

8

Checking the models I: independence

New commands are introduced in just one section of this chapter.

8.2 Repeated measures

The main test discusses how to correctly analyse a repeated measures data set. The first option given is the single summary approach, as illustrated here. We use the dataset *piglets.sav* for this analysis, and not *Chapter08.sav*. This saves us having to produce an unnatural new name for the shorter DIET.

SPSS COMMANDS FOR BOX 8.3 Analysing the pigs' final weight	
Syntax	<pre>glm LOGWT60 by DIET /print parameters /design DIET.</pre>
Menu route	Analyze > General Linear Model > Univariate LOGWT60 → Dependent Variable DIET → Fixed Factor(s) <input type="text" value="Options"/> <input checked="" type="checkbox"/> Parameter estimates

SPSS OUTPUT FOR BOX 8.3 **Analysing the pigs' final weight****General linear model****Between-Subjects Factors**

		N
DIET	1	5
	2	5

Tests of Between-Subjects Effects

Dependent Variable: LOGWT60

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	6.123E-02 ^a	1	6.123E-02	4.320	.071
Intercept	203.220	1	203.220	14337.786	.000
DIET	6.123E-02	1	6.123E-02	4.320	.071
Error	.113	8	1.417E-02		
Total	203.394	10			
Corrected Total	.175	9			

a. R Squared = .351 (Adjusted R Squared = .269)

Parameter Estimates

Dependent Variable: LOGWT60

Parameter	B	Std. Error	t	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Intercept	4.430	.053	83.200	.000	4.307	4.553
[DIET=1]	.156	.075	2.078	.071	-1.713E-02	.330
[DIET=2]	0 ^a

a. This parameter is set to zero because it is redundant

The second option is a multivariate analysis. SPSS does provide a command to analyse these sorts of data sets, and a brief example is given here, again using the 'one-pig-one-datapoint' dataset (Table 8.2 in the main text) saved as *piglets.sav* on the website. Using the MANOVA subcommand, an analysis of variance with multiple Y variables will test the null hypothesis that there is no difference between the two diets.

SPSS COMMANDS FOR BOX 8.4 Analysis of variance with multiple Y variables	
Syntax	glm LOGWT3 LOGWT8 LOGWT20 LOGWT60 by DIET /design DIET.
Menu route	Analyze > General Linear Model > Multivariate LOGWT3 LOGWT8 LOGWT20 LOGWT60 → Dependent Variables DIET → Fixed Factor(s)

SPSS also produces a large table that contains the one-way ANOVA tables for each of the four variables.

SPSS OUTPUT FOR BOX 8.4 Analysis of variance with multiple Y variables					
General linear model					
Between-Subjects Factors					
	N				
DIET 1	5				
2	5				
Multivariate Tests^b					
Effect	Value	F	Hypothesis df	Error df	Sig.
Intercept Pillai's Trace	1.000	5668.030 ^a	4.000	5.000	.000
Wilks' Lambda	.000	5668.030 ^a	4.000	5.000	.000
Hotelling's Trace	4534.424	5668.030 ^a	4.000	5.000	.000
Roy's Largest Root	4534.424	5668.030 ^a	4.000	5.000	.000
DIET Pillai's Trace	.418	.896 ^a	4.000	5.000	.529
Wilks' Lambda	.582	.896 ^a	4.000	5.000	.529
Hotelling's Trace	.717	.896 ^a	4.000	5.000	.529
Roy's Largest Root	.717	.896 ^a	4.000	5.000	.529
a. Exact statistic					
b. Design: Intercept+DIET					
(Contd.)					

SPSS OUTPUT FOR BOX 8.4 (Contd.)

Tests of Between-Subjects Effects

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	LOGWT3	1.426E-02 ^a	1	1.426E-02	1.059	.334
	LOGWT8	2.276E-02 ^b	1	2.276E-02	2.897	.127
	LOGWT20	3.914E-02 ^c	1	3.914E-02	3.168	.113
	LOGWT60	6.123E-02 ^d	1	6.123E-02	4.320	.071
Intercept	LOGWT3	5.205	1	5.205	386.415	.000
	LOGWT8	25.831	1	25.831	3287.894	.000
	LOGWT20	136.764	1	136.764	11070.308	.000
	LOGWT60	203.220	1	203.220	14337.786	.000
DIET	LOGWT3	1.426E-02	1	1.426E-02	1.059	.334
	LOGWT8	2.276E-02	1	2.276E-02	2.897	.127
	LOGWT20	3.914E-02	1	3.914E-02	3.168	.113
	LOGWT60	6.123E-02	1	6.123E-02	4.320	.071
Error	LOGWT3	.108	8	1.347E-02		
	LOGWT8	6.285E-02	8	7.856E-03		
	LOGWT20	9.883E-02	8	1.235E-02		
	LOGWT60	.113	8	1.417E-02		
Total	LOGWT3	5.327	10			
	LOGWT8	25.916	10			
	LOGWT20	136.902	10			
	LOGWT60	203.394	10			
Corrected Total	LOGWT3	.122	9			
	LOGWT8	8.561E-02	9			
	LOGWT20	.138	9			
	LOGWT60	.175	9			

a. R Squared = .117 (Adjusted R Squared = .006)

b. R Squared = .266 (Adjusted R Squared = .174)

c. R Squared = .284 (Adjusted R Squared = .194)

d. R Squared = .351 (Adjusted R Squared = .269)

We use *Chapter08.sav* for the remaining examples and exercises.

8.6 Exercises

How non-independence can inflate sample size enormously

The calculation of LUPRATE is included in the commands.

SPSS COMMANDS FOR BOX 8.7 **Look-up rate in feeding sheep**

Syntax

```
compute LUPRATE = NLOOKUPS/DURATION.
execute.

glm LUPRATE by OBSPER SEX
/design OBSPER SEX.
```

Menu route Window > Data Editor

Transform > Compute

LUPRATE → Target Variable

“NLOOKUPS / DURATION” → Numeric Expression

Analyze > General Linear Model > Univariate

LUPRATE → Dependent Variable

OBSPER SEX → Fixed Factor(s)

Model

Custom

Factors & Covariates → Build Terms → Model

OBSPER → OBSPER

SEX → SEX

SPSS OUTPUT FOR BOX 8.7 **Look-up rate in feeding sheep**

General linear model

Between-Subjects Factors

		N
OBSPER	1	6
	2	6
	3	6
	4	6
	5	6
	6	6
	7	6
	8	6
	9	6
	10	6
	11	6
	12	6
	13	6
	14	6
	15	6
	16	6
	17	6
	18	6
	19	6
	SEX	1
2		60

Tests of Between-Subjects Effects

Dependent Variable: LUPRATE

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	.325 ^a	20	1.624E-02	3.871	.000
Intercept	5.375	1	5.375	1281.432	.000
OBSPER	.192	19	1.010E-02	2.408	.003
SEX	.133	1	.133	31.665	.000
Error	.415	99	4.194E-03		
Total	6.115	120			
Corrected Total	.740	119			

a. R Squared = .439 (Adjusted R Squared = .325)

Combining data from different experiments.

See SPSS output for this exercise in the answers for exercises.