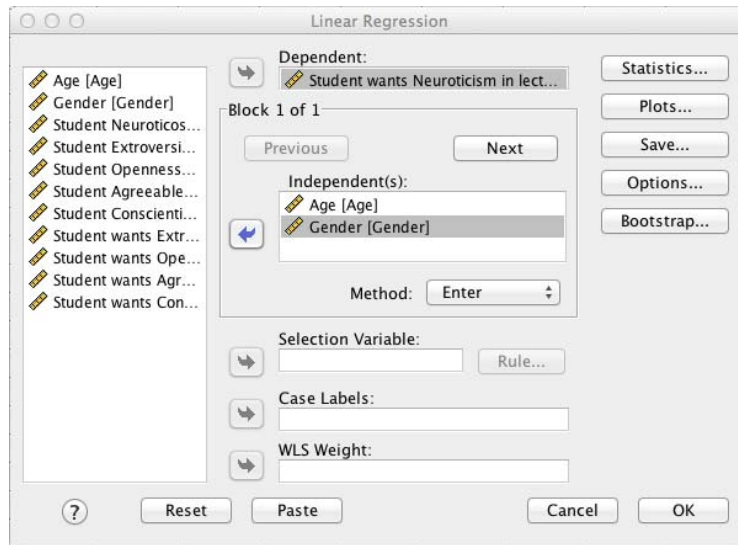
In the previous chapter we encountered a study by Chamorro-Premuzic et al. in which they measured students' personality characteristics and asked them to rate how much they wanted these same characteristics in their lecturers. In that chapter we correlated these scores; however, we could go a step further and see whether students' personality characteristics predict the characteristics that they would like to see in their lecturers.

The data from this study are in the file **Chamorro-Premuzic.sav**. Labcoat Leni wants you to carry out five multiple regression analyses: the outcome variables in each of the five analyses are the ratings of how much students want to see neuroticism, extroversion, openness to experience, agreeableness and conscientiousness. For each of these outcomes, force age and gender into the analysis in the first step of the hierarchy, then in the second block force in the five student personality traits (neuroticism, extroversion, openness to experience, agreeableness and conscientiousness). For each analysis create a table of the results.

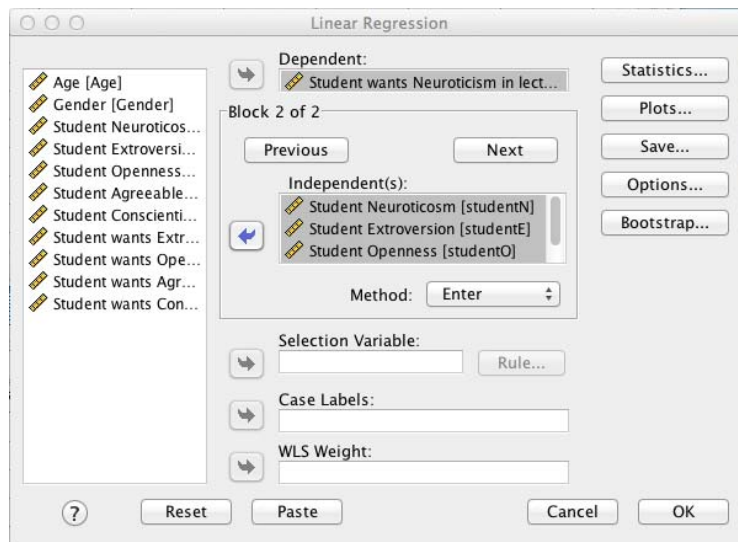
##### Solution

###### **Lecturer Neuroticism**

The first regression we'll do is whether students want lecturers to be neurotic. Define the two blocks as follows. In the first block put Age and Gender (I ran this analysis on a Mac, so the screenshots will look a little different from the rest of the book, but they are basically the same):



In the second, put all of the student personality variables (five variables in all):



Set the options as in the book chapter.

