

Genetic parameters for Limousine Interbeef genetic evaluation for calving traits

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Supplementary Materials: Supplementary Tables S1, S2, S3, S4, S5, S6, S7

Supplementary Table S1. Definition of calving ease scoring according to country.

Population	Score				
	1 / 100(CHE)	2 / 200 (CHE)	3 / 300 (CHE)	4	5
CZE	no assistance	easy pull	hard pull	c.s.	
EST	no assistance	→	vet assistance		
FRA	easy	→	→	→	embryotomy
GBR	no assistance	easy pull	hard pull	vet assistance	c.s.
IRL	no assistance	easy pull	hard pull	vet assistance	
SVN	easy	→	→	→	embryotomy
CHE	hard pull + c.s.	easy pull	no assistance		

CZE–Czech Republic; EST–Estonia; FRA–France; GBR–Great Britain; IRL–Ireland; SVN–Slovenia; CHE–Switzerland

c.s. – cesarean section

Supplementary Table S2. Size of performance data-sets (above diagonal) and pedigrees (below diagonal) for pairwise variance components estimation for birth weight.

	CZE	DFS	FRA	GBR	IRL	SVN	CHE
CZE		51,795	43,161	30,025	23,445	17,510	64,932
DFS	92,008		72,247	48,405	30,488	24,763	88,726
FRA	132,290	159,013		43,348	36,707	39,673	134,695
GBR	65,055	99,582	132,250		33,745	27,799	59,079
IRL	50,397	65,557	116,218	75,013		8,024	46,642
SVN	30,855	48,207	88,907	61,759	22,228		32,731
CHE	38,695	52,995	52,444	28,648	22,599	18,699	

CZE–Czech Republic; DFS–Denmark and Finland and Sweden; FRA–France; GBR–Great Britain; IRL–Ireland; SVN–Slovenia; CHE–Switzerland

Supplementary Table S3. Size of performance data-sets (above diagonal) and pedigrees (below diagonal) for pairwise variance components estimation for calving ease.

	CZE	DFS	FRA	GBR	IRL	SVN	EST	CHE
CZE		60,212	42,538	35,130	41,634	15,241	23,356	27,346
DFS	108,783		70,533	51,979	56,259	22,983	51,159	35,756
FRA	132,105	174,020		41,642	76,128	39,497	37,737	52,241
GBR	69,340	112,947	131,243		60,073	33,570	37,890	27,237
IRL	97,814	117,723	210,284	134,893		21,960	28,411	43,700
SVN	27,513	48,250	90,231	75,976	58,809		9,353	18,131
EST	43,350	94,440	99,722	87,349	71,127	18,871		22,953
CHE	49,711	67,339	134,344	58,597	98,274	32,067	43,591	

CZE–Czech Republic; DFS–Denmark and Finland and Sweden; FRA–France; GBR–Great Britain; IRL–Ireland; SVN–Slovenia; EST–Estonia; CHE–Switzerland

Supplementary Table S4. Weights used for the bending of the full Interbeef correlation matrix.

	Direct														Maternal																						
	Birth weight							Calving ease							Birth weight						Calving ease																
	CZE	DFS	FRA	GBR	ILR	SVN	CHE	CZE	DFS	FRA	GBR	IRL	SVN	EST	CHE	CZE	DFS	FRA	GBR	SVN	CHE	CZE	DFS	FRA	GBR	SVN	CHE										
CZE																																					
DFS	2,560																																				
FRA	2,080	2,860																																			
GBR	1,700	1,820	1,700																																		
IRL	2,280	2,180	2,340	3,340																																	
SVN	1,000	1,280	1,520	1,000	1,000																																
CHE	2,380	2,500	3,020	1,740	1,760	1,240																															
CZE	9,999	1	1	1	1	1	1																														
DFS	1	1	1	1	1	1	1	3,020																													
FRA	1	1	9,999	1	1	1	1	6,240	5,320																												
GBR	1	1	1	9,999	1	1	1	3,120	3,460	9,040																											
IRL	1	1	1	1	9,999	1	1	2,940	3,260	5,600	7,180																										
SVN	1	1	1	1	1	1	1	1,300	1,420	1,660	1,320	1,360																									
EST	1	1	1	1	1	1	1	1,000	2,200	1,000	1,580	1,580	1,000																								
CHE	1	1	1	1	1	1	9,999	1,000	1,000	4,060	2,340	2,340	1,000	1,000																							
CZE	9,999	1	1	1	1	1	1	9,999	1	1	1	1	1	1	1																						
DFS	1	9,999	1	1	1	1	1	1	1	1	1	1	1	1	1	500																					
FRA	1	1	9,999	1	1	1	1	1	1	9,999	1	1	1	1	1	500	500																				
GBR	1	1	1	9,999	1	1	1	1	1	1	1	1	1	1	1	500	500	765																			
SVN	1	1	1	1	1	9,999	1	1	1	1	1	1	1	1	1	500	500	500	500																		
CHE	1	1	1	1	1	1	9,999	1	1	1	1	1	1	1	9,999	500	895	500	760	580																	
CZE	9,999	1	1	1	1	1	1	9,999	1	1	1	1	1	1	1	9,999	1	1	1	1	1																
DFS	1	1	1	1	1	1	1	1	9,999	1	1	1	1	1	1	1	1	1	1	1	1	500															
FRA	1	1	9,999	1	1	1	1	1	1	9,999	1	1	1	1	1	1	1	1	9,999	1	1	3,860	500														
GBR	1	1	1	1	1	1	1	1	1	1	9,999	1	1	1	1	1	1	1	1	1	500	500	5,920														
SVN	1	1	1	1	1	1	1	1	1	1	1	1	9,999	1	1	1	1	1	1	1	500	500	500	500													
CHE	1	1	1	1	1	1	9,999	1	1	1	1	1	1	1	9,999	1	1	1	1	1	9,999	500	500	500	500	500											

