Untitled

Gerard Castell i Joan Valls

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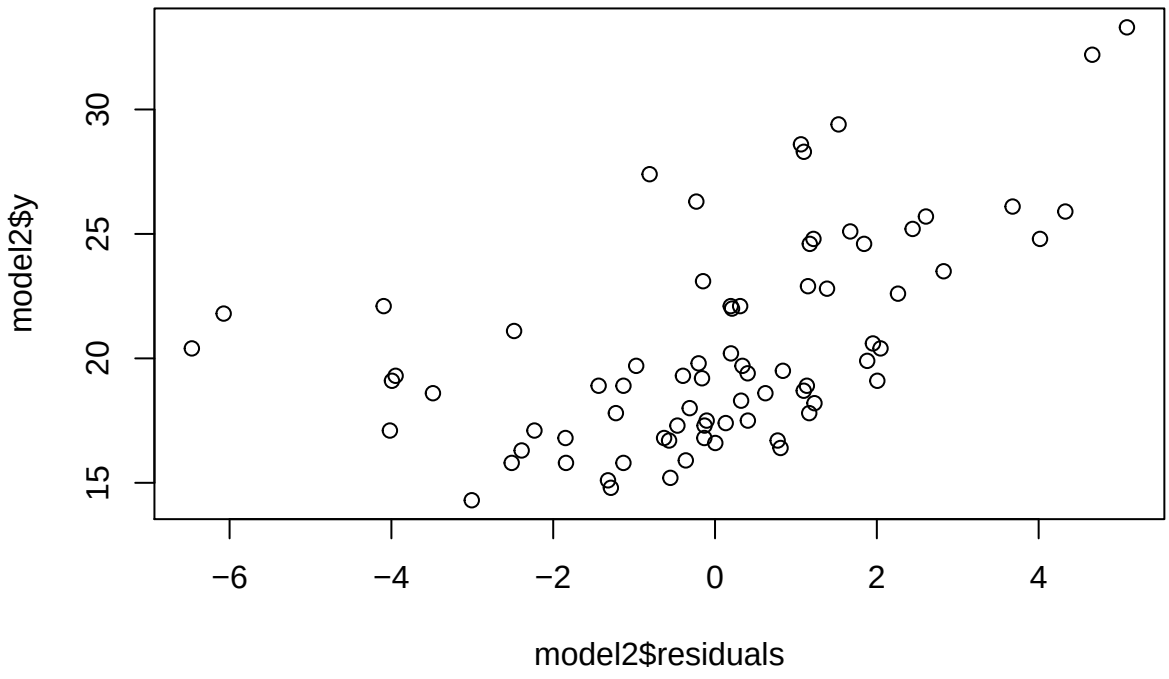
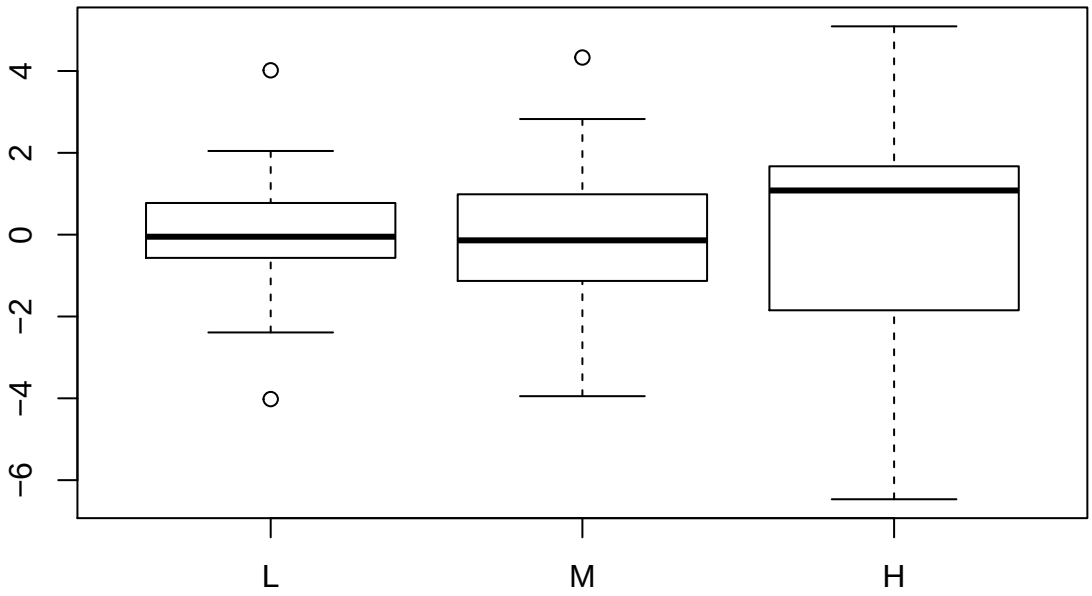
Multivariate model

Despite the fact of not being the optimal choice, a multivariate linear model was fitted to the data. It seems reasonable to think that observations are not independent, since they are comming from the same cow. However, this model can also lead to some interesting results.

