

# On the Behavior of Marginal and Conditional Akaike Information Criteria in Linear Mixed Models

## Supplementary Material

Sonja Greven  
Department of Biostatistics  
Johns Hopkins University, Baltimore  
sgreven@jhsph.edu

Thomas Kneib  
Department of Statistics  
Ludwig-Maximilians-University Munich  
thomas.kneib@stat.uni-muenchen.de

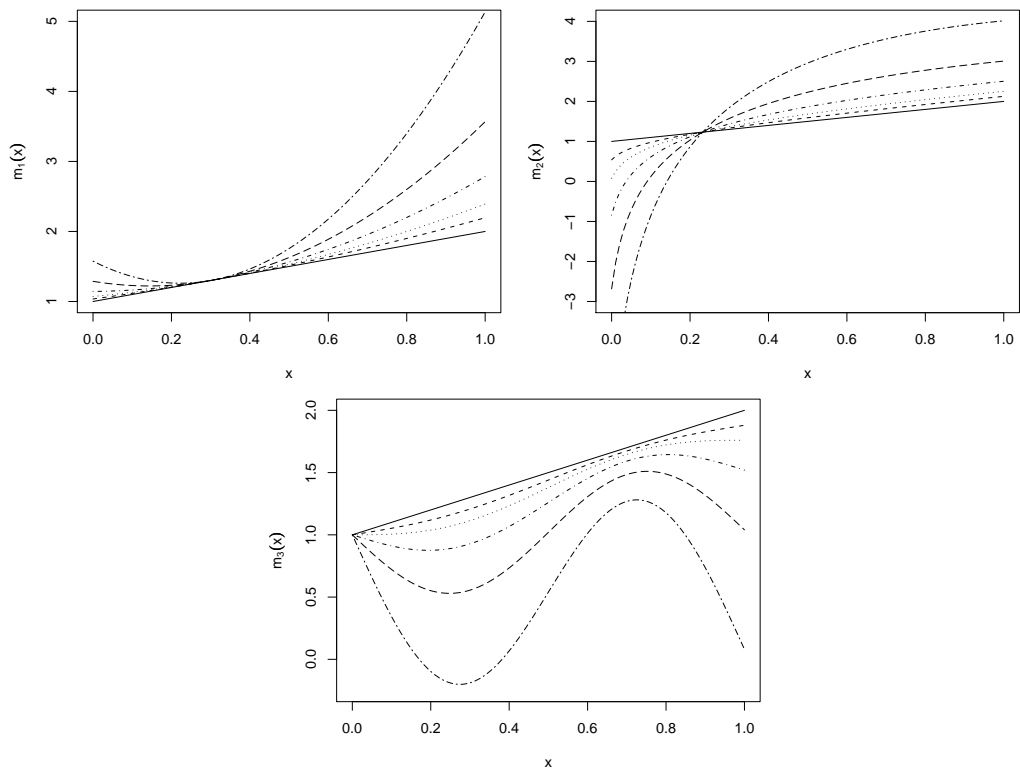


Figure 1: Functions estimated nonparametrically in the simulation study on penalized spline smoothing for varying values of the non-linearity parameter  $d$ .