CZE–Czech Republic; DFS–Denmark and Finland and Sweden; FRA–France; GBR–Great Britain; IRL–Ireland; SVN–Slovenia; EST–Estonia; CHE–Switzerland

Supplementary Table S5. Full Interbeef genetic correlation matrix before bending.

	Direct															Maternal													
	Birth weight							Calving ease								Birth weight						Calving ease							
	CZE	DFS	FRA	GBR	ILR	SVN	CHE	CZE	DFS	FRA	GBR	IRL	SVN	EST	CHE	CZE	DFS	FRA	GBR	SVN	CHE	CZE	DFS	FRA	GBR	SVN	CHE		
CZE																													
DFS	0.70																												
FRA	0.91	0.88																											
GBR	0.82	0.75	0.81																										
IRL	0.82	0.88	0.85	0.87																									
SVN	0.82	0.91	0.87	0.87	0.85																								
CHE	0.68	0.96	0.85	0.81	0.94	0.84																							
CZE	0.25	0	0	0	0	0	0																						
DFS	0	0	0	0	0	0	0	0.83																					
FRA	0	0	0.69	0	0	0	0	0.62	0.70																				
GBR	0	0	0	0.53	0	0	0	0.75	0.82	0.73																			
IRL	0	0	0	0	0.62	0	0	0.78	0.78	0.80	0.65																		
SVN	0	0	0	0	0	0	0	0.76	0.77	0.82	0.67	0.86																	
EST	0	0	0	0	0	0	0	0.75	0.77	0.75	0.94	0.67	0.75																
CHE	0	0	0	0	0	0	-0.63	-0.75	-0.75	-0.73	-0.63	-0.75	-0.75	-0.75															
CZE	-0.48	0	0	0	0	0	0	-0.01	0	0	0	0	0	0	0														
DFS	0	-0.15	0	0	0	0	0	0	0	0	0	0	0	0	0	0.60													
FRA	0	0	-0.61	0	0	0	0	0	0	-0.20	0	0	0	0	0	0.60	0.60												
GBR	0	0	0	-0.37	0	0	0	0	0	0	0	0	0	0	0	0.60	0.60	0.41											
SVN	0	0	0	0	0	-0.49	0	0	0	0	0	0	0	0	0	0.60	0.60	0.60	0.60										
CHE	0	0	0	0	0	0	-0.72	0	0	0	0	0	0	0	0.39	0.60	0.59	0.60	0.58	0.70									
CZE	0.04	0	0	0	0	0	0	-0.47	0	0	0	0	0	0	0	0.42	0	0	0	0	0								
DFS	0	0	0	0	0	0	0	0	-0.20	0	0	0	0	0	0	0	0	0	0	0	0	0.60							
FRA	0	0	-0.45	0	0	0	0	0	0	-0.56	0	0	0	0	0	0	0	0	0.28	0	0	0	0.56	0.60					
GBR	0	0	0	0	0	0	0	0	0	0	-0.35	0	0	0	0	0	0	0	0	0	0	0.60	0.60	0.67					
SVN	0	0	0	0	0	0	0	0	0	0	0	0	-0.51	0	0	0	0	0	0	0	0	0.60	0.60	0.60	0.60				
CHE	0	0	0	0	0	0	0.24	0	0	0	0	0	0	0	-0.53	0	0	0	0	0	-0.24	-0.60	-0.60	-0.60	-0.60	-0.60			

CZE–Czech Republic; DFS–Denmark and Finland and Sweden; FRA–France; GBR–Great Britain; IRL–Ireland; SVN–Slovenia; EST–Estonia; CHE–Switzerland

Supplementary Table S6. Full Interbeef matrix after bending: genetic correlations (below diagonal), genetic variances (diagonal), and genetic covariances (above diagonal).

