

APPENDIX II. Number of common bulls

BSW hco

common bulls below diagonal
common three quarter sib group above diagonal

CAN DEA FRA USA

CAN	0	55	33	52
DEA	47	0	129	69
FRA	31	87	0	36
USA	53	60	30	0

BSW crc

common bulls below diagonal
common three quarter sib group above diagonal

CAN CHE DEA NLD NZL USA GBR FRA ITA

CAN	0	76	75	38	37	79	38	49	65
CHE	58	0	466	71	44	181	43	115	285
DEA	64	372	0	119	55	156	45	147	382
NLD	34	69	118	0	30	42	32	60	89
NZL	36	38	47	23	0	35	30	29	39
USA	78	149	122	43	33	0	44	66	106
GBR	37	33	34	29	25	44	0	34	41
FRA	41	80	106	47	23	44	28	0	119
ITA	55	226	254	69	33	72	32	85	0

BSW ccl

common bulls below diagonal
common three quarter sib group above diagonal

CAN CHE DEA NLD USA GBR FRA

CAN	0	73	72	33	77	37	52
CHE	55	0	444	58	176	44	113
DEA	62	346	0	105	151	46	149
NLD	31	56	106	0	35	28	61
USA	76	143	116	38	0	45	69
GBR	37	34	36	28	46	0	37
FRA	44	78	110	50	48	32	0

BSW cc2

common bulls below diagonal

common three quarter sib group above diagonal

	CAN	CHE	DEA	NLD	NZL	USA	GBR	FRA	ITA
CAN	0	73	74	38	42	93	38	54	65
CHE	58	0	458	71	51	265	43	122	285
DEA	65	368	0	118	61	267	44	157	377
NLD	33	69	119	0	33	69	32	68	89
NZL	40	44	50	25	0	59	33	37	45
USA	91	245	243	65	57	0	54	100	160
GBR	36	33	35	29	27	55	0	36	41
FRA	46	87	120	55	30	66	31	0	129
ITA	55	226	255	69	37	107	32	95	0

BSW int

common bulls below diagonal

common three quarter sib group above diagonal

	CAN	DEA	NLD	NZL	USA	GBR	ITA
CAN	0	67	38	39	90	38	60
DEA	57	0	113	58	261	43	401
NLD	33	110	0	33	67	32	89
NZL	37	46	25	0	58	33	43
USA	88	235	63	56	0	54	166
GBR	36	33	29	27	55	0	42
ITA	50	256	69	34	108	32	0

GUE hco

GUE crc

common bulls below diagonal

common three quarter sib group above diagonal

CAN GBR NZL USA AUS

CAN	0	14	6	26	18
GBR	12	0	21	34	26
NZL	4	19	0	13	30
USA	25	30	12	0	18
AUS	13	21	29	15	0

GUE cc1

common bulls below diagonal

common three quarter sib group above diagonal

CAN GBR USA

CAN	0	14	26
GBR	12	0	35
USA	25	31	0

GUE cc2

common bulls below diagonal

common three quarter sib group above diagonal

CAN GBR NZL USA ZAF AUS

CAN	0	11	4	29	3	15
GBR	9	0	22	67	9	27
NZL	2	22	0	40	7	33
USA	27	69	43	0	21	48
ZAF	3	7	5	17	0	7
AUS	11	22	32	45	5	0

GUE int

common bulls below diagonal

common three quarter sib group above diagonal

CAN GBR NZL USA ZAF AUS

CAN 0 11 4 29 3 15
GBR 9 0 22 67 9 27
NZL 2 22 0 40 7 33
USA 27 69 43 0 21 48
ZAF 3 7 5 17 0 7
AUS 11 22 32 45 5 0

HOL hco

 common bulls below diagonal
 common three quarter sib group above diagonal

	CAN	CZE	DEU	DFS	FRA	USA	POL	FRR
CAN	0	656	1366	691	734	1486	487	1
CZE	426	0	1244	713	794	856	501	8
DEU	629	748	0	1792	1666	1660	809	62
DFS	487	321	667	0	1083	868	499	11
FRA	437	389	596	370	0	1044	602	1
USA	1369	570	716	538	440	0	690	3
POL	333	321	420	258	228	531	0	22
FRR	1	3	43	1	0	1	35	0