From the bivariate linear regressions models fitted in the previous section, both time and dose seem to have some kind of effect in the PCV. Following this rationale, the first multivariant model used to explain differences in PCV among observations, was the one with the additive effects of the variables time and dose. Since both were significant, two F-tests were performed right after, to test if the models adding the new additive effect of number of births or the second order interaction between time and dose, were significantly different with respect to the first one. The variable with the lowest p-value under 0.05 was added to the model. This procedure was followed until no other covariates or interactions below 3rd order could be added, because they would not produce a significantly better model. Note that with this procedure the most parsimonious model was ensured to be found. Table 1 summarizes the results of all models considered. Finally, the best model explaining the data was,

$$PCV = 15.82 + 2.43X_{time} - 0.32X_{doseM} - 1.31X_{doseH} - 0.34X_{nbirth} + 0.48X_{doseM}X_{time} + 2.35X_{doseH}X_{time}$$




4
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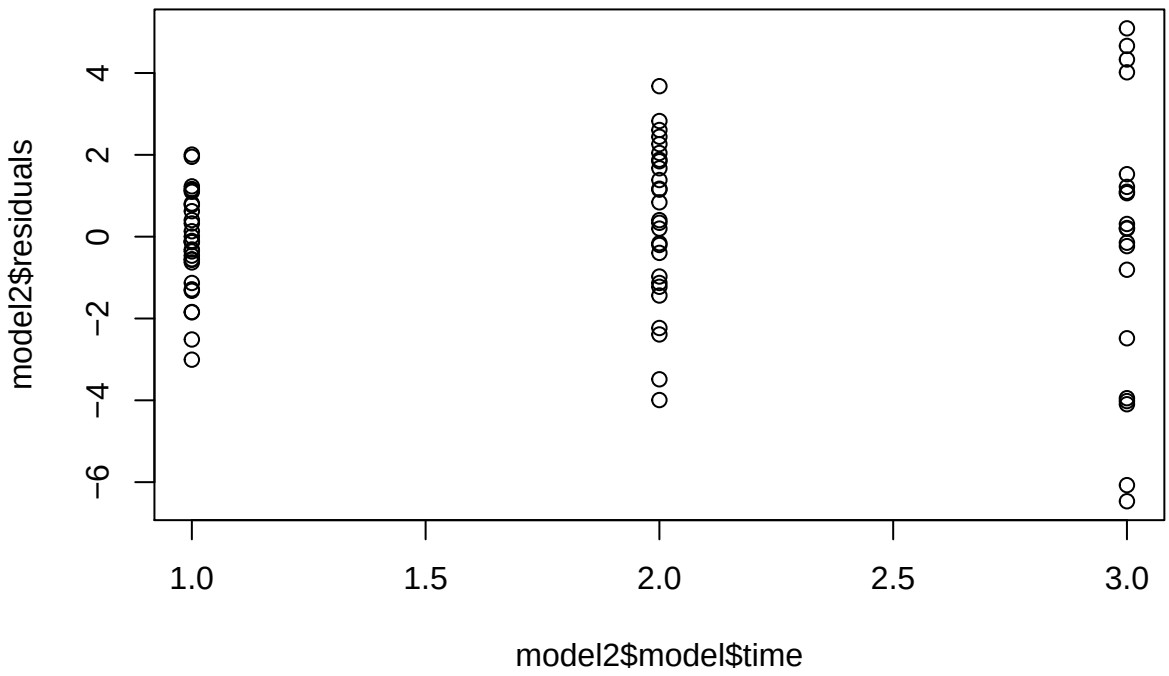
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4
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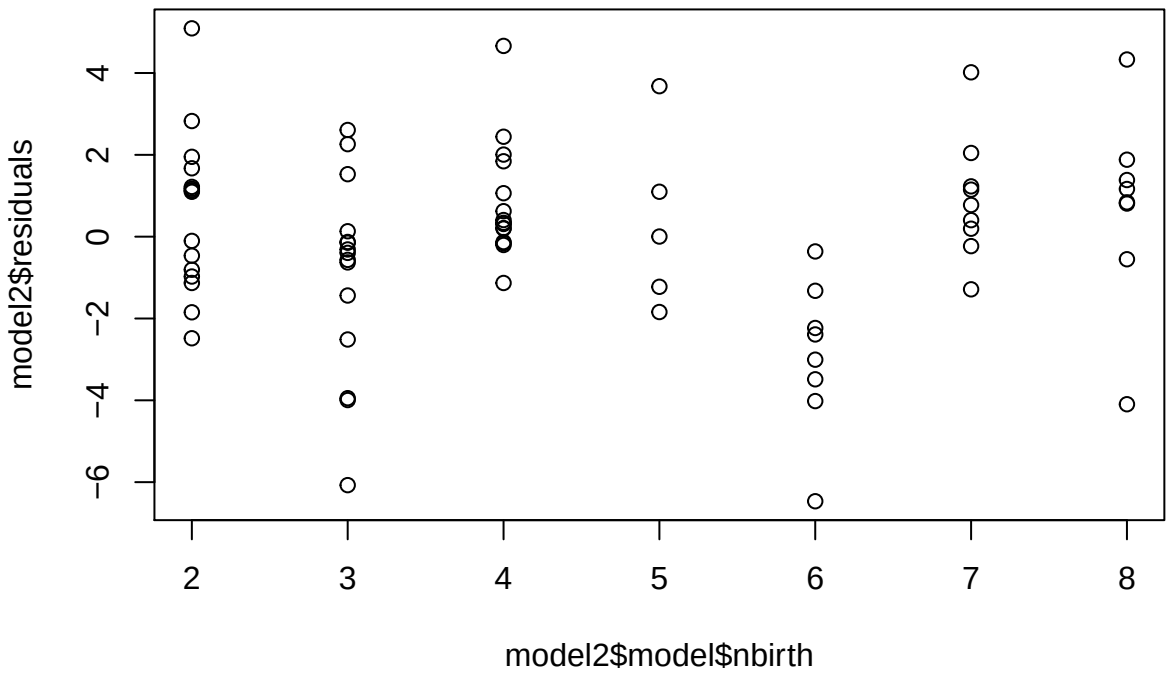
1.5
2.0
2.5
3.0
model2$model$time