## 5 Simulations

## 5.1 Penalised Spline Smoothing

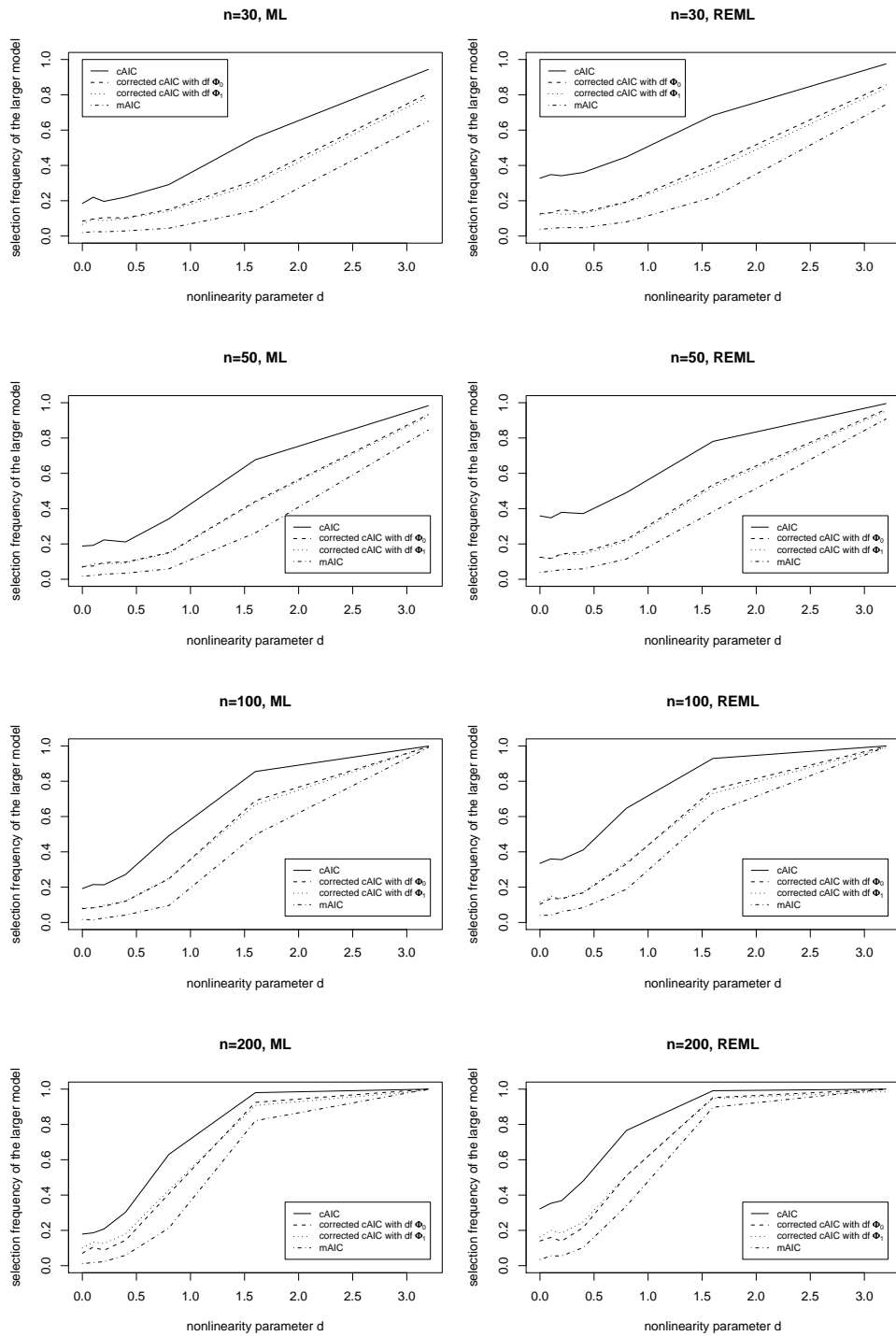


Figure 2: Proportion of simulation replications where the more complex, non-linear model was favored by the AIC for function  $f_1(x)$ .