HOL crc

 common bulls below diagonal
 common three quarter sib group above diagonal

	BEL	CAN	CHE	CHR	DEU	DFS	ESP	GBR	IRL	ITA	NLD	NZL	USA	POL	FRA	FRR	AUS
BEL	0	326	208	156	565	386	294	418	266	398	619	290	353	143	448	9	374
CAN	280	0	348	217	1469	758	728	947	341	1101	849	503	1715	410	797	2	753
CHE	191	243	0	235	447	297	253	329	205	304	341	217	341	82	283	3	269
CHR	146	181	250	0	392	168	139	174	111	201	324	133	246	64	153	11	168
DEU	473	732	335	312	0	2007	921	1496	647	2004	2495	800	2001	743	1836	73	1184
DFS	292	519	237	136	855	0	614	1040	537	1177	1376	644	1061	480	1177	12	859
ESP	259	421	210	110	512	388	0	671	325	770	690	401	812	294	663	2	536
GBR	350	882	290	156	880	612	495	0	657	1141	1257	725	1190	398	1116	4	946
IRL	238	314	202	100	511	381	299	628	0	492	656	539	442	152	544	2	515
ITA	293	691	240	165	974	628	513	715	385	0	1351	656	1584	510	1431	1	887
NLD	648	720	318	300	1921	892	569	950	577	913	0	864	1325	570	1437	34	1054
NZL	221	481	192	118	575	416	302	607	442	450	780	0	644	226	649	0	961
USA	287	1578	265	227	1002	640	470	948	393	863	992	580	0	625	1258	3	907
POL	85	265	41	44	378	252	132	179	82	264	369	146	421	0	542	19	294
FRA	387	467	253	139	704	428	404	559	387	553	691	349	531	193	0	2	891
FRR	7	1	2	4	50	3	0	1	1	1	10	0	1	32	0	0	3
AUS	275	610	218	139	669	445	344	702	395	489	806	926	738	138	491	1	0

HOL ccl

common bulls below diagonal

common three quarter sib group above diagonal

	CAN	CHE	CHR	CZE	DEU	DFS	FRA	GBR	ISR	ITA	NLD	USA	POL	FRR
CAN	0	349	219	692	1452	760	788	983	62	1103	842	1741	427	2
CHE	244	0	235	189	445	297	286	329	23	303	342	340	92	3
CHR	183	250	0	123	388	168	159	176	8	201	323	246	72	11
CZE	446	112	85	0	1271	759	797	674	65	845	972	974	488	9
DEU	676	328	303	827	0	1987	1804	1537	95	1972	2453	1976	778	73
DFS	521	237	136	382	816	0	1180	1060	82	1172	1372	1061	500	12
FRA	479	257	143	401	686	437	0	1141	80	1427	1440	1255	558	2
GBR	914	287	156	358	840	612	569	0	83	1182	1278	1239	423	4
ISR	45	16	5	51	76	60	42	57	0	84	96	86	42	0
ITA	691	240	165	476	913	626	563	722	60	0	1343	1587	529	1
NLD	711	318	299	749	1836	888	698	957	83	905	0	1317	603	34
USA	1602	263	227	644	940	638	536	974	68	857	971	0	650	3
POL	279	45	50	311	410	272	207	195	24	282	408	444	0	20
FRR	1	2	4	3	50	3	0	1	0	1	10	1	33	0

