

Introduction

The latest routine international evaluation for conformation traits took place as scheduled at the Interbull Centre. Data from twenty four (24) countries were included in this evaluation.

International genetic evaluations for calving traits of bulls from Australia, Belgium, Canada, Switzerland, Czech Republic, Germany, Denmark-Finland-Sweden, Spain, France, United Kingdom, Hungary, Ireland, Italy, Japan, Korea, The Netherlands, Norway, New Zealand, Poland, South Africa, Estonia, Slovenia, Portugal and the United States of America were computed. Brown Swiss, Guernsey, Holstein, Jersey and Red Dairy Cattle breed data were included in this evaluation.

The WHFF trait definitions are available on this link http://www.interbull.org/ib/conf_trait_hol_jer

The following is a list of substitute traits as applied by countries:

COU	BRD	TRT_Code	TRT_NAME	Subs_Trt
USA	BSW	ofr	overall frame	sta
USA	BSW	oru	overall rump	rwi
USA	BSW	rle	rump length	rwi
USA	BSW	thp	thurl position	rwi

Changes in national procedures

Changes in the national genetic evaluation of conformation traits are as follows:

CZE (HOL) Base change from 2005 to 2010
ITA (BSW) New data for OUS, new method of estimation tested: moving from a combined trait to a direct evaluation of overall udder score from the classifiers
NOR (RDC) First time with CWI and RWI, New data extraction pipeline, evaluation and EDC by Mix99, inbreeding considered in setting up A-matrix. The new pipeline also includes new multitrait groups that the traits are evaluated within. It also involves the scaling that may deviate from the old system, Base change
DFS (ALL) Change in lactation weights for all traits and breeds
FRA (ALL) Evaluation now performed by a new genetic centre, GENEVAL
JPN (HOL) New model, changing from ST-AM model to ST-RP-AM model. Pedigree modifications.
CHE (ALL) Data corrections
IRL (HOL) Moved software to calculate EBVs and reliabilities in MIX99. Reliabilities are now calculated using the Tier and Meyer type accuracies method, therefore there are some changes to the reliabilty solutions
PRT (HOL) Pedigree corrections
NZL (ALL) Continues DNA parentage testing resulting in pedigree editing
EST (RDC) Pedigree updates
SVN (ALL) Pedigree updates and phenotypic data improvement
DEA (BSW) Base change due to rolling base
USA (HOL) Pedigree updates

INTERBULL CHANGES COMPARED TO THE DECEMBER ROUTINE RUN

Subsetting:

As decided by the ITC in Orlando, new subsetting was introduced in the september test run. Sub-setting is necessary for operational purposes and restrictions of time scales. To minimize the effect of subsetting, larger subsets with 10-12 countries and with 4 link providing countries have been applied.

Window:

According to the decision taken by ITC in Orlando, the following changes have been introduced in regards to the windows used for post processing:

The upper bounds have been set to 0.99 as these were judged to have very little effect on evaluations. The lower values have been set to about the 25% percentile value. The largest changes are for the lower values for conformation traits, with the lowest window being 40% for OFL otherwise it is about 50% for all other confirmation traits. It is anticipated that these low values may not have large impact on evaluations since there were very few countries combinations whose estimated correlations fell between the old limit of 0.30 and these new limits.

Data were national genetic evaluations of AI sampled bulls with at least 10 daughters or 10 EDC (for clinical mastitis and maternal calving traits at least 50 daughters or 50 EDC, and for direct calving traits at least 50 calvings or 50 EDC) in at least 10 herds. Table 1 presents the amount of data included in this Interbull evaluation for all breeds.

National proofs were first de-regressed within country and then analysed jointly with a linear model including the effects of evaluation country, genetic group of bull and bull merit. Heritability estimates used in both the de-regression and international evaluation were as in each country's national evaluation.

Table 2 presents the date of evaluation as supplied by each country

Estimated genetic parameters and sire standard deviations are shown in APPENDIX I and the corresponding number of common bulls are listed in APPENDIX II.

SCIENTIFIC LITERATURE

The international genetic evaluation procedure is based on international work described in the following scientific publications:

International genetic evaluation computation:
Schaeffer. 1994. J. Dairy Sci. 77:2671-2678
Klei, 1998. Interbull Bulletin 17:3-7

Verification and Genetic trend validation:
Klei et al., 2002. Interbull Bulletin 29:178-182.
Boichard et al., 1995. J. Dairy Sci. 78:431-437

Weighting factors:
Fikse and Banos, 2001. J. Dairy Sci. 84:1759-1767

De-regression:
Sigurdsson and G. Banos. 1995. Acta Agric. Scand. 45:207-219
Jairath et al. 1998. J. Dairy Sci. Vol. 81:550-562

Genetic parameter estimation:
Klei and Weigel, 1998, Interbull Bulletin 17:8-14
Sullivan, 1999. Interbull Bulletin 22:146-148

Post-processing of estimated genetic correlations:
Mark et al., 2003, Interbull Bulletin 30:126-135
Jorjani et al., 2003. J. Dairy Sci. 86:677-679
<https://wiki.interbull.org/public/rG%20procedure?action=print>

Time edits
Weigel and Banos. 1997. J. Dairy Sci. 80:3425-3430

International reliability estimation
Harris and Johnson. 1998. Interbull Bulletin 17:31-36

 NEXT ROUTINE INTERNATIONAL EVALUATION

Dates for the next routine evaluation can be found on
<http://www.interbull.org/ib/servicecalendar>.

 NEXT TEST INTERNATIONAL EVALUATION

Dates for the next test run can be found on
<http://www.interbull.org/ib/servicecalendar>.

 PUBLICATION OF INTERBULL TEST RUN

Test evaluation results are meant for review purposes only and should not be published.

^LTable 1. National evaluation data considered in the Interbull evaluation for conformation traits (December Routine Evaluation 2018).
 Number of records for stature by breed

Country	BSW	GUE	HOL	JER	RDC	SIM
AUS		52	3539	684	273	
BEL			1457			
CAN	195	97	11194	685	822	
CHE	2612		3082	39		
CZE			3868			
DEA	3336					
DEU			20852		263	
DFS			11646	1910	6081	
ESP			3628			
EST			677			
FRA	335		16457			
FRM						
GBR	19	202	5611	418	298	
HUN			2495			
IRL			1623			
ISR						
ITA	2002		8594	100		
JPN			5406			
KOR			1158			
LTU						
LVA						
NLD	118		14307	36	45	
NOR					2284	
NZL			5922	3758	561	
POL			8224			
PRT			2027			
SVK						
SVN	289		460			
URY						
USA	820	680	31637	3914	246	
ZAF			824	522		
HRV						
MEX						
CAM					31	
=====						
No. Records	9726	1031	164688	12066	10904	
Pub. Proofs	7848	874	134453	10553	11687	0

^LAPPENDIX I. Sire standard deviations in diagonal and genetic correlations below diagonal

 BSW sta

	CAN	CHE	FRA	ITA	NLD	USA	DEA	SVN	GBR
CAN	6.66								
CHE	0.95	12.39							
FRA	0.98	0.97	0.91						
ITA	0.96	0.95	0.95	14.80					
NLD	0.95	0.95	0.96	0.92	4.59				
USA	0.98	0.95	0.97	0.95	0.94	1.60			
DEA	0.96	0.98	0.97	0.96	0.96	0.96	11.26		
SVN	0.92	0.90	0.91	0.93	0.91	0.90	0.92	16.40	
GBR	0.96	0.93	0.96	0.94	0.93	0.96	0.91	0.89	0.71

BSW cwi

	CAN	CHE	FRA	ITA	NLD	USA	DEA	SVN	GBR
CAN	8.61								
CHE	0.89	10.14							
FRA	0.84	0.82	0.92						
ITA	0.81	0.84	0.86	22.12					
NLD	0.89	0.79	0.79	0.71	4.27				
USA	0.91	0.90	0.87	0.85	0.81	0.87			
DEA	0.87	0.82	0.67	0.74	0.77	0.79	11.59		
SVN	0.85	0.83	0.79	0.85	0.73	0.84	0.87	22.89	
GBR	0.91	0.85	0.82	0.72	0.89	0.81	0.79	0.81	1.31

BSW bde

	CAN	CHE	FRA	ITA	NLD	DEA	SVN	GBR	USA
CAN	6.63								
CHE	0.86	10.23							
FRA	0.75	0.87	0.91						
ITA	0.79	0.90	0.91	18.18					
NLD	0.83	0.84	0.86	0.84	4.12				
DEA	0.86	0.90	0.92	0.90	0.84	11.33			
SVN	0.80	0.78	0.77	0.86	0.79	0.76	25.88		
GBR	0.87	0.88	0.82	0.85	0.90	0.86	0.86	1.34	
USA	0.73	0.77	0.86	0.78	0.86	0.79	0.79	0.88	0.80

BSW ang

	CAN	CHE	FRA	NLD	USA	GBR
CAN	8.09					
CHE	0.70	10.91				
FRA	0.89	0.67	0.88			
NLD	0.75	0.65	0.66	3.79		
USA	0.88	0.70	0.77	0.68	1.21	
GBR	0.89	0.77	0.80	0.79	0.89	0.67

BSW ran

	CAN	CHE	FRA	ITA	NLD	USA	DEA	SVN	GBR
CAN	6.64								
CHE	0.93	10.62							
FRA	0.97	0.96	0.94						
ITA	0.95	0.93	0.94	23.03					
NLD	0.95	0.92	0.95	0.93	4.39				
USA	0.97	0.94	0.97	0.92	0.95	1.12			
DEA	0.96	0.94	0.95	0.94	0.91	0.97	11.97		
SVN	0.92	0.91	0.91	0.91	0.91	0.92	0.91	20.78	
GBR	0.96	0.94	0.97	0.94	0.97	0.96	0.92	0.92	1.78

BSW	rwi								
	CAN	CHE	FRA	NLD	USA	DEA	GBR	SVN	ITA
CAN	7.31								
CHE	0.90	10.05							
FRA	0.89	0.83	0.95						
NLD	0.92	0.86	0.89	3.79					
USA	0.91	0.83	0.87	0.81	0.74				
DEA	0.93	0.89	0.80	0.81	0.87	13.39			
GBR	0.93	0.87	0.92	0.88	0.93	0.83	1.18		
SVN	0.91	0.84	0.83	0.88	0.84	0.88	0.88	26.64	
ITA	0.88	0.80	0.83	0.81	0.85	0.86	0.90	0.82	20.62

BSW	rls								
	CAN	CHE	FRA	ITA	NLD	USA	DEA	SVN	GBR
CAN	7.13								
CHE	0.92	12.95							
FRA	0.91	0.90	1.02						
ITA	0.91	0.85	0.92	23.92					
NLD	0.88	0.82	0.88	0.85	5.06				
USA	0.94	0.93	0.90	0.86	0.86	0.74			
DEA	0.92	0.91	0.93	0.89	0.81	0.92	12.44		
SVN	0.87	0.83	0.87	0.87	0.82	0.88	0.88	21.84	
GBR	0.85	0.89	0.91	0.84	0.87	0.84	0.88	0.83	1.04

BSW	fan								
	CAN	CHE	FRA	ITA	NLD	USA	DEA	SVN	GBR
CAN	8.63								
CHE	0.70	13.75							
FRA	0.73	0.72	1.08						
ITA	0.71	0.85	0.79	22.66					
NLD	0.73	0.67	0.82	0.69	5.45				
USA	0.79	0.69	0.84	0.85	0.81	0.71			
DEA	0.66	0.90	0.68	0.89	0.66	0.65	11.77		
SVN	0.70	0.84	0.70	0.85	0.67	0.69	0.94	24.58	
GBR	0.81	0.70	0.90	0.73	0.88	0.83	0.70	0.69	0.93