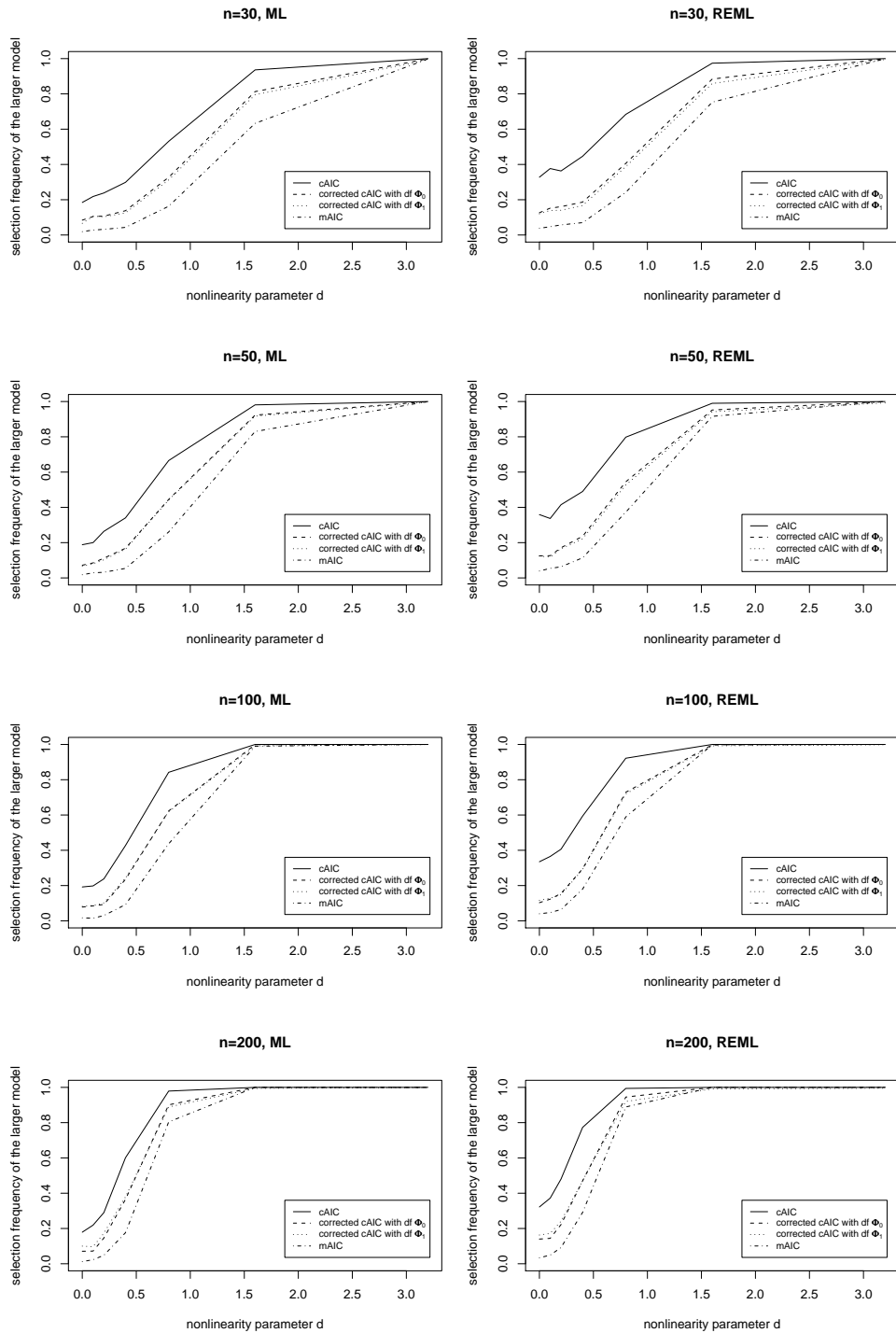


Figure 3: Proportion of simulation replications where the more complex, non-linear model was favored by the AIC for function  $f_2(x)$ .