common bulls below diagonal

common three quarter sib group above diagonal

	BEL	CAN	CHE	CHR	CZE	DEU	DFS	ESP	FRA	GBR	IRL	ISR	ITA	NLD	NZL	USA	POL	ZAF	FRR	AUS
BEL	0	320	213	157	262	551	388	298	453	422	272	37	400	620	303	449	141	184	9	376
CAN	273	0	346	212	668	1350	746	724	765	934	342	62	1030	817	514	1816	401	312	2	738
CHE	193	244	0	236	191	446	303	256	291	333	211	24	308	347	227	395	80	163	3	274
CHR	147	179	251	0	124	381	170	140	161	176	114	9	201	325	138	313	62	91	11	170
CZE	164	432	112	85	0	1254	766	474	803	660	307	65	841	977	462	1101	454	215	9	535
DEU	456	663	335	300	821	0	1976	931	1796	1478	654	99	1908	2389	839	2574	713	428	72	1167
DFS	294	512	242	136	384	833	0	635	1199	1059	550	87	1176	1388	682	1425	470	381	12	876
ESP	260	427	213	110	276	515	406	0	693	691	336	60	789	708	425	978	295	309	2	551
FRA	394	486	265	144	402	718	458	441	0	1138	566	86	1429	1449	694	1925	538	363	2	910
GBR	352	884	299	157	356	852	634	526	605	0	673	86	1147	1268	769	1521	390	376	4	959
IRL	239	317	208	100	197	513	395	312	416	658	0	63	502	673	567	579	149	250	2	528
ISR	20	45	16	5	51	77	62	39	43	58	52	0	88	101	81	107	41	42	0	67
ITA	294	679	246	165	478	930	645	545	596	739	404	64	0	1345	696	2017	497	380	1	893
NLD	647	701	326	303	751	1788	918	596	741	986	605	85	935	0	929	1862	552	377	34	1064
NZL	230	487	200	123	310	605	451	331	389	658	474	71	501	851	0	946	229	312	0	1007
USA	321	1624	294	286	695	1216	733	579	823	1152	463	83	984	1368	896	0	645	478	7	1296
POL	83	258	40	42	281	351	247	132	188	176	79	21	259	353	150	416	0	100	18	292
ZAF	142	290	140	72	134	308	266	279	236	323	218	31	287	321	256	440	49	0	2	349
FRR	7	1	2	4	3	50	3	0	0	1	1	0	1	10	0	1	31	1	0	3
AUS	277	603	222	140	280	663	463	366	522	730	419	48	523	835	995	1080	137	288	1	0

HOL int

common bulls below diagonal

common three quarter sib group above diagonal

	BEL	CAN	DEU	DFS	ESP	GBR	IRL	ITA	NLD	NZL	USA	POL	ZAF	AUS
BEL	0	310	513	354	271	390	238	370	575	278	414	129	169	352
CAN	263	0	1352	730	710	925	331	1022	807	502	1808	396	306	729
DEU	430	686	0	1965	907	1466	622	1911	2372	831	2581	703	424	1158
DFS	269	499	835	0	603	1034	510	1157	1358	659	1403	455	369	856
ESP	232	414	501	377	0	658	306	764	669	404	949	282	300	529
GBR	318	872	852	599	478	0	636	1132	1243	750	1501	379	367	945
IRL	207	307	488	359	273	603	0	473	626	535	547	135	233	498
ITA	279	667	948	623	519	712	378	0	1325	680	2006	479	375	881
NLD	605	689	1790	875	548	935	549	906	0	906	1834	524	370	1040
NZL	215	478	603	431	311	638	448	483	826	0	931	219	304	993
USA	308	1613	1239	714	558	1133	446	966	1345	883	0	633	471	1280
POL	77	255	353	240	120	173	71	251	334	137	411	0	98	277
ZAF	135	285	306	259	271	315	210	280	314	250	434	49	0	343
AUS	262	596	667	445	344	713	396	512	799	974	1068	124	284	0

JER hco

common bulls below diagonal
common three quarter sib group above diagonal

CAN DFS USA

CAN 0 45 137
DFS 33 0 67
USA 127 49 0

JER crc

common bulls below diagonal
common three quarter sib group above diagonal

CAN DFS GBR NLD NZL USA AUS

CAN 0 46 85 31 99 168 116
DFS 34 0 104 92 112 94 92
GBR 86 93 0 79 152 133 139
NLD 27 87 77 0 80 73 65
NZL 112 81 157 78 0 207 313
USA 169 72 146 81 242 0 239
AUS 113 52 144 62 349 246 0

