

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	51
DEA	46	0	127	66
FRA	31	85	0	35
USA	52	56	29	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	73	72	29	37	79	38	48	65
CHE	56	0	454	53	43	176	40	113	280
DEA	61	360	0	90	54	149	41	144	374
NLD	23	49	85	0	25	32	26	51	71
NZL	36	38	46	17	0	36	29	29	39
USA	78	145	118	31	34	0	44	64	105
GBR	37	33	31	22	25	44	0	33	40
FRA	40	78	103	39	23	44	28	0	118
ITA	55	222	246	53	33	72	31	84	0

BSW ccl

common bulls below diagonal
common three quarter sib group above diagonal

	CAN	CHE	DEA	NLD	USA	GBR	FRA
CAN	0	71	72	23	77	36	51
CHE	54	0	436	41	172	41	112
DEA	62	340	0	75	147	43	146
NLD	20	37	72	0	25	21	50
USA	76	140	115	26	0	44	67
GBR	36	33	34	21	45	0	35
FRA	43	77	107	42	48	30	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	70	70	29	41	90	38	53	64
CHE	55	0	448	52	51	257	40	121	280
DEA	62	360	0	87	61	261	41	153	370
NLD	23	47	83	0	27	55	26	57	69
NZL	39	44	50	18	0	59	32	36	45
USA	88	238	242	47	57	0	52	98	161
GBR	36	33	33	22	27	54	0	35	40
FRA	45	86	116	46	29	65	30	0	127
ITA	54	222	249	51	37	108	31	93	0

BSW int

common bulls below diagonal

common three quarter sib group above diagonal

	CAN	DEA	NLD	NZL	USA	GBR	ITA
CAN	0	64	29	39	87	38	60
DEA	55	0	87	58	254	40	395
NLD	23	80	0	27	54	26	70
NZL	37	46	18	0	58	32	43
USA	85	234	47	56	0	52	167
GBR	36	31	22	27	54	0	41
ITA	50	251	52	34	109	31	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	17
GBR	12	0	21	34	26
NZL	4	19	0	13	29
USA	25	30	12	0	17
AUS	12	21	28	14	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 10 4 26 2 14
GBR 8 0 22 67 9 27
NZL 2 22 0 40 7 32
USA 25 69 43 0 20 47
ZAF 2 7 5 17 0 7
AUS 10 22 31 44 5 0

GUE int

common bulls below diagonal
common three quarter sib group above diagonal
CAN GBR NZL USA ZAF AUS

CAN 0 10 4 26 2 14
GBR 8 0 22 67 9 27
NZL 2 22 0 40 7 32
USA 25 69 43 0 20 47
ZAF 2 7 5 17 0 7
AUS 10 22 31 44 5 0

HOL hco

common bulls below diagonal
common three quarter sib group above diagonal
CAN CZE DEU DFS FRA USA POL FRR

CAN 0 642 1333 669 718 1442 462 1
CZE 417 0 1212 693 780 829 473 8
DEU 590 726 0 1757 1644 1609 768 62
DFS 464 316 630 0 1070 843 481 11
FRA 424 385 581 356 0 1019 572 1
USA 1306 553 675 516 417 0 657 3
POL 311 299 384 245 214 494 0 22
FRR 1 3 43 1 0 1 34 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	318	206	148	549	376	285	411	263	387	592	284	344	132	440	9	362
CAN	271	0	345	208	1428	740	690	928	330	1069	790	498	1682	388	769	2	727
CHE	188	247	0	209	445	297	248	325	204	308	330	217	342	77	286	3	262
CHR	138	174	222	0	373	157	133	167	107	195	302	128	234	57	144	11	158
DEU	461	703	336	300	0	1974	876	1463	627	1956	2362	794	1947	700	1802	73	1143
DFS	281	502	235	127	827	0	593	1024	520	1156	1316	633	1036	451	1162	12	828
ESP	255	405	210	105	489	374	0	647	314	739	642	393	772	278	629	2	520
GBR	345	862	290	150	852	588	477	0	633	1120	1198	714	1163	376	1097	4	915
IRL	236	298	203	97	490	363	290	601	0	481	632	520	428	138	530	2	502
ITA	287	669	248	159	942	608	493	698	370	0	1285	652	1546	479	1409	1	860
NLD	611	630	304	276	1712	818	509	878	538	813	0	847	1252	518	1389	34	998
NZL	215	477	191	113	569	406	293	595	421	440	753	0	642	217	643	0	944
USA	280	1518	272	218	967	614	453	918	372	834	883	576	0	597	1238	3	874
POL	80	245	37	40	347	227	119	167	71	239	319	137	391	0	516	20	263
FRA	380	453	253	131	687	415	389	543	373	534	619	342	515	179	0	2	865
FRR	7	1	2	4	50	3	0	1	1	1	10	0	1	31	0	0	3
AUS	268	586	219	130	650	428	336	674	382	471	746	911	707	126	475	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	345	208	672	1413	740	763	964	58	1075	783	1704	405	2
CHE	247	0	209	185	443	297	287	325	23	307	329	340	84	3
CHR	174	222	0	115	369	156	147	165	8	195	300	234	66	11
CZE	428	112	80	0	1238	739	772	660	61	819	919	948	459	9
DEU	651	326	291	807	0	1957	1771	1492	92	1921	2313	1920	732	73
DFS	503	235	127	370	790	0	1164	1049	79	1152	1309	1035	472	12
FRA	465	258	134	392	674	428	0	1120	78	1405	1388	1234	528	2
GBR	890	288	148	347	811	594	557	0	81	1160	1215	1210	398	4
ISR	41	16	5	49	73	58	41	55	0	80	92	81	38	0
ITA	669	248	159	463	886	608	552	703	54	0	1276	1546	495	1
NLD	618	304	275	678	1629	815	624	881	79	800	0	1241	548	34
USA	1549	269	218	627	913	613	522	947	63	829	859	0	618	3
POL	259	41	47	289	374	246	193	179	22	255	347	408	0	21
FRR	1	2	4	3	50	3	0	1	0	1	10	1	31	0