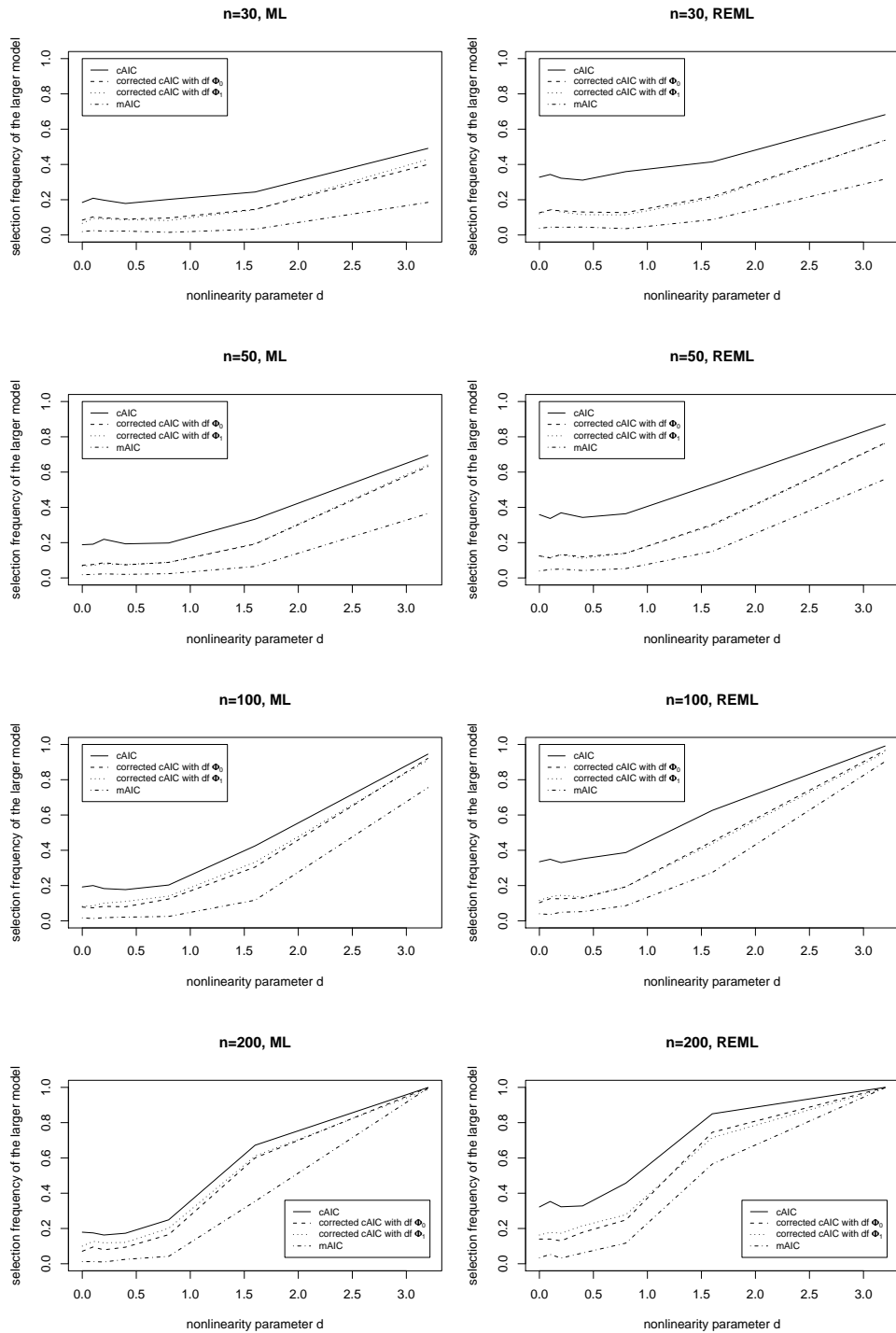


Figure 4: Proportion of simulation replications where the more complex, non-linear model was favored by the AIC for function  $f_3(x)$ .

## 5.2 Random Effects

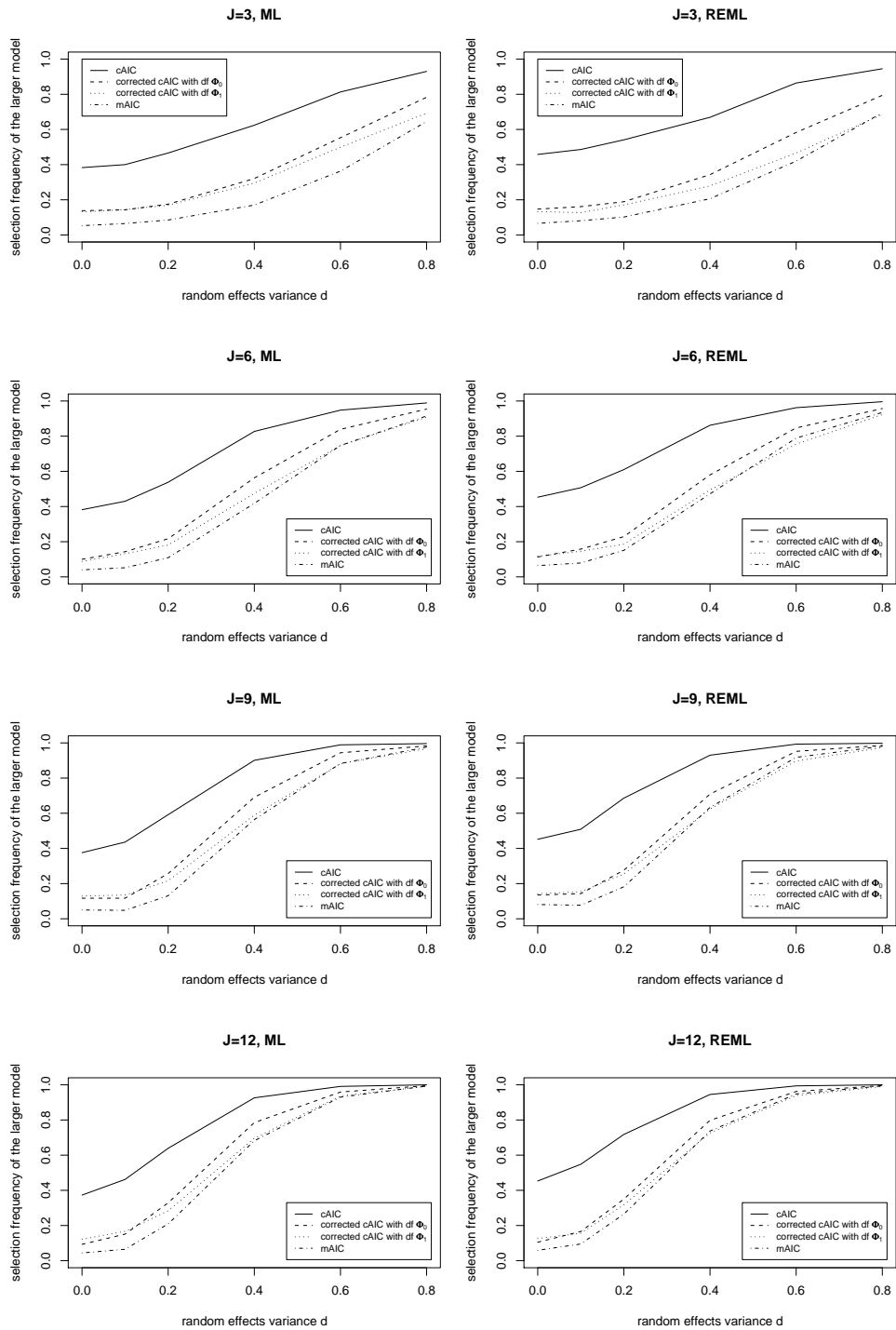


Figure 5: Proportion of simulation replications where the more complex random intercept model was favored by the AIC in the case of ten clusters.