BSW	hde								
	CAN	CHE	FRA	ITA	NLD	DEA	SVN	USA	
CAN	8.83								
CHE	0.87	12.62							
FRA	0.80	0.79	1.15						
ITA	0.78	0.83	0.85	22.93					
NLD	0.77	0.73	0.84	0.74	5.45				
DEA	0.78	0.86	0.83	0.91	0.77	12.32			
SVN	0.77	0.76	0.82	0.89	0.75	0.89	30.33		
USA	0.84	0.74	0.86	0.89	0.82	0.76	0.82	0.71	

BSW	fua								
	CAN	CHE	FRA	ITA	NLD	USA	DEA	SVN	GBR
CAN	6.99								
CHE	0.86	11.69							
FRA	0.88	0.85	0.90						
ITA	0.90	0.83	0.83	21.07					
NLD	0.91	0.84	0.89	0.84	4.70				
USA	0.94	0.84	0.84	0.90	0.87	1.29			
DEA	0.87	0.84	0.93	0.82	0.84	0.85	11.35		
SVN	0.81	0.75	0.84	0.86	0.79	0.79	0.89	21.90	

GBR 0.93 0.85 0.87 0.89 0.91 0.92 0.78 0.72 1.36

BSW ruh

	CAN	CHE	FRA	ITA	NLD	USA	DEA	SVN	GBR
CAN	7.47								
CHE	0.91	11.53							
FRA	0.87	0.83	0.94						
ITA	0.78	0.86	0.85	13.37					
NLD	0.80	0.85	0.87	0.87	4.55				
USA	0.86	0.85	0.88	0.88	0.86	1.17			
DEA	0.83	0.86	0.89	0.93	0.92	0.88	11.96		
SVN	0.82	0.81	0.79	0.85	0.89	0.82	0.90	19.41	
GBR	0.77	0.82	0.86	0.86	0.87	0.91	0.79	0.77	1.27

BSW ruw

	CAN	CHE	FRA	ITA	NLD	USA	DEA	SVN
CAN	7.78							
CHE	0.91	11.61						
FRA	0.87	0.87	0.85					
ITA	0.81	0.88	0.80	13.55				
NLD	0.72	0.66	0.79	0.70	4.55			
USA	0.87	0.89	0.85	0.90	0.78	1.04		
DEA	0.85	0.91	0.76	0.95	0.56	0.91	12.34	
SVN	0.81	0.79	0.74	0.82	0.70	0.79	0.81	17.85

BSW usu

	CAN	CHE	FRA	ITA	NLD	USA	DEA	SVN	GBR
CAN	7.99								
CHE	0.90	11.92							
FRA	0.84	0.91	0.91						
ITA	0.90	0.88	0.88	18.79					
NLD	0.83	0.83	0.90	0.83	4.40				
USA	0.85	0.89	0.86	0.85	0.89	1.09			
DEA	0.92	0.91	0.87	0.93	0.78	0.80	11.59		
SVN	0.83	0.82	0.71	0.81	0.67	0.72	0.83	23.78	
GBR	0.83	0.80	0.87	0.88	0.91	0.93	0.76	0.69	2.53

BSW ude

	CAN	CHE	FRA	ITA	NLD	USA	DEA	SVN	GBR
CAN	6.55								
CHE	0.96	11.93							
FRA	0.95	0.95	0.98						
ITA	0.94	0.97	0.95	21.33					
NLD	0.96	0.96	0.95	0.94	4.22				
USA	0.95	0.95	0.96	0.95	0.95	1.22			
DEA	0.93	0.98	0.92	0.97	0.95	0.92	12.05		
SVN	0.93	0.95	0.91	0.97	0.94	0.92	0.95	21.41	
GBR	0.96	0.94	0.96	0.94	0.97	0.96	0.92	0.91	1.92

BSW ftp

	CAN	CHE	FRA	NLD	USA	DEA	SVN	GBR	ITA
CAN	6.99								
CHE	0.97	14.10							
FRA	0.97	0.95	0.93						
NLD	0.96	0.95	0.95	4.77					
USA	0.92	0.90	0.88	0.91	1.19				

DEA	0.96	0.99	0.95	0.95	0.89	11.07			
SVN	0.94	0.93	0.93	0.92	0.90	0.92	18.08		
GBR	0.96	0.93	0.90	0.94	0.94	0.89	0.93	1.23	
ITA	0.87	0.85	0.85	0.86	0.88	0.85	0.86	0.88	23.25

BSW ftl

	CAN	CHE	FRA	ITA	NLD	USA	DEA	SVN	GBR
CAN	6.16								
CHE	0.91	14.74							
FRA	0.93	0.95	0.97						
ITA	0.91	0.94	0.95	18.79					
NLD	0.92	0.96	0.92	0.93	5.05				
USA	0.92	0.96	0.95	0.94	0.96	1.37			
DEA	0.89	0.97	0.98	0.96	0.94	0.96	11.19		
SVN	0.90	0.93	0.90	0.93	0.94	0.91	0.92	18.24	
GBR	0.94	0.93	0.93	0.95	0.97	0.96	0.92	0.93	1.34

BSW rtp

	CAN	CHE	FRA	ITA	NLD	DEA	SVN	USA
CAN	6.77							
CHE	0.97	14.65						
FRA	0.96	0.97	0.93					
ITA	0.92	0.94	0.94	21.56				
NLD	0.97	0.96	0.97	0.93	4.43			
DEA	0.95	0.99	0.96	0.95	0.95	12.20		
SVN	0.94	0.94	0.93	0.94	0.94	0.93	17.50	
USA	0.93	0.90	0.92	0.91	0.94	0.90	0.91	1.19

BSW ocs

	CAN	CHE	FRA	ITA	NLD	USA	DEA	SVN	GBR
CAN	7.76								
CHE	0.87	8.84							
FRA	0.81	0.88	0.97						
ITA	0.83	0.84	0.89	9.57					
NLD	0.78	0.78	0.82	0.78	3.70				
USA	0.87	0.78	0.85	0.84	0.83	0.62			
DEA	0.82	0.91	0.90	0.89	0.76	0.76	10.94		
SVN	0.79	0.78	0.78	0.77	0.78	0.79	0.78	22.38	
GBR	0.83	0.89	0.89	0.83	0.88	0.89	0.82	0.79	1.59

BSW ous

	CAN	CHE	FRA	ITA	NLD	USA	DEA	SVN	GBR
CAN	7.96								
CHE	0.89	13.21							
FRA	0.89	0.93	0.98						
ITA	0.84	0.91	0.89	10.81					
NLD	0.89	0.88	0.91	0.81	4.47				
USA	0.87	0.90	0.89	0.89	0.87	0.94			
DEA	0.87	0.95	0.90	0.92	0.87	0.88	12.55		
SVN	0.77	0.81	0.75	0.82	0.76	0.81	0.91	21.09	
GBR	0.83	0.85	0.76	0.83	0.79	0.88	0.79	0.76	1.33

BSW ofl

	CAN	CHE	FRA	ITA	NLD	USA	DEA	SVN	GBR
CAN	7.93								
CHE	0.87	11.21							

FRA	0.67	0.69	1.29						
ITA	0.69	0.72	0.86	18.14					
NLD	0.68	0.68	0.76	0.67	4.68				
USA	0.75	0.68	0.78	0.75	0.68	0.99			
DEA	0.70	0.84	0.71	0.81	0.66	0.65	11.53		
SVN	0.76	0.86	0.67	0.76	0.69	0.74	0.88	28.20	
GBR	0.75	0.77	0.81	0.69	0.75	0.73	0.69	0.68	1.52

BSW ofr

	CAN	CHE	DEA	ITA	SVN	USA	FRA		
CAN	7.27								
CHE	0.84	11.90							
DEA	0.88	0.90	11.74						
ITA	0.84	0.91	0.94	18.98					
SVN	0.81	0.83	0.79	0.86	23.31				
USA	0.86	0.83	0.91	0.86	0.80	1.60			
FRA	0.83	0.86	0.92	0.90	0.84	0.90	0.88		

BSW tpl

	CAN	CHE	DEA	ITA	SVN	FRA			
CAN	7.00								
CHE	0.91	11.81							
DEA	0.91	0.91	11.79						
ITA	0.93	0.92	0.94	24.55					
SVN	0.91	0.90	0.90	0.89	23.61				
FRA	0.97	0.94	0.91	0.91	0.90	1.28			

BSW oru

	CAN	CHE	DEA	ITA	SVN	USA	FRA		
CAN	7.38								
CHE	0.78	15.65							
DEA	0.70	0.88	12.67						
ITA	0.92	0.80	0.77	19.12					
SVN	0.83	0.65	0.66	0.71	28.23				
USA	0.91	0.56	0.47	0.83	0.76	0.74			
FRA	0.91	0.90	0.82	0.90	0.75	0.84	1.07		

BSW rle

	CHE	DEA	ITA	SVN	USA	FRA			
CHE	11.78								
DEA	0.96	12.47							
ITA	0.83	0.87	22.07						
SVN	0.81	0.85	0.83	27.53					
USA	0.53	0.50	0.78	0.71	0.74				
FRA	0.92	0.93	0.90	0.84	0.73	1.02			

BSW thp

	CAN	CHE	DEA	ITA	SVN	USA	FRA		
CAN	7.73								
CHE	0.84	11.15							
DEA	0.76	0.86	12.30						
ITA	0.88	0.92	0.83	30.74					
SVN	0.80	0.86	0.87	0.87	37.14				
USA	0.89	0.88	0.71	0.85	0.75	1.12			
FRA	0.89	0.87	0.87	0.85	0.85	0.81	1.01		

BSW hoq						
	CAN	CHE	DEA	ITA	SVN	FRA
CAN	6.49					
CHE	0.93	11.81				
DEA	0.92	0.89	12.53			
ITA	0.91	0.82	0.86	20.20		
SVN	0.92	0.82	0.85	0.86	21.28	
FRA	0.89	0.82	0.90	0.88	0.88	1.01

BSW ful					
	CHE	DEA	ITA	SVN	FRA
CHE	11.59				
DEA	0.91	12.51			
ITA	0.91	0.96	12.72		
SVN	0.78	0.87	0.85	21.38	
FRA	0.67	0.81	0.74	0.74	0.96

BSW udb					
	CHE	DEA	ITA	SVN	FRA
CHE	11.22				
DEA	0.97	13.12			
ITA	0.93	0.97	26.70		
SVN	0.82	0.87	0.81	25.63	
FRA	0.91	0.89	0.85	0.80	0.96

BSW tdi					
	CHE	DEA	ITA	SVN	FRA
CHE	15.71				
DEA	0.96	11.43			
ITA	0.94	0.95	21.33		
SVN	0.92	0.92	0.94	17.96	
FRA	0.97	0.96	0.91	0.92	0.92

BSW tth					
	CHE	DEA	ITA	SVN	FRA
CHE	14.43				
DEA	0.97	12.95			
ITA	0.92	0.93	22.93		
SVN	0.89	0.91	0.88	20.17	
FRA	0.93	0.91	0.95	0.88	0.88