model2$residuals
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−4
−2
0
2
4
2
3
4
5
6
7
8
model2$model$nbirth

Formula	Variables	Estimate	Std. Error	t value	Pr(>|t|)
pcv~time + dose	(Intercept)	12.3248	0.834	14.7788	0
	time	3.5488	0.3686	9.6281	0
	doseM	0.5629	0.7477	0.7528	0.454
	doseH	3.2009	0.7163	4.4688	0
pcv~time + dose + nbirth	(Intercept)	13.9405	1.0288	13.5508	0
	time	3.5807	0.3558	10.0628	0
	doseM	0.4042	0.7241	0.5582	0.5785
	doseH	3.0766	0.6928	4.4407	0
	nbirth	-0.3534	0.1402	-2.5203	0.014
pcv~time * dose + nbirth	(Intercept)	15.8457	1.3496	11.7408	0
	time	2.4286	0.6613	3.6725	5e-04
	doseM	-0.3189	1.748	-0.1824	0.8558
	doseH	-1.3061	1.6714	-0.7814	0.4372
	nbirth	-0.3355	0.1337	-2.5092	0.0145
	time:doseM	0.4806	0.8975	0.5355	0.594
	time:doseH	2.3514	0.84	2.7993	0.0066
pcv~dose + time * nbirth	(Intercept)	13.7005	1.7826	7.6857	0
	doseM	0.3971	0.7304	0.5436	0.5884
	doseH	3.0706	0.6986	4.3956	0
	time	3.7107	0.8637	4.2961	1e-04
	nbirth	-0.2983	0.362	-0.8238	0.4128
	time:nbirth	-0.0292	0.1763	-0.1655	0.869
pcv~time + dose * nbirth	(Intercept)	13.1703	1.5061	8.7446	0
	time	3.5643	0.358	9.9571	0
	doseM	0.6816	1.8149	0.3756	0.7084
	doseH	4.8865	1.8079	2.7029	0.0086
	nbirth	-0.1845	0.2808	-0.6572	0.5132
	doseM:nbirth	-0.0469	0.3645	-0.1288	0.8979
	doseH:nbirth	-0.3978	0.3615	-1.1004	0.275

Table 1: All multivariant models considered for fitting the data, using a forward stepwise for selecting the model.