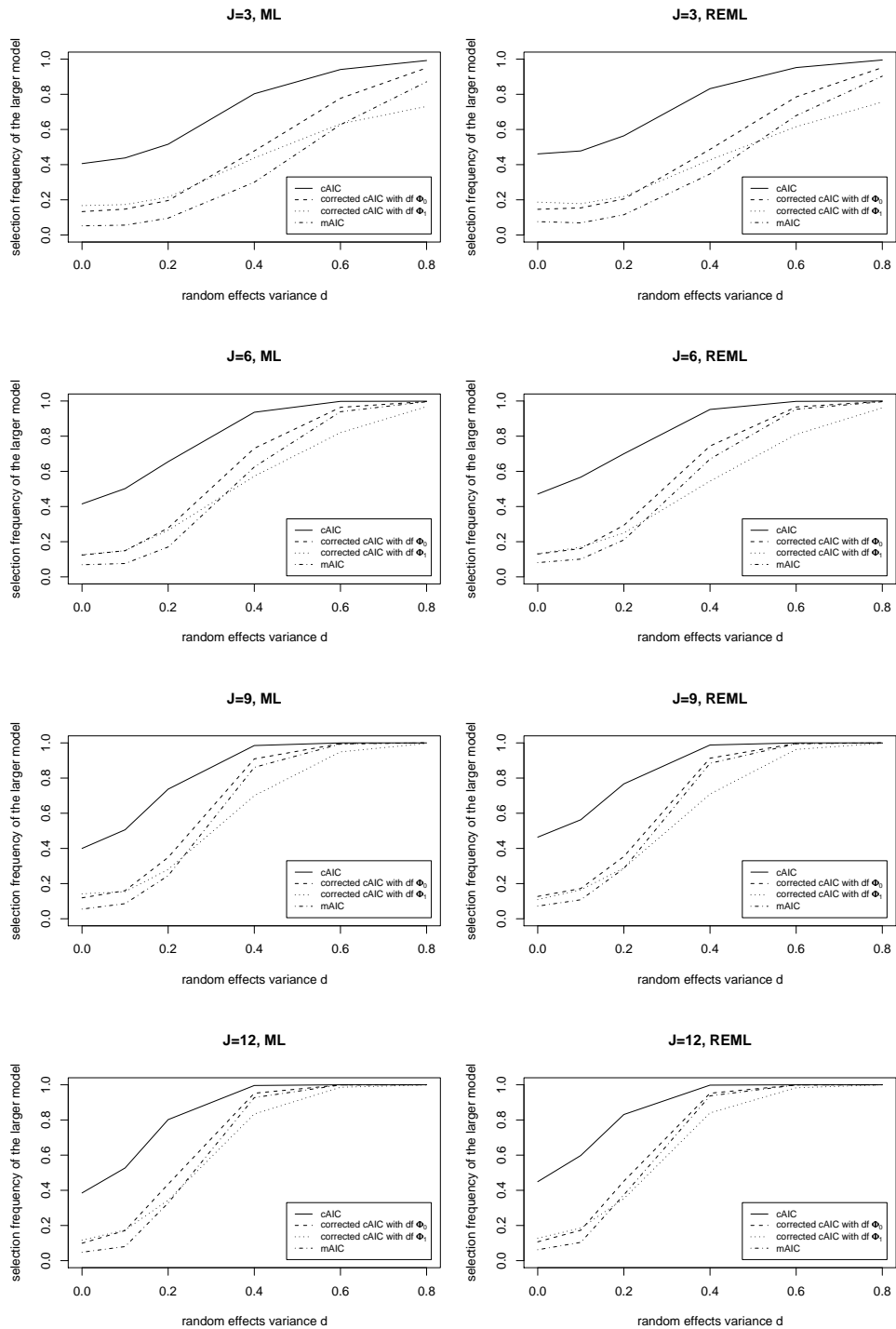


Figure 6: Proportion of simulation replications where the more complex random intercept model was favored by the AIC in the case of twenty clusters.