GUE sta				
	CAN	GBR	USA	AUS
CAN	6.24			
GBR	0.97	1.08		
USA	0.98	0.96	2.44	
AUS	0.89	0.92	0.89	4.52

GUE cwi				
	CAN	GBR	USA	AUS
CAN	6.87			
GBR	0.92	1.59		

USA	0.88	0.86	1.32	
AUS	0.77	0.82	0.66	7.12

GUE bde

	CAN	GBR	USA	AUS
CAN	6.25			
GBR	0.88	1.31		
USA	0.77	0.90	1.48	
AUS	0.86	0.83	0.76	5.16

GUE ang

	CAN	GBR	USA	AUS
CAN	7.74			
GBR	0.86	1.40		
USA	0.86	0.91	1.78	
AUS	0.65	0.81	0.72	6.78

GUE ran

	CAN	GBR	USA	AUS
CAN	6.39			
GBR	0.97	1.65		
USA	0.97	0.97	1.59	
AUS	0.94	0.96	0.92	8.17

GUE rwi

	CAN	GBR	USA	AUS
CAN	6.86			
GBR	0.94	1.42		
USA	0.92	0.92	1.37	
AUS	0.92	0.90	0.82	5.10

GUE rls

	CAN	GBR	USA	AUS
CAN	7.86			
GBR	0.82	1.79		
USA	0.93	0.79	1.00	
AUS	0.78	0.86	0.76	6.14

GUE rlr

	CAN	USA	AUS
CAN	7.03		
USA	0.85	0.71	
AUS	0.65	0.62	5.03

GUE fan

	CAN	GBR	USA	AUS
CAN	7.86			
GBR	0.77	1.61		
USA	0.83	0.75	0.81	
AUS	0.68	0.84	0.72	8.89

GUE fua				
	CAN	GBR	USA	AUS
CAN	7.22			
GBR	0.94	1.49		
USA	0.92	0.91	1.66	
AUS	0.86	0.85	0.78	7.85

GUE ruh				
	CAN	GBR	USA	AUS
CAN	6.93			
GBR	0.77	1.71		
USA	0.81	0.90	1.53	
AUS	0.82	0.81	0.77	6.59

GUE usu				
	CAN	GBR	USA	AUS
CAN	7.18			
GBR	0.80	1.51		
USA	0.81	0.85	1.15	
AUS	0.84	0.82	0.81	7.43

GUE ude				
	CAN	GBR	USA	AUS
CAN	6.19			
GBR	0.97	1.55		
USA	0.95	0.94	1.61	
AUS	0.94	0.95	0.92	4.50

GUE ftp				
	CAN	GBR	USA	AUS
CAN	5.74			
GBR	0.96	1.22		
USA	0.92	0.91	1.36	
AUS	0.92	0.92	0.88	6.84

GUE ftl				
	CAN	GBR	USA	AUS
CAN	4.80			
GBR	0.93	1.74		
USA	0.94	0.97	1.48	
AUS	0.92	0.96	0.95	6.20

GUE rtp				
	CAN	AUS	USA	
CAN	5.52			
AUS	0.91	7.20		
USA	0.94	0.92	1.36	

GUE ocs				
	CAN	GBR	USA	AUS
CAN	8.32			

HUN	0.64	0.83	0.85	0.83	0.84	0.83	0.83	0.89	0.76	0.81	0.81	0.88	1.10										
POL	0.67	0.87	0.87	0.83	0.85	0.85	0.87	0.85	0.83	0.77	0.85	0.82	0.83	12.32									
NZL	0.77	0.66	0.70	0.66	0.70	0.69	0.70	0.65	0.80	0.65	0.66	0.66	0.65	0.65	0.37								
ZAF	0.68	0.89	0.86	0.87	0.86	0.87	0.87	0.88	0.91	0.79	0.86	0.87	0.83	0.84	0.71	0.85							
JPN	0.62	0.82	0.77	0.83	0.71	0.71	0.80	0.90	0.66	0.91	0.73	0.90	0.82	0.74	0.63	0.75	1.50						
CZE	0.72	0.90	0.92	0.84	0.90	0.90	0.91	0.83	0.88	0.77	0.88	0.84	0.86	0.88	0.69	0.87	0.77	16.22					
EST	0.70	0.78	0.82	0.73	0.70	0.82	0.81	0.71	0.76	0.65	0.78	0.66	0.66	0.75	0.65	0.71	0.65	0.76	15.11				
IRL	0.79	0.80	0.84	0.82	0.88	0.82	0.76	0.80	0.95	0.70	0.85	0.77	0.75	0.78	0.84	0.87	0.65	0.83	0.70	1.38			
KOR	0.65	0.73	0.65	0.65	0.69	0.71	0.69	0.70	0.65	0.64	0.65	0.67	0.70	0.64	0.67	0.65	0.69	0.75	0.63	0.66	2.65		
SVN	0.66	0.74	0.82	0.80	0.82	0.81	0.83	0.75	0.80	0.73	0.80	0.81	0.80	0.79	0.66	0.85	0.67	0.78	0.68	0.78	0.66	20.63	
PRT	0.68	0.83	0.81	0.78	0.85	0.83	0.81	0.83	0.79	0.74	0.84	0.83	0.84	0.84	0.65	0.79	0.76	0.84	0.66	0.77	0.69	0.74	2.12

HOL bde

AUS	AUS	BEL	CAN	CHE	DEU	DFS	ESP	FRA	GBR	ITA	NLD	USA	HUN	POL	NZL	ZAF	JPN	CZE	EST	IRL	KOR	PRT	SVN
AUS	5.25																						
BEL	0.71	1.37																					
CAN	0.88	0.77	5.81																				
CHE	0.74	0.90	0.85	11.24																			
DEU	0.80	0.90	0.88	0.90	11.69																		
DFS	0.86	0.84	0.92	0.86	0.93	11.57																	
ESP	0.78	0.90	0.89	0.92	0.91	0.88	0.98																
FRA	0.67	0.92	0.69	0.88	0.82	0.72	0.85	1.08															
GBR	0.82	0.91	0.87	0.91	0.91	0.89	0.92	0.83	1.18														
ITA	0.69	0.87	0.71	0.85	0.85	0.76	0.87	0.89	0.87	1.22													
NLD	0.72	0.88	0.83	0.92	0.91	0.84	0.90	0.86	0.92	0.88	4.70												
USA	0.69	0.91	0.74	0.90	0.88	0.79	0.90	0.92	0.88	0.92	0.90	1.16											
HUN	0.71	0.91	0.78	0.87	0.88	0.85	0.90	0.85	0.88	0.85	0.84	0.90	1.05										
POL	0.81	0.80	0.86	0.80	0.91	0.89	0.86	0.70	0.85	0.78	0.81	0.79	0.86	12.25									
NZL	0.78	0.69	0.69	0.69	0.70	0.70	0.70	0.68	0.70	0.69	0.68	0.69	0.69	0.71	0.37								
ZAF	0.81	0.87	0.85	0.84	0.88	0.88	0.90	0.75	0.93	0.80	0.83	0.85	0.85	0.88	0.71	0.87							
JPN	0.68	0.93	0.72	0.90	0.87	0.79	0.88	0.95	0.85	0.90	0.90	0.94	0.87	0.75	0.79	1.42							
CZE	0.84	0.83	0.92	0.83	0.94	0.92	0.88	0.70	0.89	0.76	0.83	0.79	0.87	0.92	0.70	0.88	0.77	16.49					
EST	0.77	0.85	0.86	0.84	0.87	0.87	0.88	0.78	0.86	0.77	0.83	0.84	0.85	0.86	0.68	0.81	0.81	0.85	14.20				
IRL	0.84	0.88	0.86	0.88	0.92	0.90	0.90	0.79	0.96	0.85	0.87	0.85	0.84	0.85	0.72	0.90	0.81	0.87	0.81	1.19			
KOR	0.70	0.80	0.70	0.79	0.81	0.82	0.78	0.75	0.73	0.69	0.71	0.73	0.80	0.72	0.69	0.75	0.80	0.78	0.71	0.73	3.39		
PRT	0.77	0.81	0.79	0.78	0.88	0.87	0.83	0.70	0.84	0.77	0.78	0.80	0.84	0.86	0.70	0.84	0.78	0.87	0.78	0.85	0.71	2.01	
SVN	0.75	0.88	0.84	0.88	0.91	0.84	0.92	0.83	0.89	0.83	0.91	0.86	0.86	0.82	0.71	0.81	0.87	0.85	0.84	0.85	0.77	0.78	20.45

HOL ang

AUS	AUS	BEL	CAN	CHE	DEU	DFS	ESP	FRA	GBR	ITA	NLD	USA	HUN	POL	ZAF	JPN	CZE	EST	IRL	KOR	PRT	SVN	
AUS	6.33																						
BEL	0.60	1.07																					
CAN	0.68	0.76	6.38																				
CHE	0.61	0.77	0.88	11.62																			
DEU	0.60	0.71	0.83	0.76	12.58																		
DFS	0.68	0.86	0.89	0.81	0.83	10.57																	
ESP	0.68	0.76	0.88	0.78	0.73	0.84	0.74																
FRA	0.65	0.83	0.88	0.87	0.79	0.88	0.84	0.96															
GBR	0.83	0.75	0.90	0.79	0.78	0.87	0.82	0.80	1.20														
ITA	0.71	0.74	0.90	0.77	0.79	0.85	0.84	0.82	0.87	1.30													
NLD	0.76	0.60	0.73	0.68	0.60	0.66	0.76	0.64	0.79	0.73	4.56												
USA	0.72	0.76	0.94	0.81	0.83	0.90	0.85	0.85	0.91	0.87	0.68	1.38											
HUN	0.62	0.71	0.77	0.71	0.83	0.78	0.70	0.81	0.71	0.76	0.59	0.79	1.00										
POL	0.59	0.68	0.72	0.70	0.63	0.72	0.77	0.75	0.66	0.77	0.64	0.69	0.60	6.52									
ZAF	0.69	0.79	0.72	0.67	0.75	0.80	0.70	0.73	0.85	0.77	0.60	0.76	0.76	0.62	0.73								
JPN	0.70	0.80	0.90	0.79	0.77	0.90	0.88	0.86	0.86	0.91	0.74	0.87	0.73	0.76	0.77	1.57							
CZE	0.65	0.77	0.82	0.74	0.74	0.85	0.73	0.78	0.75	0.80	0.60	0.78	0.80	0.62	0.66	0.78	15.38						
EST	0.62	0.75	0.67	0.64	0.69	0.80	0.62	0.67	0.64	0.62	0.61	0.64	0.74	0.64	0.69	0.70	0.77	16.29					
IRL	0.75	0.75	0.89	0.79	0.78	0.85	0.81	0.84	0.93	0.85	0.68	0.90	0.75	0.66	0.82	0.85	0.76	0.63	0.75				
KOR	0.70	0.78	0.78	0.74	0.72	0.75	0.78	0.75	0.78	0.74	0.61	0.76	0.73	0.63	0.79	0.84	0.68	0.69	0.76	2.35			
PRT	0.61	0.69	0.78	0.64	0.72	0.78	0.75	0.73	0.78	0.80	0.60	0.80	0.69	0.64	0.69	0.79	0.71	0.62	0.74	0.78	1.31		
SVN	0.67	0.70	0.74	0.79	0.61	0.66	0.71	0.69	0.72	0.74	0.74	0.71	0.61	0.83	0.63	0.70	0.68	0.65	0.68	0.72	0.68	22.42	

CZE	0.77	0.85	0.83	0.72	0.91	0.82	0.85	0.87	0.85	0.72	0.82	0.83	0.92	0.73	0.81	0.85	16.55							
EST	0.75	0.74	0.69	0.67	0.79	0.73	0.84	0.82	0.77	0.64	0.82	0.73	0.81	0.65	0.68	0.84	0.84	15.46						
IRL	0.75	0.68	0.74	0.65	0.81	0.66	0.74	0.77	0.90	0.69	0.76	0.71	0.70	0.66	0.76	0.65	0.72	0.66	1.61					
KOR	0.65	0.65	0.73	0.63	0.73	0.65	0.79	0.75	0.75	0.67	0.71	0.76	0.78	0.67	0.66	0.66	0.74	0.66	0.65	1.64				
SVN	0.65	0.65	0.72	0.65	0.70	0.71	0.73	0.65	0.66	0.65	0.65	0.71	0.65	0.65	0.64	0.65	0.69	0.63	0.69	0.64	22.39			
PRT	0.65	0.65	0.65	0.65	0.75	0.65	0.71	0.74	0.68	0.65	0.70	0.73	0.66	0.65	0.66	0.65	0.72	0.72	0.65	0.75	0.68	2.21		