HOL cc2

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	312	210	149	251	540	379	289	441	415	269	37	389	594	298	440	131	184	9	364
CAN	266	0	343	203	642	1311	727	687	741	914	331	58	1004	756	509	1760	381	312	2	718
CHE	189	249	0	210	187	442	303	253	292	329	210	24	313	331	228	397	76	167	3	268
CHR	139	171	223	0	116	367	159	134	149	169	110	9	194	303	134	302	55	91	11	160
CZE	159	415	112	80	0	1218	746	450	778	644	294	61	817	924	455	1076	430	214	9	510
DEU	446	635	332	290	799	0	1943	885	1759	1451	636	96	1877	2247	833	2529	677	427	72	1134
DFS	283	496	239	127	372	807	0	614	1182	1044	533	84	1160	1321	669	1397	447	380	12	845
ESP	256	410	213	105	261	492	393	0	657	666	325	60	758	655	419	935	278	308	2	534
FRA	384	473	266	135	393	705	448	427	0	1118	552	84	1410	1397	688	1898	510	363	2	884
GBR	347	865	299	151	345	826	612	509	593	0	649	84	1128	1208	755	1493	372	375	4	928
IRL	237	302	209	97	186	495	379	304	405	632	0	62	490	646	549	564	137	247	2	515
ISR	20	41	16	5	49	75	61	39	43	57	51	0	84	96	79	102	37	42	0	66
ITA	288	659	254	159	466	908	630	525	585	722	389	59	0	1275	690	1994	472	380	1	865
NLD	610	607	308	277	675	1563	830	535	660	903	559	82	825	0	902	1763	499	369	34	1005
NZL	225	482	201	119	306	594	442	325	383	646	456	70	491	814	0	940	220	312	0	989
USA	314	1573	301	279	677	1187	706	560	806	1123	443	79	968	1223	893	0	614	478	7	1258
POL	78	242	36	38	261	327	224	118	174	164	70	19	235	299	142	385	0	98	19	262
ZAF	142	290	143	71	133	306	265	277	236	322	214	31	287	307	256	440	48	0	2	349
FRR	7	1	2	4	3	50	3	0	0	1	1	0	1	10	0	1	29	1	0	3
AUS	270	585	223	131	270	641	448	359	509	703	407	47	507	773	980	1050	126	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	303	504	346	262	383	235	361	556	274	408	120	169	342
CAN	257	0	1314	715	674	905	321	997	737	498	1753	376	306	711
DEU	421	662	0	1936	863	1441	605	1880	2227	825	2537	670	423	1129
DFS	259	486	808	0	582	1018	495	1141	1286	646	1379	432	368	827
ESP	228	398	479	364	0	635	298	734	618	398	907	266	299	513
GBR	313	853	827	576	462	0	615	1113	1174	735	1474	363	366	916
IRL	205	293	468	344	267	578	0	463	605	519	535	127	231	488
ITA	274	648	926	608	500	695	364	0	1249	673	1983	457	375	855
NLD	577	592	1565	794	492	850	509	792	0	878	1736	474	360	982
NZL	211	474	596	422	305	626	431	474	785	0	924	210	304	976
USA	302	1563	1211	692	540	1104	427	950	1201	880	0	603	471	1245
POL	72	239	330	216	107	162	64	228	276	129	380	0	96	250
ZAF	135	285	306	258	269	314	206	280	301	250	434	48	0	343
AUS	256	579	650	430	337	687	386	497	742	960	1039	113	284	0