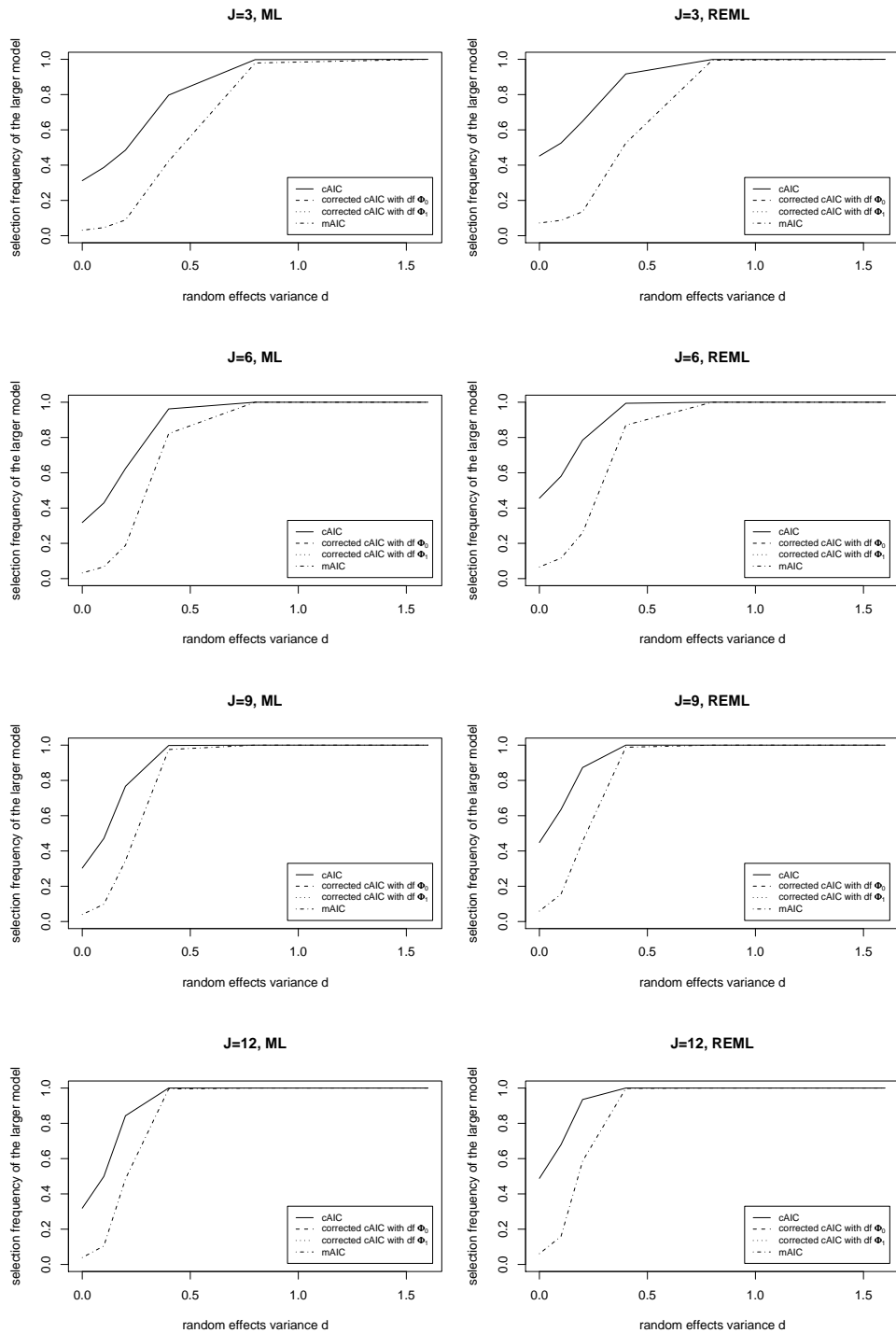


Figure 7: Proportion of simulation replications where the more complex random intercept model was favored by the AIC in the case of forty clusters.