HOL fua

	AUS	BEL	CAN	CHE	DEU	DFS	ESP	FRA	GBR	ITA	NLD	USA	HUN	POL	NZL	ZAF	JPN	CZE	EST	IRL	KOR	SVN	PRT	
AUS	5.35																							
BEL	0.78	1.57																						
CAN	0.82	0.76	5.64																					
CHE	0.86	0.79	0.91	11.72																				
DEU	0.75	0.82	0.93	0.85	12.15																			
DFS	0.85	0.84	0.91	0.89	0.89	11.76																		
ESP	0.81	0.77	0.88	0.85	0.82	0.82	0.86																	
FRA	0.84	0.90	0.89	0.87	0.90	0.92	0.84	1.07																
GBR	0.84	0.77	0.95	0.87	0.96	0.88	0.88	0.89	1.17															
ITA	0.74	0.67	0.89	0.82	0.86	0.79	0.85	0.80	0.91	1.38														
NLD	0.80	0.87	0.93	0.90	0.95	0.91	0.86	0.93	0.92	0.82	5.15													
USA	0.78	0.69	0.95	0.86	0.89	0.85	0.89	0.83	0.94	0.94	0.87	1.42												
HUN	0.86	0.73	0.90	0.87	0.87	0.88	0.82	0.85	0.87	0.80	0.86	0.83	1.04											
POL	0.75	0.81	0.85	0.84	0.90	0.88	0.79	0.88	0.86	0.78	0.88	0.80	0.83	9.99										
NZL	0.78	0.76	0.81	0.77	0.83	0.78	0.79	0.83	0.85	0.77	0.83	0.82	0.71	0.74	0.39									
ZAF	0.84	0.78	0.87	0.82	0.90	0.87	0.82	0.84	0.91	0.77	0.87	0.83	0.84	0.81	0.76	0.86								
JPN	0.80	0.74	0.95	0.91	0.89	0.91	0.83	0.85	0.91	0.86	0.89	0.91	0.88	0.84	0.77	0.82	1.50							
CZE	0.85	0.85	0.89	0.86	0.94	0.91	0.79	0.91	0.91	0.78	0.91	0.80	0.92	0.90	0.75	0.91	0.87	14.47						
EST	0.69	0.73	0.81	0.75	0.78	0.83	0.68	0.81	0.76	0.68	0.81	0.71	0.77	0.79	0.69	0.72	0.74	0.78	14.31					
IRL	0.81	0.75	0.86	0.82	0.86	0.77	0.87	0.84	0.94	0.87	0.84	0.89	0.73	0.79	0.87	0.82	0.80	0.79	0.68	1.17				
KOR	0.78	0.74	0.72	0.77	0.72	0.78	0.73	0.76	0.75	0.68	0.76	0.68	0.77	0.81	0.68	0.81	0.74	0.80	0.68	0.71	3.31			
SVN	0.69	0.79	0.68	0.68	0.69	0.68	0.68	0.69	0.68	0.68	0.68	0.68	0.67	0.68	0.68	0.67	0.68	0.69	0.67	0.67	0.70	18.47		
PRT	0.68	0.72	0.68	0.68	0.68	0.68	0.71	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.71	0.68	0.68	0.68	0.68	0.68	0.69	0.70	1.58	

HOL ruh

	AUS	BEL	CAN	CHE	DEU	DFS	ESP	FRA	GBR	ITA	NLD	USA	HUN	POL	NZL	ZAF	JPN	CZE	EST	IRL	KOR	SVN	PRT	
AUS	5.03																							
BEL	0.86	1.34																						
CAN	0.80	0.92	5.72																					
CHE	0.81	0.90	0.92	11.00																				
DEU	0.82	0.89	0.88	0.87	13.05																			
DFS	0.80	0.90	0.88	0.91	0.95	11.55																		
ESP	0.84	0.85	0.82	0.84	0.90	0.91	0.81																	
FRA	0.80	0.89	0.88	0.88	0.90	0.93	0.89	1.09																
GBR	0.83	0.83	0.77	0.83	0.87	0.90	0.88	0.88	1.16															
ITA	0.75	0.75	0.75	0.75	0.83	0.86	0.90	0.82	0.87	1.30														
NLD	0.78	0.84	0.78	0.83	0.92	0.93	0.91	0.87	0.88	0.84	4.75													
USA	0.78	0.83	0.84	0.85	0.89	0.92	0.89	0.88	0.93	0.88	0.85	1.51												
HUN	0.84	0.78	0.80	0.78	0.87	0.84	0.89	0.83	0.84	0.83	0.82	0.83	0.97											
POL	0.75	0.83	0.74	0.77	0.84	0.86	0.86	0.82	0.82	0.83	0.84	0.79	0.79	7.18										
NZL	0.82	0.80	0.76	0.82	0.82	0.85	0.83	0.83	0.90	0.81	0.82	0.88	0.83	0.76	0.38									
ZAF	0.76	0.77	0.75	0.80	0.79	0.82	0.80	0.76	0.86	0.80	0.78	0.81	0.75	0.75	0.78	0.81								
JPN	0.83	0.91	0.91	0.91	0.89	0.93	0.92	0.90	0.84	0.85	0.87	0.87	0.85	0.85	0.81	0.80	1.44							
CZE	0.82	0.88	0.89	0.83	0.89	0.86	0.79	0.84	0.76	0.75	0.76	0.79	0.85	0.75	0.76	0.79	0.85	14.66						
EST	0.74	0.81	0.77	0.74	0.78	0.80	0.81	0.77	0.76	0.76	0.76	0.79	0.79	0.78	0.76	0.73	0.80	0.76	12.15					
IRL	0.75	0.77	0.75	0.77	0.82	0.85	0.86	0.81	0.93	0.88	0.83	0.90	0.79	0.78	0.85	0.82	0.80	0.74	0.74	1.05				
KOR	0.76	0.85	0.83	0.76	0.74	0.75	0.76	0.75	0.74	0.74	0.75	0.75	0.75	0.73	0.74	0.75	0.83	0.78	0.73	0.73	3.61			
SVN	0.76	0.91	0.82	0.79	0.87	0.85	0.80	0.83	0.77	0.75	0.83	0.76	0.74	0.77	0.74	0.73	0.81	0.83	0.81	0.73	0.78	16.73		
PRT	0.76	0.77	0.75	0.75	0.79	0.83	0.85	0.80	0.85	0.84	0.81	0.80	0.79	0.80	0.75	0.76	0.77	0.75	0.75	0.81	0.75	0.75	1.42	

HOL usu

ESP	0.40	0.72	0.82	0.76	0.71	0.82	0.92													
FRA	0.40	0.80	0.69	0.72	0.74	0.64	0.75	1.07												
GBR	0.40	0.73	0.76	0.79	0.75	0.72	0.80	0.83	1.20											
ITA	0.40	0.71	0.71	0.70	0.72	0.64	0.69	0.79	0.70	1.70										
NLD	0.40	0.83	0.68	0.69	0.74	0.65	0.66	0.82	0.76	0.68	5.20									
USA	0.40	0.71	0.82	0.77	0.73	0.67	0.72	0.72	0.74	0.77	0.69	1.54								
HUN	0.47	0.74	0.65	0.65	0.68	0.63	0.65	0.77	0.65	0.75	0.69	0.72	1.13							
POL	0.47	0.74	0.70	0.69	0.71	0.64	0.65	0.68	0.65	0.73	0.64	0.78	0.72	10.84						
JPN	0.40	0.65	0.85	0.77	0.77	0.70	0.69	0.65	0.65	0.71	0.65	0.84	0.65	0.73	0.55					
CZE	0.44	0.76	0.81	0.72	0.79	0.65	0.65	0.69	0.66	0.78	0.65	0.83	0.81	0.86	0.80	17.57				
EST	0.43	0.66	0.65	0.64	0.66	0.65	0.67	0.68	0.65	0.66	0.70	0.66	0.68	0.66	0.67	0.67	15.15			
IRL	0.65	0.68	0.75	0.79	0.69	0.66	0.69	0.67	0.78	0.67	0.62	0.66	0.64	0.62	0.69	0.65	0.45	1.37		
SVN	0.43	0.70	0.68	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.70	0.85	0.77	0.76	0.78	0.81	0.71	0.59	24.94	
PRT	0.40	0.65	0.65	0.65	0.65	0.65	0.65	0.67	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.67	0.47	0.66	0.19	

HOL loc

	BEL	CAN	CHE	DEU	DFS	ESP	FRA	GBR	ITA	NLD	USA	CZE	IRL	KOR	SVN	PRT	EST	HUN	
BEL	1.94																		
CAN	0.84	6.68																	
CHE	0.54	0.62	12.41																
DEU	0.63	0.73	0.66	11.73															
DFS	0.86	0.90	0.51	0.65	12.91														
ESP	0.58	0.71	0.69	0.73	0.72	0.97													
FRA	0.78	0.77	0.70	0.81	0.69	0.75	1.07												
GBR	0.63	0.67	0.88	0.79	0.61	0.79	0.84	1.27											
ITA	0.58	0.67	0.66	0.71	0.54	0.73	0.77	0.74	1.97										
NLD	0.83	0.79	0.67	0.83	0.77	0.68	0.81	0.75	0.63	4.73									
USA	0.54	0.70	0.50	0.75	0.63	0.70	0.73	0.68	0.78	0.60	1.54								
CZE	0.51	0.60	0.62	0.66	0.59	0.65	0.65	0.67	0.73	0.50	0.65	20.64							
IRL	0.56	0.58	0.51	0.68	0.52	0.63	0.68	0.71	0.62	0.64	0.57	0.50	1.67						
KOR	0.58	0.75	0.57	0.56	0.67	0.74	0.68	0.65	0.65	0.64	0.61	0.61	0.51	10.96					
SVN	0.61	0.61	0.58	0.62	0.60	0.60	0.70	0.61	0.60	0.64	0.59	0.65	0.52	0.65	29.20				
PRT	0.50	0.50	0.51	0.60	0.50	0.58	0.52	0.59	0.57	0.51	0.50	0.68	0.51	0.62	0.53	2.42			
EST	0.54	0.53	0.54	0.53	0.53	0.53	0.54	0.53	0.53	0.52	0.53	0.53	0.53	0.58	0.70	0.52	14.44		
HUN	0.68	0.69	0.52	0.67	0.70	0.58	0.75	0.67	0.64	0.65	0.61	0.83	0.51	0.71	0.66	0.57	0.62	1.13	

HOL bcs

	BEL	CHE	DEU	DFS	FRA	GBR	ITA	NLD	USA	CZE	JPN	IRL	KOR	CAN	PRT	ESP	SVN	EST	HUN	
BEL	1.04																			
CHE	0.75	11.60																		
DEU	0.75	0.90	13.21																	
DFS	0.76	0.88	0.95	12.18																
FRA	0.75	0.92	0.93	0.95	1.00															
GBR	0.76	0.91	0.90	0.90	0.93	1.19														
ITA	0.75	0.90	0.95	0.95	0.96	0.89	6.66													
NLD	0.75	0.93	0.95	0.96	0.94	0.91	0.93	4.87												
USA	0.78	0.75	0.76	0.77	0.77	0.75	0.75	0.75	1.38											
CZE	0.76	0.86	0.96	0.94	0.91	0.88	0.94	0.93	0.75	15.10										
JPN	0.79	0.92	0.96	0.96	0.96	0.92	0.95	0.95	0.80	0.94	1.81									
IRL	0.75	0.88	0.83	0.84	0.88	0.94	0.82	0.86	0.74	0.80	0.87	1.04								
KOR	0.75	0.76	0.82	0.85	0.86	0.80	0.84	0.78	0.74	0.83	0.86	0.76	2.54							
CAN	0.75	0.92	0.94	0.94	0.94	0.95	0.93	0.95	0.78	0.93	0.97	0.89	0.84	6.07						
PRT	0.75	0.82	0.86	0.85	0.85	0.84	0.82	0.85	0.75	0.82	0.85	0.76	0.81	0.85	1.95					
ESP	0.76	0.88	0.94	0.94	0.95	0.93	0.93	0.92	0.75	0.92	0.95	0.85	0.87	0.95	0.86	1.07				
SVN	0.76	0.84	0.89	0.90	0.84	0.79	0.88	0.91	0.76	0.89	0.87	0.77	0.78	0.85	0.76	0.86	22.22			
EST	0.78	0.84	0.86	0.86	0.84	0.77	0.87	0.88	0.77	0.83	0.88	0.78	0.79	0.82	0.77	0.77	0.86	13.11		
HUN	0.76	0.88	0.94	0.91	0.92	0.88	0.93	0.90	0.75	0.95	0.92	0.79	0.83	0.91	0.82	0.91	0.85	0.80	0.97	