The main output (I haven't reproduced it all, but you can find it in the file **Charmorro-Premuzic.spv**), is as follows:

Model Summary<sup>a</sup>

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.167 <sup>a</sup>	.028	.023	8.77393	.028	5.300	2	370	.005	
2	.253 <sup>a</sup>	.064	.046	8.66878	.036	2.806	5	365	.017	1.963

a. Predictors: (Constant), Gender, Age

b. Predictors: (Constant), Gender, Age, Student Extroversion, Student Openness, Student Agreeableness, Student Neuroticism, Student Conscientiousness

c. Dependent Variable: Student wants Neuroticism in lecturers

ANOVA<sup>a</sup>

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	816.040	2	408.020	5.300	.005 <sup>a</sup>
	Residual	28483.290	370	76.982		
	Total	29299.330	372			
2	Regression	1870.379	7	267.197	3.556	.001 <sup>a</sup>
	Residual	27428.951	365	75.148		
	Total	29299.330	372			

a. Predictors: (Constant), Gender, Age

b. Predictors: (Constant), Gender, Age, Student Extroversion, Student Openness, Student Agreeableness, Student Neuroticism, Student Conscientiousness

c. Dependent Variable: Student wants Neuroticism in lecturers

Coefficients<sup>a</sup>

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B		Correlations			Collinearity Statistics		
		B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF	
1	(Constant)	-28.220	2.586		-10.913	.000	-33.305	-23.135						
	Age	.278	.129	.110	2.151	.032	.024	.533	.115	.111	.110	.999	1.001	
	Gender	2.419	1.023	.121	2.364	.019	.407	4.430	.125	.122	.121	.999	1.001	
2	(Constant)	-16.774	5.296		-3.167	.002	-27.189	-6.359						
	Age	.301	.128	.119	2.353	.019	.049	.553	.115	.122	.119	.995	1.005	
	Gender	1.903	1.085	.095	1.754	.080	-.230	4.037	.125	.091	.089	.867	1.153	
	Student Neuroticism	-.060	.059	-.059	-1.022	.307	-.176	.056	-.015	-.053	-.052	.762	1.313	
	Student Extroversion	-.107	.075	-.078	-1.428	.154	-.256	.041	-.091	-.075	-.072	.853	1.172	
	Student Openness	-.174	.073	-.123	-2.391	.017	-.318	-.031	-.099	-.124	-.121	.974	1.027	
	Student Agreeableness	.087	.072	.073	1.218	.224	-.054	.228	-.018	.064	.062	.719	1.391	
	Student Conscientiousness	-.203	.082	-.157	-2.482	.013	-.363	-.042	-.124	-.129	-.126	.845	1.550	

a. Dependent Variable: Student wants Neuroticism in lecturers

Excluded Variables<sup>a</sup>

Model		Beta In	t	Sig.	Partial Correlation	Collinearity Statistics		
						Tolerance	VIF	Minimum Tolerance
1	Student Neuroticism	.017 <sup>a</sup>	.319	.750	.017	.942	1.062	.941
	Student Extroversion	-.069 <sup>a</sup>	-1.715	.087	-.089	.999	1.001	.998
	Student Openness	-.116 <sup>a</sup>	-2.262	.024	-.117	.988	1.012	.987
	Student Agreeableness	-.007 <sup>a</sup>	-.137	.891	-.007	.988	1.012	.987
	Student Conscientiousness	-.110 <sup>a</sup>	-2.109	.036	-.109	.961	1.040	.961