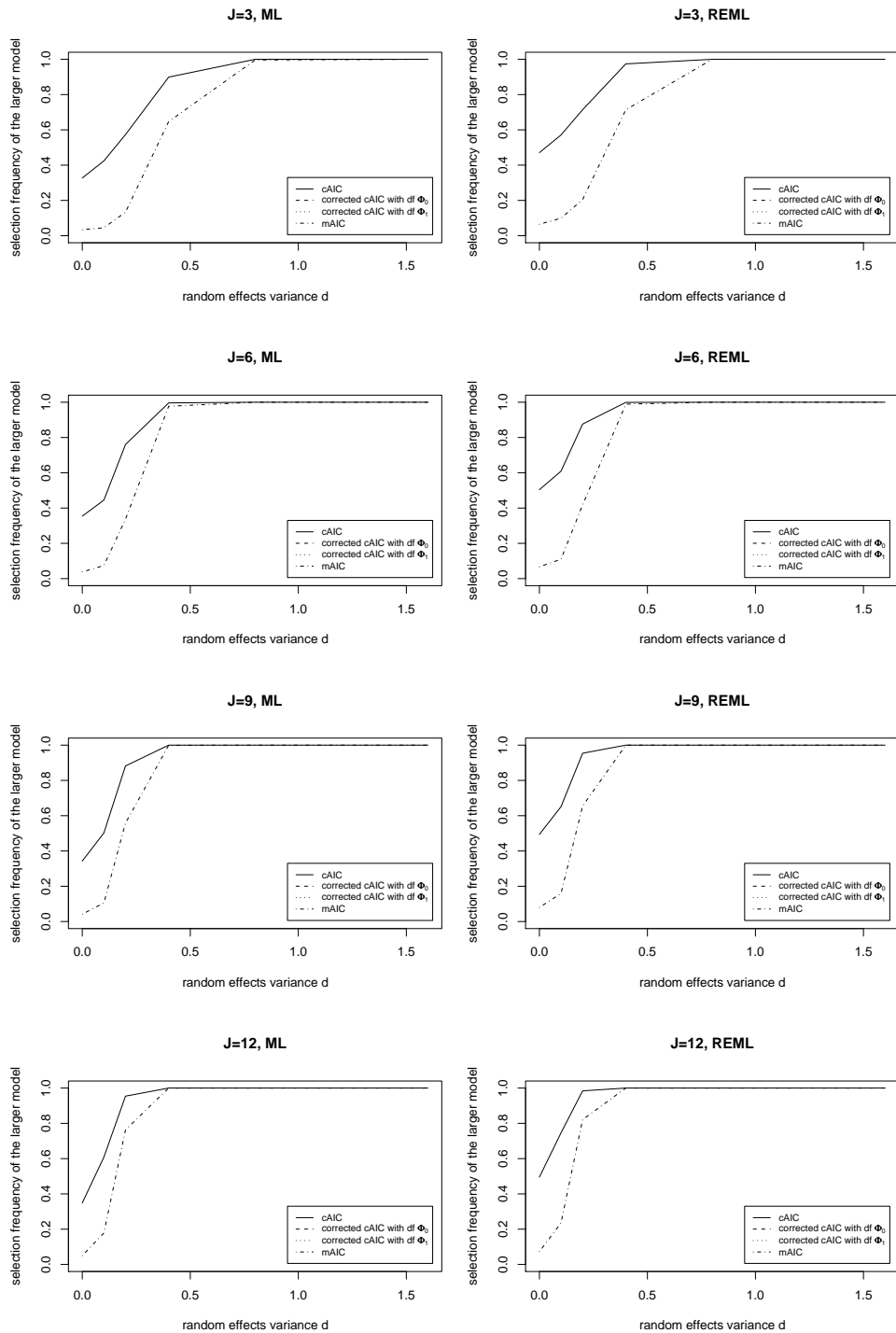


Figure 8: Proportion of simulation replications where the more complex random intercept model was favored by the AIC in the case of eight clusters.