JER sta

	AUS	CAN	DFS	GBR	ITA	NZL	USA	ZAF	NLD	CHE
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AUS	6.22									
CAN	0.87	6.46								
DFS	0.89	0.96	11.82							
GBR	0.89	0.95	0.94	1.00						
ITA	0.89	0.94	0.92	0.95	1.19					
NZL	0.89	0.86	0.88	0.92	0.89	0.37				
USA	0.90	0.97	0.95	0.97	0.93	0.90	1.30			
ZAF	0.87	0.87	0.86	0.93	0.87	0.93	0.89	9.02		
NLD	0.88	0.96	0.97	0.94	0.92	0.87	0.93	0.88	4.89	
CHE	0.89	0.95	0.96	0.95	0.92	0.87	0.94	0.88	0.96	10.70

JER cwi

	AUS	CAN	DFS	GBR	ITA	NZL	USA	ZAF	NLD	CHE
AUS	5.72									
CAN	0.72	6.77								
DFS	0.81	0.84	15.63							
GBR	0.81	0.91	0.83	1.57						
ITA	0.66	0.83	0.71	0.73	1.35					
NZL	0.81	0.68	0.69	0.81	0.67	0.37				
USA	0.77	0.91	0.81	0.83	0.88	0.66	0.88			
ZAF	0.74	0.83	0.72	0.85	0.72	0.78	0.79	8.83		
NLD	0.72	0.89	0.90	0.88	0.74	0.67	0.85	0.79	4.11	
CHE	0.71	0.88	0.87	0.82	0.82	0.69	0.88	0.73	0.87	11.07

JER bde

	AUS	CAN	DFS	GBR	ITA	NZL	ZAF	NLD	USA	CHE
AUS	5.16									
CAN	0.82	5.83								
DFS	0.85	0.86	13.58							
GBR	0.79	0.85	0.84	1.54						
ITA	0.70	0.73	0.74	0.83	1.39					
NZL	0.76	0.70	0.71	0.72	0.72	0.37				
ZAF	0.88	0.75	0.83	0.81	0.74	0.78	9.17			
NLD	0.74	0.83	0.83	0.90	0.86	0.69	0.79	3.12		
USA	0.73	0.72	0.75	0.78	0.89	0.71	0.73	0.87	0.88	
CHE	0.81	0.86	0.89	0.88	0.83	0.73	0.83	0.91	0.86	13.56

JER ang

	AUS	CAN	DFS	GBR	ITA	USA	ZAF	NLD	CHE
AUS	6.16								
CAN	0.64	7.47							
DFS	0.71	0.80	13.26						
GBR	0.84	0.76	0.86	1.09					
ITA	0.74	0.83	0.81	0.86	1.28				
USA	0.78	0.83	0.88	0.86	0.79	0.94			
ZAF	0.66	0.63	0.73	0.82	0.73	0.73	9.06		
NLD	0.75	0.74	0.67	0.78	0.73	0.69	0.64	4.28	
CHE	0.63	0.80	0.71	0.72	0.72	0.73	0.65	0.70	9.50

JER ran

	AUS	CAN	DFS	GBR	ITA	NZL	USA	ZAF	NLD	CHE
AUS	6.16									
CAN	0.91	5.70								
DFS	0.91	0.96	11.43							
GBR	0.96	0.95	0.96	1.20						
ITA	0.90	0.96	0.94	0.93	1.42					
NZL	0.97	0.90	0.90	0.93	0.90	0.30				
USA	0.93	0.95	0.96	0.97	0.93	0.91	1.06			

CAN	0.77	5.29								
DFS	0.83	0.86	12.65							
GBR	0.83	0.94	0.85	1.58						
ITA	0.71	0.86	0.80	0.87	1.49					
NZL	0.85	0.73	0.73	0.81	0.73	0.40				
USA	0.82	0.94	0.88	0.93	0.90	0.73	1.21			
ZAF	0.80	0.91	0.86	0.93	0.83	0.74	0.91	12.01		
NLD	0.80	0.91	0.90	0.92	0.82	0.81	0.86	0.87	5.02	
CHE	0.81	0.92	0.84	0.87	0.82	0.75	0.86	0.88	0.89	10.79

JER ruh

	AUS	CAN	DFS	GBR	ITA	NZL	USA	ZAF	NLD	CHE
AUS	5.36									
CAN	0.76	7.06								
DFS	0.77	0.88	10.94							
GBR	0.86	0.81	0.86	1.15						
ITA	0.78	0.80	0.83	0.87	1.36					
NZL	0.76	0.76	0.79	0.80	0.81	0.40				
USA	0.80	0.85	0.90	0.91	0.83	0.78	1.07			
ZAF	0.87	0.76	0.84	0.91	0.82	0.77	0.88	9.40		
NLD	0.78	0.79	0.92	0.88	0.84	0.80	0.85	0.79	4.65	
CHE	0.80	0.92	0.88	0.85	0.79	0.79	0.85	0.80	0.83	11.92

JER usu

	AUS	CAN	DFS	GBR	ITA	NZL	USA	ZAF	NLD	CHE
AUS	5.19									
CAN	0.86	6.39								
DFS	0.75	0.86	13.02							
GBR	0.87	0.89	0.85	1.65						
ITA	0.70	0.77	0.72	0.78	1.54					
NZL	0.63	0.64	0.64	0.64	0.66	0.39				
USA	0.77	0.86	0.87	0.83	0.79	0.63	0.80			
ZAF	0.83	0.82	0.77	0.82	0.68	0.63	0.81	10.43		
NLD	0.84	0.83	0.89	0.90	0.81	0.64	0.88	0.80	5.20	
CHE	0.79	0.90	0.88	0.80	0.78	0.67	0.84	0.76	0.86	9.92

JER ude

	AUS	CAN	DFS	GBR	ITA	USA	ZAF	NLD	CHE	
AUS	5.35									
CAN	0.95	5.07								
DFS	0.95	0.94	12.12							
GBR	0.96	0.96	0.94	1.52						
ITA	0.95	0.94	0.94	0.92	1.41					
USA	0.95	0.96	0.96	0.94	0.95	1.42				
ZAF	0.92	0.91	0.93	0.94	0.92	0.92	10.89			
NLD	0.94	0.97	0.96	0.96	0.95	0.95	0.94	4.38		
CHE	0.97	0.96	0.94	0.95	0.95	0.94	0.92	0.97	9.05	

JER ftp

	AUS	CAN	DFS	GBR	ITA	NZL	USA	ZAF	NLD	CHE
AUS	6.00									
CAN	0.91	6.17								
DFS	0.88	0.95	12.83							
GBR	0.92	0.93	0.91	1.37						
ITA	0.84	0.86	0.86	0.85	1.60					
NZL	0.89	0.93	0.88	0.87	0.86	0.30				
USA	0.88	0.95	0.95	0.93	0.87	0.89	1.08			
ZAF	0.87	0.93	0.91	0.93	0.86	0.91	0.91	10.49		

NLD	0.93	0.97	0.95	0.94	0.85	0.89	0.90	0.92	5.26	
CHE	0.93	0.95	0.93	0.93	0.86	0.88	0.89	0.89	0.96	10.17

JER ftl

	AUS	CAN	DFS	GBR	ITA	USA	ZAF	NLD	CHE
AUS	6.35								
CAN	0.90	5.78							
DFS	0.93	0.91	13.97						
GBR	0.96	0.92	0.94	1.40					
ITA	0.91	0.89	0.91	0.93	1.61				
USA	0.94	0.92	0.95	0.96	0.93	0.92			
ZAF	0.95	0.90	0.92	0.94	0.91	0.97	11.08		
NLD	0.95	0.93	0.97	0.97	0.92	0.96	0.95	4.67	
CHE	0.94	0.91	0.94	0.96	0.91	0.94	0.93	0.96	11.92

JER rtp

	AUS	CAN	DFS	NZL	ZAF	NLD	USA	CHE
AUS	5.86							
CAN	0.96	6.39						
DFS	0.92	0.95	12.98					
NZL	0.94	0.95	0.92	0.40				
ZAF	0.94	0.95	0.91	0.90	9.87			
NLD	0.94	0.96	0.96	0.92	0.89	4.55		
USA	0.90	0.91	0.93	0.89	0.89	0.94	1.39	
CHE	0.96	0.98	0.96	0.95	0.94	0.97	0.92	11.83

JER ocs

	AUS	CAN	DFS	GBR	ITA	NZL	USA	NLD	CHE
AUS	6.12								
CAN	0.55	6.03							
DFS	0.59	0.76	12.81						
GBR	0.66	0.84	0.83	1.96					
ITA	0.55	0.82	0.77	0.82	0.75				
NZL	0.64	0.60	0.57	0.63	0.59	0.30			
USA	0.67	0.79	0.81	0.86	0.81	0.61	0.91		
NLD	0.61	0.78	0.87	0.88	0.80	0.64	0.84	2.66	
CHE	0.61	0.89	0.79	0.91	0.81	0.63	0.83	0.82	7.04

JER ous

	AUS	CAN	DFS	GBR	NZL	USA	NLD	CHE
AUS	5.01							
CAN	0.66	6.28						
DFS	0.53	0.84	12.93					
GBR	0.74	0.88	0.72	1.27				
NZL	0.80	0.72	0.63	0.74	0.42			
USA	0.66	0.91	0.80	0.87	0.67	0.65		
NLD	0.61	0.88	0.90	0.79	0.76	0.90	4.68	
CHE	0.66	0.93	0.81	0.87	0.69	0.88	0.92	10.66

JER ofl

	AUS	CAN	DFS	GBR	ITA	USA	NLD	CHE
AUS	6.31							
CAN	0.56	5.99						
DFS	0.42	0.80	13.72					
GBR	0.58	0.72	0.66	1.29				
ITA	0.45	0.74	0.65	0.73	1.11			

USA	0.65	0.84	0.66	0.72	0.77	0.92				
NLD	0.43	0.67	0.65	0.74	0.68	0.68	5.52			
CHE	0.49	0.87	0.73	0.73	0.69	0.75	0.70	9.54		

RDC sta

	AUS	CAN	DEU	DFS	GBR	NOR	NZL	USA	NLD	CAM
AUS	6.20									
CAN	0.88	6.06								
DEU	0.89	0.97	13.23							
DFS	0.87	0.97	0.97	8.59						
GBR	0.91	0.96	0.96	0.93	1.16					
NOR	0.89	0.94	0.96	0.98	0.93	12.67				
NZL	0.89	0.90	0.87	0.90	0.93	0.93	0.49			
USA	0.89	0.97	0.95	0.94	0.96	0.93	0.89	2.11		
NLD	0.86	0.95	0.97	0.97	0.93	0.96	0.85	0.93	4.81	
CAM	0.93	0.92	0.92	0.92	0.93	0.93	0.92	0.92	0.92	5.51