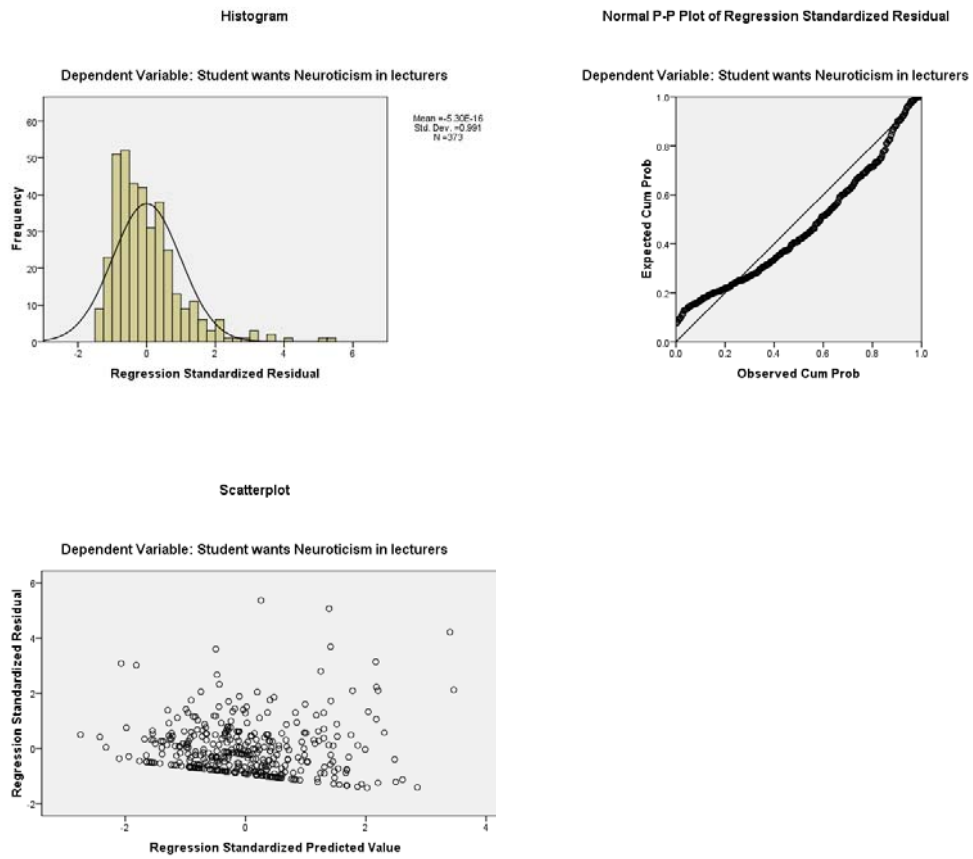
a. Predictors in the Model: (Constant), Gender, Age

b. Dependent Variable: Student wants Neuroticism in lecturers

Cases Diagnostics<sup>a</sup>

Case Number	Std. Residual	Student wants Neuroticism in lecturers	Predicted Value	Residual
14	-3.084	.00	-26.7384	26.73836
34	3.019	.00	-26.1746	26.17456
149	2.316	-3.00	-23.0767	20.07671
203	2.903	5.00	-19.2951	24.29508
247	2.037	-4.00	-21.6626	17.66256
277	4.208	22.00	-14.4774	36.47737
282	3.143	10.00	-17.2458	27.24581
286	2.115	4.00	-14.3368	18.33676
400	2.217	2.00	-17.2208	19.22084
403	2.049	-6.00	-23.7646	17.76463
407	2.672	.00	-23.1646	23.16463
411	2.095	1.00	-17.1585	18.15846
414	3.600	8.00	-23.2076	31.20758
419	5.074	25.00	-18.9847	43.98469
422	5.367	25.00	-21.5246	46.52460
425	3.683	13.00	-18.9311	31.93106
427	2.089	.00	-18.1093	18.10933

a. Dependent Variable: Student wants Neuroticism in lecturers



You could report these results as follows:

	<i>B</i>	<i>SE B</i>	<i>β</i>
<b>Step 1</b>			
Constant	-28.22	2.59	
Age	0.28	0.13	.11*
Gender	2.42	1.02	.12*
<b>Step 2</b>			
Constant	-16.77	5.30	
Age	0.30	0.13	.12*
Gender	1.90	1.08	.10
Neuroticism	-0.06	0.06	-0.06
Extroversion	-0.12	0.08	-0.08

Openness	-0.17	0.07	-.12*
Agreeableness	0.09	0.07	.07
Conscientiousness	-0.20	0.08	-.16*

Note:  $R^2 = .03$  for step 1;  $\Delta R^2 = .04$  for step 2 ( $p < .05$ ). \*  $p < .05$ .

So basically, age, openness and conscientiousness were significant predictors of wanting a neurotic lecturer (note that for openness and conscientiousness the relationship is negative, i.e. the more a student scored on these characteristics, the *less* they wanted a neurotic lecturer).

### **Lecturer Extroversion**

The second variable we want to predict is lecturer extroversion. I won't run through the analysis and output, but you can find it in the file **Charmorro-Premuzic.spv**.