## **6 Childhood Malnutrition in Zambia**

	cfeed	cage	mage	mheight	mbmi	district	ML		REML	
							cAIC	mAIC	cAIC	mAIC
1	-	-	-	-	-	-	4261.258	4261.258	4261.296	4289.287
2	-	-	-	-	-	+	4249.393	4258.190	4249.374	4285.460
3	+	-	-	-	-	-	4178.298	4211.837	4178.289	4232.128
4	+	-	-	-	-	+	4168.932	4210.120	4168.932	4229.828
5	-	+	-	-	-	-	4148.080	4158.453	4148.260	4183.692
6	-	+	-	-	-	+	4134.518	4154.564	4134.518	4179.148
7	-	-	+	-	-	-	4261.258	4263.258	4261.296	4291.287
8	-	-	+	-	-	+	4249.393	4260.190	4249.393	4287.518
9	-	-	-	+	-	-	4261.258	4263.258	4261.116	4291.179
10	-	-	-	+	-	+	4249.394	4260.190	4249.394	4287.518
11	-	-	-	-	+	-	4261.258	4263.258	4261.296	4291.287
12	-	-	-	-	+	+	4249.393	4260.190	4249.393	4287.518
13	+	+	-	-	-	-	4137.779	4154.146	4137.999	4177.238
14	+	+	-	-	-	+	<b>4125.784</b>	<b>4151.102</b>	<b>4125.784</b>	<b>4173.720</b>
15	+	-	+	-	-	-	4178.299	4213.837	4178.289	4234.128
16	+	-	+	-	-	+	4168.932	4212.120	4168.932	4231.828
17	+	-	-	+	-	-	4178.298	4213.837	4178.236	4234.101
18	+	-	-	+	-	+	4168.932	4212.120	4168.932	4231.828
19	+	-	-	-	+	-	4178.299	4213.837	4178.289	4234.128
20	+	-	-	-	+	+	4168.932	4212.120	4168.932	4231.828
21	-	+	+	-	-	-	4148.080	4160.453	4148.260	4185.692
22	-	+	+	-	-	+	4134.518	4156.564	4134.518	4181.148
23	-	+	-	+	-	-	4148.080	4160.453	4148.149	4185.623
24	-	+	-	+	-	+	4134.518	4156.564	4134.518	4181.148
25	-	+	-	-	+	-	4148.080	4160.453	4148.260	4185.692
26	-	+	-	-	+	+	4134.518	4156.564	4134.518	4181.148
27	-	-	+	+	-	-	4261.258	4265.258	4261.116	4293.179
28	-	-	+	+	-	+	4249.393	4262.190	4249.393	4289.518
29	-	-	+	-	+	-	4261.258	4265.258	4261.296	4293.287
30	-	-	+	-	+	+	4249.393	4262.190	4249.393	4289.518
31	-	-	-	+	+	+	4261.258	4265.258	4261.116	4293.179
32	-	-	-	+	+	+	4249.394	4262.190	4249.394	4289.518
33	+	+	+	-	-	-	4137.779	4156.146	4137.999	4179.238
34	+	+	+	-	-	+	<b>4125.784</b>	4153.102	<b>4125.784</b>	4175.720
35	+	+	-	+	-	-	4137.779	4156.146	4137.776	4179.109
36	+	+	-	+	-	+	<b>4125.784</b>	4153.102	<b>4125.784</b>	4175.720
37	+	+	-	-	+	-	4137.779	4156.146	4137.999	4179.238
38	+	+	-	-	+	+	<b>4125.784</b>	4153.102	<b>4125.784</b>	4175.720
39	+	-	+	+	-	-	4178.299	4215.837	4178.289	4236.128
40	+	-	+	+	-	+	4168.933	4214.122	4168.933	4233.828
41	+	-	+	-	+	+	4178.299	4215.837	4178.289	4236.128
42	+	-	+	-	+	+	4168.932	4214.120	4168.932	4233.828
43	+	-	-	+	+	+	4178.298	4215.837	4178.290	4236.128
44	+	-	-	+	+	+	4168.932	4214.122	4168.932	4233.828
45	-	+	+	+	-	-	4148.080	4162.453	4148.149	4187.623
46	-	+	+	+	-	+	4134.518	4158.564	4134.518	4183.148
47	-	+	+	-	+	-	4148.080	4162.453	4148.260	4187.692
48	-	+	+	-	+	+	4134.518	4158.564	4134.518	4183.148
49	-	+	-	+	+	+	4148.080	4162.453	4148.149	4187.623
50	-	+	-	+	+	+	4134.518	4158.564	4134.518	4183.148
51	-	-	+	+	+	-	4261.258	4267.258	4261.116	4295.179
52	-	-	+	+	+	+	4249.393	4264.190	4249.393	4291.518
53	+	+	+	+	-	-	4137.779	4158.146	4137.777	4181.109
54	+	+	+	+	-	+	<b>4125.784</b>	4155.102	<b>4125.784</b>	4177.720
55	+	+	+	-	+	-	4137.779	4158.146	4137.999	4181.238
56	+	+	+	-	+	+	<b>4125.784</b>	4155.102	<b>4125.784</b>	4177.720
57	+	+	-	+	+	-	4137.779	4158.146	4137.776	4181.109
58	+	+	-	+	+	+	<b>4125.784</b>	4155.102	<b>4125.784</b>	4177.720
59	+	-	+	+	-	-	4178.298	4217.837	4178.289	4238.127
60	+	-	+	+	+	+	4168.932	4216.120	4168.932	4235.828
61	-	+	+	+	+	-	4148.080	4164.453	4148.149	4189.623
62	-	+	+	+	+	+	4134.517	4160.564	4134.517	4185.148
63	+	+	+	+	+	-	4137.779	4160.146	4137.776	4183.109
64	+	+	+	+	+	+	<b>4125.784</b>	4157.102	<b>4125.784</b>	4179.720

Table 1: Conditional and marginal AIC for various specifications of additive mixed models. The first column contains a model identification number, the following six columns indicate non-linear (+) versus linear (-) modelling of continuous covariate effects and presence (+) versus absence (-) of a district-specific random effect. In each column, the models with minimal AIC are marked in bold.