RDC cwi

	AUS	CAN	DEU	DFS	GBR	NZL	USA	NLD	CAM	NOR
AUS	6.55									
CAN	0.73	7.14								
DEU	0.70	0.87	11.84							
DFS	0.77	0.83	0.88	12.78						
GBR	0.82	0.87	0.90	0.86	1.48					
NZL	0.79	0.69	0.73	0.70	0.82	0.35				
USA	0.68	0.86	0.82	0.82	0.84	0.71	1.15			
NLD	0.70	0.91	0.92	0.88	0.91	0.67	0.83	4.42		
CAM	0.81	0.82	0.81	0.82	0.82	0.82	0.82	0.82	6.85	
NOR	0.84	0.83	0.79	0.88	0.83	0.82	0.83	0.85	0.83	14.68

RDC bde

	AUS	CAN	DEU	DFS	GBR	NOR	NZL	USA	NLD	CAM
AUS	6.85									
CAN	0.84	5.99								
DEU	0.80	0.88	9.74							
DFS	0.85	0.84	0.92	11.74						
GBR	0.82	0.84	0.91	0.88	1.35					
NOR	0.83	0.83	0.79	0.79	0.83	14.72				
NZL	0.79	0.71	0.73	0.78	0.76	0.82	0.35			
USA	0.72	0.76	0.88	0.82	0.90	0.83	0.74	1.03		
NLD	0.73	0.83	0.90	0.84	0.91	0.79	0.70	0.90	4.04	
CAM	0.86	0.83	0.84	0.84	0.84	0.83	0.85	0.84	0.83	4.93

RDC ang

	AUS	CAN	DEU	DFS	GBR	USA	NLD	CAM		
AUS	7.73									
CAN	0.67	6.66								
DEU	0.62	0.79	12.65							
DFS	0.66	0.81	0.80	9.16						
GBR	0.81	0.81	0.75	0.84	1.26					
USA	0.73	0.87	0.80	0.84	0.86	1.03				
NLD	0.75	0.74	0.64	0.68	0.79	0.69	4.75			
CAM	0.75	0.76	0.76	0.76	0.76	0.77	0.76	7.07		

RDC ran

	AUS	CAN	DEU	DFS	GBR	NOR	NZL	USA	NLD	CAM
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AUS	7.61									
CAN	0.93	5.76								
DEU	0.93	0.97	8.86							
DFS	0.92	0.95	0.96	10.05						
GBR	0.96	0.97	0.97	0.95	1.48					
NOR	0.92	0.94	0.93	0.91	0.95	12.60				
NZL	0.94	0.92	0.91	0.91	0.94	0.93	0.29			
USA	0.93	0.98	0.96	0.94	0.97	0.95	0.91	1.05		
NLD	0.93	0.97	0.98	0.96	0.97	0.95	0.90	0.96	5.78	
CAM	0.94	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	5.72

RDC rwi

	AUS	CAN	DEU	DFS	GBR	NZL	USA	NLD	CAM	NOR
AUS	6.16									
CAN	0.90	6.00								
DEU	0.84	0.93	9.48							
DFS	0.87	0.93	0.92	10.43						
GBR	0.88	0.91	0.89	0.88	1.28					
NZL	0.88	0.88	0.82	0.89	0.89	0.32				
USA	0.82	0.91	0.84	0.88	0.93	0.86	1.17			
NLD	0.91	0.94	0.95	0.92	0.88	0.83	0.81	5.90		
CAM	0.88	0.88	0.87	0.88	0.88	0.88	0.88	0.88	6.41	
NOR	0.86	0.88	0.86	0.91	0.88	0.88	0.88	0.89	0.88	13.02

RDC rls

	AUS	CAN	DEU	DFS	GBR	NOR	NZL	USA	NLD	CAM
AUS	7.86									
CAN	0.80	6.24								
DEU	0.79	0.94	9.15							
DFS	0.77	0.97	0.94	9.21						
GBR	0.88	0.80	0.87	0.80	1.57					
NOR	0.78	0.90	0.90	0.96	0.83	12.69				
NZL	0.75	0.74	0.74	0.74	0.76	0.79	0.12			
USA	0.80	0.93	0.92	0.93	0.83	0.87	0.74	0.75		
NLD	0.82	0.92	0.92	0.89	0.87	0.82	0.73	0.90	5.07	
CAM	0.83	0.84	0.84	0.84	0.84	0.85	0.84	0.84	0.84	6.44

RDC rlr

	AUS	CAN	DEU	DFS	NOR	NLD	USA	CAM		
AUS	7.40									
CAN	0.65	6.61								
DEU	0.63	0.88	9.72							
DFS	0.65	0.84	0.91	10.79						
NOR	0.64	0.78	0.85	0.91	15.35					
NLD	0.62	0.87	0.91	0.90	0.88	5.64				
USA	0.60	0.73	0.76	0.70	0.74	0.81	0.75			
CAM	0.77	0.75	0.74	0.74	0.74	0.74	0.75	6.76		

RDC fan

	AUS	CAN	DEU	DFS	GBR	NOR	USA	NLD	CAM	
AUS	7.25									
CAN	0.67	6.41								
DEU	0.72	0.81	14.28							
DFS	0.67	0.73	0.80	9.33						
GBR	0.82	0.79	0.91	0.72	1.56					
NOR	0.71	0.74	0.82	0.67	0.76	14.35				
USA	0.71	0.83	0.83	0.73	0.85	0.76	0.91			
NLD	0.76	0.75	0.88	0.78	0.89	0.69	0.81	4.72		

CAN	0.94	5.07								
DEU	0.94	0.97	12.90							
DFS	0.90	0.95	0.92	11.80						
GBR	0.94	0.94	0.96	0.89	1.48					
NOR	0.90	0.91	0.89	0.90	0.92	12.20				
NZL	0.93	0.89	0.89	0.86	0.89	0.90	0.26			
USA	0.89	0.93	0.92	0.92	0.93	0.92	0.87	1.18		
NLD	0.95	0.98	0.97	0.95	0.95	0.89	0.90	0.90	4.19	
CAM	0.91	0.92	0.92	0.92	0.92	0.92	0.93	0.92	0.92	6.59

RDC ftl

	AUS	CAN	DEU	DFS	GBR	NOR	USA	NLD	CAM
AUS	7.37								
CAN	0.95	5.03							
DEU	0.95	0.94	13.52						
DFS	0.94	0.91	0.97	10.54					
GBR	0.96	0.93	0.98	0.94	1.41				
NOR	0.93	0.94	0.94	0.93	0.94	13.06			
USA	0.96	0.94	0.96	0.93	0.97	0.95	1.15		
NLD	0.96	0.93	0.98	0.97	0.97	0.94	0.95	5.55	
CAM	0.94	0.95	0.95	0.95	0.95	0.95	0.95	0.95	7.10

RDC rtp

	AUS	CAN	DEU	DFS	NOR	NZL	NLD	USA	CAM
AUS	6.90								
CAN	0.95	6.21							
DEU	0.93	0.97	13.94						
DFS	0.91	0.94	0.97	12.15					
NOR	0.92	0.93	0.91	0.90	14.28				
NZL	0.94	0.95	0.94	0.90	0.92	0.35			
NLD	0.95	0.98	0.97	0.96	0.91	0.94	5.09		
USA	0.93	0.92	0.95	0.93	0.94	0.91	0.96	1.18	
CAM	0.93	0.94	0.94	0.94	0.94	0.94	0.94	0.94	6.25

RDC ocs

	AUS	CAN	DEU	DFS	GBR	NOR	NZL	USA	NLD	CAM
AUS	4.67									
CAN	0.59	5.33								
DEU	0.61	0.84	18.56							
DFS	0.65	0.76	0.80	10.38						
GBR	0.69	0.81	0.91	0.84	1.52					
NOR	0.65	0.84	0.81	0.77	0.86	10.82				
NZL	0.73	0.61	0.65	0.62	0.67	0.72	0.26			
USA	0.64	0.83	0.87	0.82	0.88	0.86	0.70	0.80		
NLD	0.63	0.78	0.87	0.86	0.89	0.79	0.64	0.86	3.20	
CAM	0.74	0.86	0.86	0.86	0.86	0.86	0.78	0.86	0.86	5.83

RDC ous

	AUS	CAN	DEU	DFS	GBR	NOR	NZL	USA	NLD	CAM
AUS	5.73									
CAN	0.69	5.49								
DEU	0.65	0.89	15.63							
DFS	0.58	0.80	0.83	10.98						
GBR	0.82	0.84	0.85	0.72	1.43					
NOR	0.61	0.86	0.80	0.82	0.88	11.94				
NZL	0.81	0.78	0.79	0.71	0.78	0.69	0.34			
USA	0.72	0.91	0.90	0.88	0.88	0.88	0.82	0.98		
NLD	0.64	0.89	0.90	0.89	0.79	0.85	0.79	0.89	4.10	

CAM 0.67 0.88 0.88 0.87 0.88 0.88 0.69 0.89 0.89 6.34

RDC of1

	AUS	CAN	DEU	DFS	GBR	NOR	USA	NLD	CAM
AUS	7.25								
CAN	0.42	5.80							
DEU	0.42	0.83	15.01						
DFS	0.43	0.81	0.79	13.22					
GBR	0.42	0.74	0.73	0.69	1.41				
NOR	0.49	0.72	0.75	0.66	0.74	14.28			
USA	0.46	0.74	0.72	0.66	0.71	0.74	1.17		
NLD	0.42	0.68	0.73	0.66	0.75	0.73	0.68	7.33	
CAM	0.63	0.74	0.73	0.74	0.74	0.74	0.75	0.75	7.02

^LAPPENDIX II. Number of common bulls

BSW

common bulls below diagonal
common three quarter sib group above diagonal

	CAN	CHE	FRA	ITA	NLD	USA	DEA	SVN	GBR
CAN	0	108	66	107	38	130	95	22	16
CHE	87	0	146	416	62	254	472	52	14
FRA	57	109	0	160	54	86	160	39	13
ITA	86	359	130	0	82	188	502	68	15
NLD	31	57	42	63	0	54	78	28	10
USA	114	226	59	137	40	0	205	25	16
DEA	72	378	119	422	67	163	0	69	12
SVN	20	50	37	66	27	20	64	0	7
GBR	12	12	12	13	8	14	10	5	0

BSW

common bulls below diagonal
common three quarter sib group above diagonal

	CAN	CHE	FRA	ITA	NLD	USA	DEA	SVN	GBR
CAN	0	102	66	107	32	130	93	21	16
CHE	84	0	129	361	57	225	408	49	14
FRA	57	93	0	160	50	86	158	38	13
ITA	86	305	130	0	74	188	467	66	15
NLD	28	54	39	59	0	40	72	28	10
USA	114	193	59	137	31	0	187	24	16
DEA	71	319	118	386	65	138	0	67	11
SVN	19	47	36	64	27	19	63	0	7
GBR	12	12	12	13	8	14	10	5	0

BSW

common bulls below diagonal
common three quarter sib group above diagonal

	CAN	CHE	FRA	ITA	NLD	DEA	SVN	GBR	USA
CAN	0	108	66	107	32	95	15	16	130
CHE	87	0	146	416	61	472	38	14	254
FRA	57	109	0	160	50	160	27	13	86
ITA	86	359	130	0	74	502	50	15	188
NLD	28	57	39	59	0	73	20	10	40
DEA	72	378	119	422	66	0	50	12	205
SVN	14	35	27	47	20	47	0	6	17
GBR	12	12	12	13	8	10	4	0	16
USA	114	226	59	137	31	163	14	14	0