	Direct														Maternal												
	Birth weight							Calving ease							Birth weight						Calving ease						
	CZE	DFS	FRA	GBR	ILR	SVN	CHE	CZE	DFS	FRA	GBR	IRL	SVN	EST	CHE	CZE	DFS	FRA	GBR	SVN	CHE	CZE	DFS	FRA	GBR	SVN	CHE
CZE	4.10	4.01	3.42	2.79	4.08	4.68	4.35	0.06	0.01	0.04	0.08	0.15	0.01	0.00	-5.32	-0.89	-0.04	-0.65	-0.10	-0.36	-0.40	0.00	0.01	0.00	0.02	0.01	-2.20
DFS	0.67	8.77	5.18	3.98	6.49	7.94	8.68	0.00	-0.04	0.05	0.03	0.14	-0.04	-0.02	-11.37	-0.02	-0.67	-0.62	0.12	-0.26	-1.39	0.02	0.00	-0.01	0.02	0.00	0.14
FRA	0.76	0.78	4.98	2.89	4.53	5.39	5.74	0.05	0.03	0.09	0.12	0.22	0.06	0.01	-12.53	-0.40	-0.30	-1.32	-0.13	-0.68	-0.83	0.00	0.00	-0.03	-0.02	-0.01	0.68
GBR	0.73	0.71	0.68	3.60	4.11	4.51	4.50	0.05	0.02	0.04	0.19	0.16	0.01	0.02	-7.35	-0.17	0.02	-0.22	-0.56	-0.28	-0.51	0.01	0.00	0.00	-0.04	0.01	-1.17
IRL	0.74	0.81	0.75	0.80	7.31	6.46	7.27	0.08	0.03	0.07	0.14	0.44	0.07	0.01	-16.00	-0.16	0.04	-0.27	-0.14	-0.05	-0.74	0.01	0.00	0.00	0.02	0.01	-1.09
SVN	0.69	0.80	0.72	0.71	0.71	11.26	8.11	0.01	-0.03	0.04	0.06	0.11	-0.04	-0.02	-6.60	-0.34	-0.06	-0.77	-0.13	-3.31	-1.16	0.02	0.00	-0.01	0.00	0.00	-1.20
CHE	0.62	0.84	0.74	0.68	0.77	0.69	12.13	0.06	0.02	0.08	0.14	0.32	0.05	0.02	-34.30	-0.45	-0.77	-0.92	-0.40	-1.35	-3.38	0.01	0.00	-0.01	0.01	0.01	10.06
CZE	0.24	0.01	0.18	0.19	0.24	0.03	0.14	0.02	0.01	0.01	0.02	0.03	0.01	0.01	-1.33	0.00	0.01	0.01	0.01	0.01	0.02	0.00	0.00	0.00	0.00	0.00	0.16
DFS	0.05	-0.14	0.11	0.10	0.12	-0.09	0.06	0.79	0.01	0.00	0.02	0.02	0.01	0.01	-1.15	0.01	-0.01	0.01	0.00	-0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01
FRA	0.28	0.24	0.63	0.32	0.41	0.19	0.35	0.60	0.68	0.00	0.01	0.01	0.01	0.00	-0.73	0.00	0.00	-0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.09
GBR	0.21	0.05	0.28	0.50	0.27	0.10	0.20	0.70	0.77	0.70	0.04	0.04	0.02	0.01	-1.97	0.02	0.01	0.01	-0.03	0.01	0.01	0.00	0.00	0.00	-0.01	0.00	0.09
IRL	0.26	0.17	0.36	0.30	0.58	0.12	0.32	0.73	0.74	0.76	0.63	0.08	0.04	0.01	-3.26	0.02	0.01	0.02	0.01	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.07
SVN	0.04	-0.09	0.16	0.02	0.15	-0.07	0.08	0.66	0.70	0.71	0.59	0.74	0.03	0.01	-1.80	0.01	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	-0.01	0.18