You could report these results as follows:

	<i>B</i>	<i>SE B</i>	$\beta$
Step 1			
Constant	12.13	2.43	
Age	.03	.12	.01
Gender	.93	.94	.06
Step 2			
Constant	3.62	4.93	
Age	.02	.12	.01
Gender	1.31	1.00	.08
Neuroticism	.00	.06	.01
Extroversion	.15	.07	.14*
Openness	.04	.07	.03
Agreeableness	.00	.07	.00
Conscientiousness	.10	.08	.10

Note.  $R^2 = .00$  for step 1;  $\Delta R^2 = .03$  for step 2 ( $ps > .05$ ). \*  $p < .05$ .

So basically, student extroversion was the only significant predictor of wanting an extrovert lecturer; the model overall did not explain a significant amount of the variance in wanting an extroverted lecturer.

### ***Lecturer Openness to Experience***

The third variable we want to predict is lecturer openness to experience. As before, the SPSS output can be found in the file **Charmorro-Premuzic.spv**.

You could report these results as follows:

	<i>B</i>	<i>SE B</i>	<i>β</i>
Step 1			
Constant	9.41	2.37	
Age	-.04	.12	-.02
Gender	.23	.92	.01
Step 2			
Constant	-5.16	4.75	
Age	-.05	.12	-.02
Gender	.09	.96	.01
Neuroticism	.01	.05	.01
Extroversion	.07	.07	.05
Openness	.26	.07	.20***
Agreeableness	.14	.06	.12*
Conscientiousness	-.03	.07	-.03

*Note:*  $R^2 = .00$  for step 1 (*ns*);  $\Delta R^2 = .06$  for step 2 ( $p < .001$ ). \*  $< .05$ , \*\*\* $p < .001$ .

So basically, student openness to experience was the most significant predictor of wanting a lecturer who is open to experience, but student agreeableness predicted this also.

**Lecturer Agreeableness**

The fourth variable we want to predict is lecturer agreeableness. As before, the SPSS output can be found in the file **Charmorro-Premuzic.spv**.

You could report these results as follows:

	<i>B</i>	<i>SE B</i>	$\beta$
Step 1			
Constant	18.30	2.77	
Age	-.47	.14	-.17
Gender	-.83	1.07	-.04
Step 2			
Constant	8.76	5.51	
Age	-.47	.14	-.17**
Gender	.78	1.11	.04
Neuroticism	.14	.06	.13*
Extroversion	.05	.08	.03
Openness	-.22	.08	-.14**
Agreeableness	.14	.07	.11
Conscientiousness	.14	.09	.10

Note:  $R^2 = .03$  for step 1 ( $p < .01$ );  $\Delta R^2 = .06$  for step 2 ( $p < .001$ ). \* $p < .05$ , \*\* $p < .01$ .

Age, student openness to experience and student neuroticism significantly predicted wanting a lecturer who is agreeable. Age and openness to experience had negative relationships (the older and more open to experienced you are, the less you want an agreeable lecturer), whereas as student neuroticism increases so does the desire for an agreeable lecturer (not surprisingly, because neurotics will lack confidence and probably feel more able to ask an agreeable lecturer questions).

**Lecturer Conscientiousness**

The final variable we want to predict is lecturer conscientiousness. As before, the SPSS output can be found in the file **Charmorro-Premuzic.spv**.

You could report these results as follow:

	<i>B</i>	<i>SE B</i>	<i>β</i>
Step 1			
Constant	13.84	2.24	
Age	.16	.11	.07
Gender	-2.33	.87	-.14**
Step 2			
Constant	5.85	4.50	
Age	.14	.11	.06
Gender	-1.65	.91	-.10
Neuroticism	-.01	.05	-.01
Extroversion	-.06	.07	-.05
Openness	-.01	.06	-.01
Agreeableness	.12	.06	.12*
Conscientiousness	.16	.07	.14*

Note:  $R^2 = .02$  for step 1 ( $p < .05$ );  $\Delta R^2 = .05$  for step 2 ( $p < .01$ ). \* $p < .05$ , \*\* $p < .01$ .