BSW

common bulls below diagonal
common three quarter sib group above diagonal

	CAN	CHE	FRA	NLD	USA	GBR
CAN	0	107	66	21	129	16
CHE	87	0	141	37	252	14
FRA	57	105	0	32	86	13
NLD	18	37	27	0	25	7
USA	113	226	59	20	0	16
GBR	12	12	12	5	14	0

BSW

common bulls below diagonal
common three quarter sib group above diagonal

	CAN	CHE	FRA	ITA	NLD	USA	DEA	SVN	GBR
CAN	0	108	66	107	38	130	95	22	16
CHE	87	0	146	416	62	254	472	52	14
FRA	57	109	0	160	54	86	160	39	13
ITA	86	359	130	0	82	188	502	68	15
NLD	31	57	42	63	0	54	78	28	10
USA	114	226	59	137	40	0	205	25	16
DEA	72	378	119	422	67	163	0	69	12
SVN	20	50	37	66	27	20	64	0	7
GBR	12	12	12	13	8	14	10	5	0

BSW

common bulls below diagonal
common three quarter sib group above diagonal

	CAN	CHE	FRA	NLD	USA	DEA	GBR	SVN	ITA
CAN	0	108	66	38	130	95	16	15	104
CHE	87	0	146	62	254	472	14	38	410
FRA	57	109	0	54	86	160	13	27	159
NLD	31	57	42	0	54	78	10	20	81
USA	114	226	59	40	0	205	16	17	176
DEA	72	378	119	67	163	0	12	50	496
GBR	12	12	12	8	14	10	0	6	15
SVN	14	35	27	20	14	47	4	0	50
ITA	84	354	130	63	125	415	13	47	0

BSW

common bulls below diagonal
common three quarter sib group above diagonal

	CAN	CHE	FRA	ITA	NLD	USA	DEA	SVN	GBR
CAN	0	108	66	107	38	130	95	22	16
CHE	87	0	146	416	62	254	472	52	14
FRA	57	109	0	160	54	86	160	39	13
ITA	86	359	130	0	82	188	502	68	15
NLD	31	57	42	63	0	54	78	28	10
USA	114	226	59	137	40	0	205	25	16
DEA	72	378	119	422	67	163	0	69	12
SVN	20	50	37	66	27	20	64	0	7
GBR	12	12	12	13	8	14	10	5	0

BSW

common bulls below diagonal
common three quarter sib group above diagonal

	CAN	CHE	FRA	ITA	NLD	USA	DEA	SVN	GBR
CAN	0	108	66	107	31	130	95	22	16
CHE	87	0	146	416	60	254	472	52	14
FRA	57	109	0	160	50	86	160	39	13
ITA	86	359	130	0	73	188	502	68	15
NLD	27	56	39	58	0	39	72	28	10
USA	114	226	59	137	29	0	205	25	16
DEA	72	378	119	422	65	163	0	69	12
SVN	20	50	37	66	27	20	64	0	7
GBR	12	12	12	13	8	14	10	5	0

BSW

common bulls below diagonal
 common three quarter sib group above diagonal

	CAN	CHE	FRA	ITA	NLD	DEA	SVN	USA
CAN	0	108	66	104	31	95	22	130
CHE	87	0	146	410	60	472	52	254
FRA	57	109	0	159	50	160	39	86
ITA	84	354	130	0	73	496	68	176
NLD	27	56	39	58	0	72	28	39
DEA	72	378	119	415	65	0	69	205
SVN	20	50	37	66	27	64	0	25
USA	114	226	59	125	29	163	20	0

BSW

common bulls below diagonal
 common three quarter sib group above diagonal

	CAN	CHE	FRA	ITA	NLD	USA	DEA	SVN	GBR
CAN	0	108	37	67	31	130	62	15	16
CHE	87	0	83	244	61	253	278	38	14
FRA	34	58	0	79	34	50	88	27	10
ITA	58	198	64	0	54	91	221	44	12
NLD	27	57	28	48	0	39	60	20	10
USA	114	226	33	66	30	0	108	17	16
DEA	49	212	63	191	54	74	0	48	9
SVN	14	35	27	42	20	14	45	0	6
GBR	12	12	9	10	8	14	8	4	0

BSW

common bulls below diagonal
 common three quarter sib group above diagonal

	CAN	CHE	FRA	ITA	NLD	USA	DEA	SVN	GBR
CAN	0	108	66	107	32	130	95	22	16
CHE	87	0	146	416	61	254	472	52	14
FRA	57	109	0	160	50	86	160	39	13
ITA	86	359	130	0	74	188	502	68	15
NLD	28	57	39	59	0	40	73	28	10
USA	114	226	59	137	31	0	205	25	16
DEA	72	378	119	422	66	163	0	69	12
SVN	20	50	37	66	27	20	64	0	7
GBR	12	12	12	13	8	14	10	5	0

BSW

common bulls below diagonal
 common three quarter sib group above diagonal

	CAN	CHE	FRA	ITA	NLD	USA	DEA	SVN
CAN	0	108	66	107	32	130	95	22

CHE	87	0	146	416	61	254	472	52
FRA	57	109	0	160	50	86	160	39
ITA	86	359	130	0	74	188	502	68
NLD	28	57	39	59	0	40	73	28
USA	114	226	59	137	31	0	205	25
DEA	72	378	119	422	66	163	0	69
SVN	20	50	37	66	27	20	64	0

BSW

common bulls below diagonal
common three quarter sib group above diagonal

	CAN	CHE	FRA	ITA	NLD	USA	DEA	SVN	GBR
CAN	0	108	66	107	38	130	95	15	16
CHE	87	0	146	416	62	254	472	38	14
FRA	57	109	0	160	54	86	160	27	13
ITA	86	359	130	0	82	188	502	50	15
NLD	31	57	42	63	0	54	78	20	10
USA	114	226	59	137	40	0	205	17	16
DEA	72	378	119	422	67	163	0	50	12
SVN	14	35	27	47	20	14	47	0	6
GBR	12	12	12	13	8	14	10	4	0

BSW

common bulls below diagonal
common three quarter sib group above diagonal

	CAN	CHE	FRA	ITA	NLD	USA	DEA	SVN	GBR
CAN	0	108	66	107	38	128	95	22	16
CHE	87	0	146	416	62	254	472	52	14
FRA	57	109	0	160	54	86	160	39	13
ITA	86	359	130	0	82	188	502	68	15
NLD	31	57	42	63	0	54	78	28	10
USA	113	226	59	137	40	0	205	25	16
DEA	72	378	119	422	67	163	0	69	12
SVN	20	50	37	66	27	20	64	0	7
GBR	12	12	12	13	8	14	10	5	0

BSW

common bulls below diagonal
common three quarter sib group above diagonal

	CAN	CHE	FRA	NLD	USA	DEA	SVN	GBR	ITA
CAN	0	108	66	38	130	84	21	16	96
CHE	87	0	146	62	254	440	50	14	374
FRA	57	109	0	54	86	150	38	13	147
NLD	31	57	42	0	54	72	28	10	73
USA	114	226	59	40	0	180	24	16	146
DEA	64	347	111	65	135	0	67	11	410
SVN	19	48	36	27	19	63	0	7	66
GBR	12	12	12	8	14	10	5	0	15
ITA	77	322	118	59	106	352	64	13	0

BSW

common bulls below diagonal
common three quarter sib group above diagonal

	CAN	CHE	FRA	ITA	NLD	USA	DEA	SVN	GBR
CAN	0	108	66	107	38	130	95	21	16
CHE	87	0	146	416	62	254	472	51	14
FRA	57	109	0	160	54	86	160	38	13
ITA	86	359	130	0	82	186	502	67	15

NLD	31	57	42	63	0	54	78	28	10
USA	114	226	59	136	40	0	205	24	16
DEA	72	378	119	422	67	163	0	68	12
SVN	19	49	36	65	27	19	63	0	7
GBR	12	12	12	13	8	14	10	5	0

BSW

common bulls below diagonal
common three quarter sib group above diagonal

	CAN	CHE	FRA	ITA	NLD	DEA	SVN	USA
CAN	0	108	66	67	27	62	21	130
CHE	87	0	143	244	57	278	50	253
FRA	57	106	0	99	47	108	38	86
ITA	58	198	78	0	53	221	54	91
NLD	24	55	37	48	0	59	27	34
DEA	49	212	74	191	54	0	60	108
SVN	19	48	36	53	27	54	0	23
USA	114	226	59	66	26	74	19	0

BSW

common bulls below diagonal
common three quarter sib group above diagonal

	CAN	CHE	FRA	ITA	NLD	USA	DEA	SVN	GBR
CAN	0	102	56	107	38	130	62	15	16
CHE	84	0	108	360	57	225	273	38	14
FRA	52	81	0	126	44	71	97	27	13
ITA	86	303	106	0	80	185	256	50	15
NLD	31	54	37	63	0	54	60	20	10
USA	114	193	52	137	40	0	108	17	16
DEA	49	208	71	225	54	74	0	48	9
SVN	14	35	27	47	20	14	45	0	6
GBR	12	12	12	13	8	14	8	4	0

BSW

common bulls below diagonal
common three quarter sib group above diagonal

	CAN	CHE	FRA	ITA	NLD	USA	DEA	SVN	GBR
CAN	0	102	56	107	38	129	95	15	16
CHE	84	0	108	361	57	225	417	38	14
FRA	52	81	0	126	44	71	129	27	13
ITA	86	305	106	0	82	188	495	50	15
NLD	31	54	37	63	0	54	78	20	10
USA	113	193	52	137	40	0	203	17	16
DEA	71	329	97	418	67	159	0	50	12
SVN	14	35	27	47	20	14	47	0	6
GBR	12	12	12	13	8	14	10	4	0

BSW

common bulls below diagonal
common three quarter sib group above diagonal

	CAN	CHE	FRA	ITA	NLD	USA	DEA	SVN	GBR
CAN	0	102	56	104	38	130	95	15	16
CHE	84	0	108	360	57	225	417	38	14
FRA	52	81	0	125	44	71	129	27	13
ITA	84	304	106	0	81	176	490	50	15
NLD	31	54	37	63	0	54	78	20	10
USA	114	193	52	125	40	0	203	17	16
DEA	71	329	97	412	67	159	0	50	12

SVN	14	35	27	47	20	14	47	0	6
GBR	12	12	12	13	8	14	10	4	0

BSW

BSW

BSW

common bulls below diagonal
common three quarter sib group above diagonal

	CAN	CHE	DEA	ITA	SVN	USA	FRA
CAN	0	102	94	68	15	138	38
CHE	83	0	411	244	38	224	83
DEA	71	326	0	261	50	199	98
ITA	58	197	216	0	44	91	79
SVN	14	35	47	42	0	17	27
USA	114	193	158	66	14	0	50
FRA	35	58	70	64	27	33	0

BSW

common bulls below diagonal
common three quarter sib group above diagonal

	CAN	CHE	DEA	ITA	SVN	FRA
CAN	0	109	96	111	22	69
CHE	86	0	472	416	51	146
DEA	71	378	0	501	69	160
ITA	86	359	421	0	67	160
SVN	20	50	64	66	0	39
FRA	58	109	119	130	37	0

BSW

common bulls below diagonal
common three quarter sib group above diagonal

	CAN	CHE	DEA	ITA	SVN	USA	FRA
CAN	0	102	72	68	15	138	38
CHE	83	0	308	244	38	224	83
DEA	58	239	0	228	49	136	90
ITA	58	197	198	0	44	91	79
SVN	14	35	46	42	0	17	27
USA	114	193	98	66	14	0	50
FRA	35	58	65	64	27	33	0

BSW

common bulls below diagonal
common three quarter sib group above diagonal

	CHE	DEA	ITA	SVN	USA	FRA
CHE	0	454	244	38	253	144
DEA	363	0	260	50	190	156
ITA	198	215	0	44	91	99
SVN	35	47	42	0	17	27
USA	226	147	66	14	0	85
FRA	108	117	78	27	59	0