EST	0.01	-0.11	0.10	0.14	0.04	-0.07	0.07	0.65	0.74	0.64	0.82	0.60	0.66	0.00	-0.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
CHE	-0.15	-0.23	-0.33	-0.23	-0.35	-0.12	-0.58	-0.61	-0.63	-0.68	-0.58	-0.68	-0.62	-0.63	287.3	-1.46	-0.14	-0.54	-0.42	-0.53	9.50	0.10	0.03	0.08	0.07	0.13	-106
CZE	-0.47	-0.01	-0.19	-0.10	-0.06	-0.11	-0.14	-0.02	0.10	0.06	0.09	0.09	0.08	0.06	-0.09	0.90	0.63	0.42	0.33	0.82	0.55	0.02	0.00	0.00	0.00	0.00	-0.54
DFS	-0.01	-0.15	-0.09	0.01	0.01	-0.01	-0.14	0.06	-0.03	0.04	0.03	0.02	-0.02	-0.02	-0.01	0.43	2.37	0.70	0.56	1.40	1.09	0.01	0.00	0.00	0.00	0.00	0.48
FRA	-0.31	-0.20	-0.57	-0.11	-0.10	-0.22	-0.25	0.08	0.05	-0.21	0.07	0.07	0.04	0.05	-0.03	0.43	0.44	1.08	0.29	0.91	0.62	0.00	0.00	0.01	0.00	0.00	0.51
GBR	-0.06	0.05	-0.07	-0.36	-0.06	-0.05	-0.14	0.08	0.00	0.05	-0.17	0.02	0.01	0.01	-0.03	0.43	0.44	0.34	0.67	0.73	0.55	0.00	0.00	0.00	0.00	0.00	0.11
SVN	-0.08	-0.04	-0.15	-0.07	-0.01	-0.47	-0.19	0.05	-0.03	0.04	0.03	0.06	-0.01	-0.02	-0.01	0.41	0.44	0.42	0.43	4.32	1.47	0.01	0.00	0.00	0.00	0.00	0.29
CHE	-0.14	-0.33	-0.26	-0.19	-0.19	-0.24	-0.67	0.09	0.03	0.01	0.04	0.01	0.02	0.02	0.39	0.40	0.49	0.41	0.46	0.49	2.09	0.00	0.00	0.00	0.00	0.00	-4.23
CZE	0.03	0.10	0.03	0.12	0.09	0.10	0.07	-0.46	-0.09	-0.11	-0.08	-0.08	-0.07	-0.04	0.10	0.41	0.07	0.02	0.06	0.08	0.05	0.00	0.00	0.00	0.00	0.00	-0.30
DFS	0.07	-0.02	-0.02	0.01	0.01	-0.01	0.02	-0.06	-0.20	-0.04	-0.04	0.00	0.00	0.04	0.03	0.06	-0.01	0.00	0.00	0.00	-0.01	0.43	0.01	0.00	0.00	0.00	-0.42
FRA	-0.01	-0.11	-0.43	-0.04	-0.04	-0.07	-0.06	-0.09	-0.04	-0.54	-0.16	-0.08	-0.15	-0.01	0.13	0.10	-0.03	0.28	-0.04	-0.02	-0.05	0.53	0.43	0.00	0.00	0.00	-0.19
GBR	0.08	0.04	-0.07	-0.16	0.05	0.00	0.03	-0.05	-0.03	-0.17	-0.34	0.05	-0.01	-0.05	0.03	0.03	0.01	-0.02	0.01	-0.01	-0.02	0.44	0.45	0.66	0.02	0.01	-0.76
SVN	0.03	0.01	-0.03	0.04	0.03	0.00	0.02	-0.05	0.02	-0.14	-0.03	-0.05	-0.50	0.02	0.09	0.03	0.00	-0.02	0.01	0.01	-0.01	0.25	0.43	0.41	0.43	0.01	-0.44
CHE	-0.09	0.00	0.02	-0.05	-0.03	-0.03	0.24	0.10	0.01	0.12	0.04	0.02	0.09	0.02	-0.51	-0.05	0.03	0.04	0.01	0.01	-0.24	-0.42	-0.44	-0.42	-0.44	-0.42	149.4