JER ccl

common bulls below diagonal
common three quarter sib group above diagonal

CAN DFS GBR NLD USA

CAN 0 46 85 31 171
DFS 34 0 100 89 93
GBR 85 90 0 71 119
NLD 27 86 68 0 71
USA 172 72 130 79 0

JER cc2

common bulls below diagonal
common three quarter sib group above diagonal

	CAN	DFS	GBR	NLD	NZL	USA	ZAF	AUS
CAN	0	46	84	32	101	175	79	114
DFS	34	0	106	96	119	137	101	96
GBR	84	95	0	81	165	153	117	143
NLD	27	89	79	0	86	83	79	70
NZL	112	88	170	83	0	307	164	332
USA	178	102	172	92	398	0	212	343
ZAF	77	74	119	79	176	223	0	168
AUS	110	56	148	64	373	369	160	0

JER int

common bulls below diagonal
common three quarter sib group above diagonal

	CAN	DFS	GBR	NLD	NZL	USA	ZAF	AUS
CAN	0	46	84	32	101	175	79	114
DFS	34	0	106	96	119	138	102	96
GBR	84	95	0	82	165	153	117	143
NLD	27	90	79	0	87	84	80	71
NZL	112	88	170	84	0	307	164	332
USA	178	104	172	92	398	0	212	343
ZAF	77	75	119	79	176	223	0	168
AUS	110	56	148	64	373	369	160	0

RDC hco

 common bulls below diagonal
 common three quarter sib group above diagonal

CAN DEU DFS NOR

 CAN 0 7 81 4
 DEU 6 0 36 8
 DFS 77 27 0 83
 NOR 4 8 65 0

RDC crc

 common bulls below diagonal
 common three quarter sib group above diagonal

CAN DEU DFS GBR NOR NZL USA NLD AUS

 CAN 0 8 79 46 4 49 79 5 53
 DEU 7 0 37 3 8 10 0 10 20
 DFS 74 29 0 38 76 140 38 31 135
 GBR 47 3 37 0 9 40 30 12 36
 NOR 4 8 58 10 0 42 0 22 33
 NZL 52 10 136 39 41 0 31 12 101
 USA 77 0 33 29 0 32 0 2 29
 NLD 5 9 32 12 22 12 2 0 13
 AUS 53 19 115 35 28 107 29 11 0

RDC cc1

 common bulls below diagonal
 common three quarter sib group above diagonal

CAN DEU DFS GBR NOR NLD

 CAN 0 8 75 44 4 5
 DEU 7 0 38 3 8 9
 DFS 71 30 0 36 77 30
 GBR 45 3 35 0 9 12
 NOR 4 8 59 10 0 22
 NLD 5 9 31 12 22 0

RDC cc2

common bulls below diagonal

common three quarter sib group above diagonal

	CAN	DEU	DFS	GBR	NOR	NZL	USA	ZAF	NLD	AUS
CAN	0	7	74	44	4	47	106	85	5	50
DEU	6	0	36	3	7	10	4	1	10	20
DFS	71	29	0	40	68	145	96	58	31	137
GBR	45	3	39	0	9	42	54	38	12	37
NOR	4	7	53	10	0	40	25	0	22	32
NZL	50	10	141	41	39	0	80	45	12	108
USA	108	4	95	55	25	82	0	84	19	68
ZAF	96	1	56	37	0	43	83	0	2	41
NLD	5	9	32	12	22	12	18	2	0	13
AUS	50	19	117	36	27	114	73	45	11	0

RDC int

common bulls below diagonal

common three quarter sib group above diagonal

	CAN	DEU	DFS	GBR	NOR	NZL	USA	ZAF	NLD	AUS
CAN	0	7	74	44	4	47	106	85	5	50
DEU	6	0	37	3	7	10	4	1	10	20
DFS	71	30	0	40	68	145	96	58	31	137
GBR	45	3	39	0	9	42	54	38	12	37
NOR	4	7	53	10	0	40	25	0	22	32
NZL	50	10	141	41	39	0	80	45	12	108
USA	108	4	95	55	25	82	0	84	19	68
ZAF	96	1	56	37	0	43	83	0	2	41
NLD	5	9	32	12	22	12	18	2	0	13
AUS	50	19	117	36	27	114	73	45	11	0