Student agreeableness and conscientiousness both predicted wanting a lecturer who is conscientious. Note also that gender predicted this in the first step, but its  $b$  became slightly non-significant ( $p = .07$ ) when the student personality variables were forced in as well. However, gender is probably a variable that should be explored further within this context.

Compare your results to Table 4 in the actual article (shown below). I've highlighted the area of the table relating to our analyses (our five analyses are represented by the columns labelled N, E, O, A and C).



Table 4  
Regressions of students' gender, age, big five, and learning style as predictors of LPQ ratings

		Preference for lecturers'										
		N		E		O		A		C		
		$\beta$	t	$\beta$	t	$\beta$	t	$\beta$	t	$\beta$	t	
Students'	1											
		Age	.11	2.13*	.02	.34	-.01	.19	-.17	3.43**	.05	1.08
		Gender	.11	2.30*	.07	1.15	.01	.23	-.03	.62	-.12	2.48*
		(2365)	5.10**		.75		.04		6.19**		3.55*	
		Adj. $R^2$	.02		.01		.00		.03		.01	
	$R^2$	.02		.06		.00		.03		.02		
2		Age	.12	2.36*	.00	.05	-.01	.27	-.18	3.62**	.04	.90
		Gender	.09	1.65	.10	1.58	-.00	.13	.06	1.11	-.08	1.49
		N	-.05	1.00	.03	.48	.00	.08	.16	2.90**	.01	.31
		E	-.08	1.56	.16	2.45*	.06	1.13	.05	.97	-.05	1.01
		O	-.12	2.38*	.03	.56	.21	4.08**	-.14	2.78**	-.01	.23
		A	.07	1.25	.00	.09	.13	2.19*	.11	1.98*	.14	2.34*
		C	-.16	2.54**	.11	1.46	-.05	.84	.10	1.66	.12	2.00*
		(7360)	3.61**		1.80*		3.44**		6.29**		4.01**	
		Adj. $R^2$	.05 $\Delta$ **		.05 $\Delta$ **		.04 $\Delta$ **		.09 $\Delta$ **		.05 $\Delta$ **	
		$R^2$	.06		.06		.06		.11		.07	
		Age	.09	1.88*	.02	.45	-.02	.44	-.15	3.89**	.05	1.89
		Gender	.06	1.15	.08	1.14	.01	.16	.07	1.39	-.11	2.07*
		N	-.07	1.20	-.00	.05	-.01	.26	.11	1.94*	-.02	.35
	E	-.10	1.86	.14	2.16*	.04	.83	.02	.51	-.08	1.48	
	O	-.15	2.58**	.12	1.75	.19	3.32**	-.04	.79	.05	.91	
	A	-.02	.22	-.06	.52	.15	1.44	.27	2.72**	.02	.26	
	C	-.14	2.29*	.13	1.77	-.05	.87	.09	1.50	.14	2.27*	
	SM	-.05	.83	.04	.53	.10	1.59	.15	2.50**	.02	.38	
	DM	.16	2.34*	-.10	1.32	.04	.62	.04	.61	.02	.39	
	AM	-.00	.10	.14	1.36	-.09	1.07	-.21	2.55**	.11	1.26	
	SS	.13	2.16*	.07	1.01	-.01	.27	.09	1.51	.12	2.01*	
	DS	.05	.82	-.06	.73	.04	.56	-.13	1.91*	-.05	.80	
	AS	-.03	.72	-.06	.52	.16	1.44	.35	2.77**	.18	.26	
	(12,354)	3.43**		1.88*		2.40**		5.62**		3.19**		
	Adj. $R^2$	.07 $\Delta$ **		.08		.04		.13 $\Delta$ **		.07		
	$R^2$	.07		.08		.07		.16		.10		

Note: N = 387; gender coded 0 = female, 1 = male; N = Neuroticism, E = Extraversion, O = Openness, A = Agreeableness, C = Conscientiousness; SM = Surface motive; DM = deep motive; AM = achieving motive; SS = surface strategy; DS = deep strategy; AS = achieving strategy; \*\* $p < .01$ , \* $p < .05$ ;  $\Delta$  = significant Delta change (increase in variance %); all  $\beta$  coefficients are standardized.

Table 4 from Chamorro-Premuzic et al. (2008)