CZE–Czech Republic; DFS–Denmark and Finland and Sweden; FRA–France; GBR–Great Britain; IRL–Ireland; SVN–Slovenia; EST–Estonia; CHE–Switzerland

Supplementary Table S7. Differences of the genetic correlations after bending.

	Direct														Maternal													
	Birth weight							Calving ease							Birth weight						Calving ease							
	CZE	DFS	FRA	GBR	ILR	SVN	CHE	CZE	DFS	FRA	GBR	IRL	SVN	EST	CHE	CZE	DFS	FRA	GBR	SVN	CHE	CZE	DFS	FRA	GBR	SVN	CHE	
CZE																												
DFS	-0.02																											
FRA	-0.11	-0.09																										
GBR	-0.08	-0.07	-0.13																									
IRL	-0.03	-0.06	-0.08	-0.08																								
SVN	-0.11	-0.14	-0.15	-0.18	-0.14																							
CHE	-0.05	-0.13	-0.10	-0.14	-0.14	-0.14																						
CZE	-0.02	0.01	0.18	0.19	0.24	0.03	0.14																					
DFS	0.05	-0.14	0.11	0.10	0.12	-0.09	0.06	-0.04																				
FRA	0.28	0.24	-0.06	0.32	0.41	0.19	0.35	-0.02	-0.03																			
GBR	0.21	0.05	0.28	-0.03	0.27	0.10	0.20	-0.05	-0.05	-0.03																		
IRL	0.26	0.17	0.36	0.30	-0.04	0.12	0.32	-0.05	-0.04	-0.04	-0.02																	
SVN	0.04	-0.09	0.16	0.02	0.15	-0.07	0.08	-0.10	-0.07	-0.11	-0.08	-0.12																
EST	0.01	-0.11	0.10	0.14	0.04	-0.08	0.07	-0.11	-0.03	-0.12	-0.12	-0.07	-0.10															
CHE	-0.16	-0.23	-0.33	-0.23	-0.35	-0.12	0.05	0.15	0.13	0.05	0.05	0.07	0.14	0.13														
CZE	0.02	-0.01	-0.19	-0.10	-0.06	-0.11	-0.14	-0.01	0.10	0.06	0.09	0.09	0.08	0.06	-0.09													
DFS	-0.01	0.00	-0.09	0.01	0.01	-0.01	-0.14	0.06	-0.03	0.04	0.03	0.02	-0.02	-0.03	-0.01	-0.17												
FRA	-0.31	-0.20	0.04	-0.11	-0.10	-0.22	-0.26	0.08	0.05	-0.01	0.07	0.07	0.04	0.05	-0.03	-0.17	-0.16											
GBR	-0.06	0.05	-0.07	0.01	-0.06	-0.05	-0.14	0.08	0.00	0.05	-0.17	0.02	0.01	0.01	-0.03	-0.17	-0.16	-0.07										
SVN	-0.09	-0.04	-0.15	-0.07	-0.01	0.02	-0.19	0.06	-0.03	0.04	0.03	0.06	-0.01	-0.02	-0.02	-0.19	-0.16	-0.18	-0.17									
CHE	-0.14	-0.33	-0.26	-0.19	-0.19	-0.24	0.05	0.09	0.03	0.01	0.04	0.01	0.02	0.02	0.00	-0.20	-0.10	-0.19	-0.12	-0.21								
CZE	-0.01	0.10	0.03	0.12	0.09	0.10	0.07	0.02	-0.09	-0.11	-0.08	-0.08	-0.07	-0.05	0.10	-0.01	0.07	0.02	0.06	0.08	0.05							
DFS	0.07	-0.02	-0.02	0.01	0.01	-0.01	0.02	-0.06	0.00	-0.04	-0.04	0.00	0.00	0.05	0.03	0.06	-0.01	0.00	-0.01	0.00	-0.01	-0.17						
FRA	-0.01	-0.11	0.02	-0.04	-0.04	-0.07	-0.06	-0.09	-0.04	0.02	-0.16	-0.08	-0.15	-0.01	0.13	0.10	-0.03	0.00	-0.04	-0.03	-0.06	-0.03	-0.17					
GBR	0.08	0.04	-0.07	-0.17	0.05	0.00	0.03	-0.05	-0.03	-0.17	0.01	0.05	-0.01	-0.05	0.03	0.03	0.01	-0.02	0.01	-0.01	-0.02	-0.16	-0.15	-0.02				
SVN	0.04	0.01	-0.03	0.04	0.03	0.00	0.02	-0.05	0.02	-0.14	-0.03	-0.05	0.01	0.03	0.09	0.03	0.00	-0.02	0.01	0.01	-0.02	-0.07	-0.17	-0.19	-0.17			
CHE	-0.09	0.00	0.03	-0.05	-0.03	-0.03	0.00	0.10	0.01	0.12	0.04	0.02	0.09	0.02	0.02	-0.05	0.03	0.04	0.01	0.01	0.00	0.18	0.16	0.18	0.16	0.18		

CZE–Czech Republic; DFS–Denmark and Finland and Sweden; FRA–France; GBR–Great Britain; IRL–Ireland; SVN–Slovenia; EST–Estonia; CHE–Switzerland