JER hco

common bulls below diagonal
common three quarter sib group above diagonal
CAN DFS USA

CAN 0 44 128
DFS 32 0 65
USA 120 46 0

JER crc

common bulls below diagonal
common three quarter sib group above diagonal
CAN DFS GBR NLD NZL USA AUS

CAN 0 46 82 18 98 159 116
DFS 34 0 104 50 112 92 91
GBR 84 93 0 45 151 130 136
NLD 14 44 41 0 53 46 43
NZL 110 81 154 50 0 204 313
USA 161 70 143 49 238 0 231
AUS 113 51 142 39 348 240 0

JER ccl

common bulls below diagonal
common three quarter sib group above diagonal
CAN DFS GBR NLD USA

CAN 0 45 82 18 159
DFS 33 0 99 49 91
GBR 83 89 0 42 116
NLD 14 43 37 0 45
USA 160 70 127 48 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 81 19 99 164 78 111
DFS 34 0 106 50 119 136 100 95
GBR 81 95 0 45 162 150 117 140
NLD 14 44 42 0 54 52 48 45
NZL 109 88 165 51 0 304 160 329
USA 167 101 169 56 394 0 206 336
ZAF 76 73 119 46 173 218 0 168
AUS 108 55 146 39 369 363 158 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	81	19	99	164	78	111
DFS	34	0	106	50	119	136	100	95
GBR	81	95	0	46	162	150	117	140
NLD	15	45	43	0	55	54	49	47
NZL	109	88	165	53	0	304	160	329
USA	167	102	169	58	394	0	206	336
ZAF	76	73	119	48	173	218	0	168
AUS	108	55	146	40	369	363	158	0

RDC hco

common bulls below diagonal

common three quarter sib group above diagonal

CAN DEU DFS NOR

CAN	0	7	76	4
DEU	6	0	34	8
DFS	72	26	0	81
NOR	4	8	63	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	77	46	4	48	80	3	53
DEU	7	0	36	3	8	10	0	7	20
DFS	73	29	0	37	76	141	38	25	130
GBR	47	3	36	0	8	40	29	9	35
NOR	4	8	58	9	0	42	0	15	32
NZL	52	10	137	39	41	0	31	10	100
USA	77	0	32	29	0	33	0	0	28
NLD	3	7	26	9	15	10	0	0	11
AUS	52	19	114	34	27	106	27	9	0

RDC cc1

common bulls below diagonal

common three quarter sib group above diagonal

	CAN	DEU	DFS	GBR	NOR	NLD
CAN	0	8	74	44	4	3
DEU	7	0	37	3	8	7
DFS	70	30	0	35	77	25
GBR	45	3	34	0	8	9
NOR	4	8	59	9	0	15
NLD	3	7	26	9	15	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	72	44	4	46	105	82	3	50
DEU	6	0	36	3	7	10	4	1	7	20
DFS	69	29	0	39	68	146	92	55	23	132
GBR	45	3	38	0	8	42	52	37	7	36
NOR	4	7	53	9	0	40	24	0	15	31
NZL	50	10	142	41	39	0	79	43	10	107
USA	105	4	89	54	24	82	0	80	13	66
ZAF	93	1	53	36	0	41	79	0	1	40
NLD	3	7	24	7	15	10	13	1	0	11
AUS	49	19	116	35	26	113	70	43	9	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	72	44	4	46	105	82	4	50
DEU	6	0	37	3	7	10	4	1	7	20
DFS	69	30	0	38	68	146	92	55	23	132
GBR	45	3	37	0	8	42	52	37	7	36
NOR	4	7	53	9	0	40	24	0	12	31
NZL	50	10	142	41	39	0	79	43	10	107
USA	105	4	89	54	24	82	0	80	11	66
ZAF	93	1	53	36	0	41	79	0	1	40
NLD	4	7	24	7	12	10	11	1	0	11
AUS	49	19	116	35	26	113	70	43	9	0