BSW

common bulls below diagonal
common three quarter sib group above diagonal

	CAN	CHE	DEA	ITA	SVN	USA	FRA
--	-----	-----	-----	-----	-----	-----	-----

CAN	0	59	46	50	13	70	26
CHE	47	0	308	244	33	224	83
DEA	33	239	0	228	43	136	90
ITA	41	197	198	0	38	91	79
SVN	12	31	40	37	0	17	26
USA	60	193	98	66	14	0	50
FRA	23	58	65	64	26	33	0

BSW

common bulls below diagonal
 common three quarter sib group above diagonal
 CAN CHE DEA ITA SVN FRA

CAN	0	109	96	108	21	69
CHE	86	0	472	410	49	146
DEA	71	378	0	495	68	160
ITA	84	354	414	0	65	159
SVN	19	48	63	64	0	38
FRA	58	109	119	130	36	0

BSW

common bulls below diagonal
 common three quarter sib group above diagonal
 CHE DEA ITA SVN FRA

CHE	0	471	413	37	143
DEA	377	0	501	50	159
ITA	356	421	0	49	158
SVN	35	47	47	0	27
FRA	108	118	130	27	0

BSW

common bulls below diagonal
 common three quarter sib group above diagonal
 CHE DEA ITA SVN FRA

CHE	0	244	219	36	96
DEA	197	0	220	48	107
ITA	182	191	0	44	98
SVN	34	45	42	0	27
FRA	71	73	78	27	0

BSW

common bulls below diagonal
 common three quarter sib group above diagonal
 CHE DEA ITA SVN FRA

CHE	0	471	407	50	143
DEA	377	0	495	68	159
ITA	351	414	0	66	157
SVN	49	63	65	0	38
FRA	108	118	130	36	0

BSW

common bulls below diagonal
 common three quarter sib group above diagonal
 CHE DEA ITA SVN FRA

CHE	0	277	242	50	79
DEA	211	0	221	60	86

ITA	196	191	0	54	78
SVN	49	54	53	0	30
FRA	57	62	63	29	0

GUE

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

CAN	0	20	60	21
GBR	17	0	72	12
USA	49	71	0	26
AUS	20	9	22	0

GUE

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

CAN	0	20	60	21
GBR	17	0	72	12
USA	49	71	0	26
AUS	20	9	22	0

GUE

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

CAN	0	20	60	21
GBR	17	0	72	12
USA	49	71	0	26
AUS	20	9	22	0

GUE

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

CAN	0	20	60	21
GBR	17	0	72	12
USA	49	71	0	26
AUS	20	9	22	0

GUE

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

CAN	0	20	60	21
GBR	17	0	72	12
USA	49	71	0	26
AUS	20	9	22	0

GUE

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

CAN	0	20	60	21
-----	---	----	----	----

GBR	17	0	72	12
USA	49	71	0	26
AUS	20	9	22	0

GUE

common bulls below diagonal
common three quarter sib group above diagonal

	CAN	GBR	USA	AUS
CAN	0	20	60	21
GBR	17	0	72	12
USA	49	71	0	26
AUS	20	9	22	0

GUE

common bulls below diagonal
common three quarter sib group above diagonal

	CAN	USA	AUS
CAN	0	32	7
USA	30	0	8
AUS	6	8	0

GUE

common bulls below diagonal
common three quarter sib group above diagonal

	CAN	GBR	USA	AUS
CAN	0	20	60	21
GBR	17	0	72	12
USA	49	71	0	26
AUS	20	9	22	0

GUE

common bulls below diagonal
common three quarter sib group above diagonal

	CAN	GBR	USA	AUS
CAN	0	20	60	21
GBR	17	0	72	12
USA	49	71	0	26
AUS	20	9	22	0

GUE

common bulls below diagonal
common three quarter sib group above diagonal

	CAN	GBR	USA	AUS
CAN	0	20	60	21
GBR	17	0	72	12
USA	49	71	0	26
AUS	20	9	22	0

GUE

common bulls below diagonal
common three quarter sib group above diagonal

	CAN	GBR	USA	AUS
CAN	0	20	60	21
GBR	17	0	72	12

```
USA 49 71 0 26
AUS 20 9 22 0
```

GUE

```
-----
common bulls below diagonal
common three quarter sib group above diagonal
      CAN  GBR  USA  AUS
```

```
-----
CAN  0  20  58  20
GBR  17  0  72  12
USA  48  71  0  26
AUS  19  9  22  0
```

GUE

```
-----
common bulls below diagonal
common three quarter sib group above diagonal
      CAN  GBR  USA  AUS
```

```
-----
CAN  0  20  60  21
GBR  17  0  72  12
USA  49  71  0  26
AUS  20  9  22  0
```

GUE

```
-----
common bulls below diagonal
common three quarter sib group above diagonal
      CAN  GBR  USA  AUS
```

```
-----
CAN  0  20  60  21
GBR  17  0  72  12
USA  49  71  0  26
AUS  20  9  22  0
```

GUE

```
-----
common bulls below diagonal
common three quarter sib group above diagonal
      CAN  AUS  USA
```

```
-----
CAN  0  7  60
AUS  6  0  10
USA  49  9  0
```

GUE

```
-----
common bulls below diagonal
common three quarter sib group above diagonal
      CAN  GBR  USA  AUS
```

```
-----
CAN  0  12  60  21
GBR  9  0  33  10
USA  49  31  0  26
AUS  20  7  22  0
```

GUE

```
-----
common bulls below diagonal
common three quarter sib group above diagonal
      CAN  GBR  USA  AUS
```

```
-----
CAN  0  18  58  20
GBR  15  0  70  12
USA  48  69  0  26
```

AUS 19 9 22 0

GUE

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

Table with 4 columns: CAN, GBR, USA, AUS. Values: CAN (0, 18, 60, 21), GBR (15, 0, 70, 12), USA (49, 69, 0, 26), AUS (20, 9, 22, 0)

GUE

GUE

HOL

common bulls below diagonal
common three quarter sib group above diagonal
AUS BEL CAN CHE DEU DFS ESP FRA GBR ITA NLD USA HUN POL NZL ZAF JPN CZE EST IRL KOR SVN PRT

Large table with 24 columns (AUS to PRT) and 24 rows (AUS to PRT) containing numerical values for various countries.

HOL

common bulls below diagonal
common three quarter sib group above diagonal
AUS BEL CAN CHE DEU DFS ESP FRA GBR ITA NLD USA HUN POL NZL ZAF JPN CZE EST IRL KOR SVN PRT

Large table with 24 columns (AUS to PRT) and 24 rows (AUS to HUN) containing numerical values for various countries.

POL	266	377	593	324	673	609	476	512	649	765	772	1009	455	0	286	250	653	923	137	369	397	179	705
NZL	343	200	286	193	241	272	248	190	346	288	471	421	197	173	0	167	296	304	37	329	158	54	277
ZAF	208	181	287	165	227	262	280	198	298	292	267	384	222	185	145	0	253	268	44	194	190	69	286
JPN	220	193	317	184	222	257	258	216	284	292	266	366	208	196	133	170	0	663	89	309	406	110	511
CZE	266	347	599	311	833	549	524	541	619	781	970	953	622	604	197	200	184	0	108	375	399	170	657
EST	30	43	47	28	77	57	43	39	53	66	89	90	50	73	16	18	19	57	0	57	49	41	92
IRL	332	359	382	329	385	416	394	367	730	456	562	483	263	273	273	188	174	288	32	0	181	87	358
KOR	173	146	491	153	209	235	274	187	308	412	235	772	284	291	108	149	181	277	19	132	0	78	374
SVN	66	106	108	79	197	144	114	97	130	167	160	131	85	140	40	48	54	123	26	68	48	0	132
PRT	305	475	813	371	564	620	669	538	724	831	801	1050	511	640	214	275	236	535	56	309	316	105	0

HOL

common bulls below diagonal
common three quarter sib group above diagonal

	AUS	BEL	CAN	CHE	DEU	DFS	ESP	FRA	GBR	ITA	NLD	USA	HUN	POL	NZL	ZAF	JPN	CZE	EST	IRL	KOR	PRT	SVN
AUS	0	411	742	390	729	666	511	699	738	634	744	910	399	457	446	278	474	462	69	373	254	431	71
BEL	332	0	548	462	760	590	501	669	637	613	882	660	356	472	256	233	371	467	72	368	210	472	101
CAN	649	510	0	736	1700	1030	1125	1167	1311	1489	1086	2637	758	896	337	363	1047	918	117	399	547	817	125
CHE	315	461	583	0	843	544	492	524	610	647	724	800	351	463	232	211	363	453	60	333	219	429	82
DEU	341	633	568	545	0	1878	1239	1932	1537	2076	2144	2488	900	1366	417	366	1087	1441	166	541	450	866	194
DFS	398	511	701	460	806	0	845	1326	1230	1277	1453	1532	662	987	432	372	737	985	127	515	368	735	148
ESP	364	484	638	394	554	566	0	983	949	1156	920	1347	620	767	295	354	757	760	102	390	385	699	119
FRA	389	605	608	428	650	534	621	0	1294	1428	1532	2105	724	1163	459	347	1016	1042	118	503	404	712	122
GBR	575	636	1286	583	734	808	753	674	0	1400	1419	1794	692	923	445	382	803	910	122	668	413	793	138
ITA	449	587	1107	573	988	901	816	631	1120	0	1433	2194	832	1146	372	364	950	1143	141	488	504	887	166
NLD	580	971	917	684	1134	1048	765	762	1143	1112	0	1825	702	1094	543	362	785	1196	154	617	375	831	151
USA	687	552	2490	694	827	896	809	898	1560	1486	1418	0	1007	1317	505	452	1551	1359	159	517	691	1041	144
HUN	254	293	644	277	514	448	462	400	546	651	504	880	0	615	257	288	529	742	87	313	350	537	98
POL	266	377	593	324	673	609	460	555	650	765	782	1009	455	0	286	276	654	923	137	369	397	705	154
NZL	342	200	286	193	241	272	241	219	346	288	491	421	197	173	0	204	296	304	37	329	158	277	44
ZAF	242	198	331	181	252	286	320	238	349	312	324	469	239	193	182	0	300	289	45	231	209	302	51
JPN	221	195	319	185	223	258	258	224	287	293	271	369	208	196	133	184	0	664	89	309	407	512	87
CZE	266	347	599	311	833	549	506	576	619	781	986	953	622	604	197	212	184	0	108	375	399	658	142
EST	30	43	47	28	77	57	41	39	53	66	90	90	50	73	16	18	19	57	0	57	49	92	37
IRL	332	359	382	329	385	416	377	398	730	456	573	483	263	273	273	219	174	288	32	0	182	358	65
KOR	173	146	491	153	209	235	272	194	308	412	242	773	285	291	108	164	182	277	19	132	0	375	65
PRT	305	474	813	371	564	620	656	550	723	831	813	1050	510	640	214	285	238	535	56	309	317	0	106
SVN	51	79	91	64	171	118	88	81	104	138	129	109	71	120	33	35	39	103	22	54	41	85	0

HOL

common bulls below diagonal
common three quarter sib group above diagonal

	AUS	BEL	CAN	CHE	DEU	DFS	ESP	FRA	GBR	ITA	NLD	USA	HUN	POL	ZAF	JPN	CZE	EST	IRL	KOR	PRT	SVN
AUS	0	399	750	376	729	669	532	575	740	632	372	915	398	453	275	474	460	67	373	254	424	70
BEL	330	0	532	435	738	574	508	588	614	601	497	627	347	459	222	355	456	71	358	205	459	100
CAN	650	505	0	699	1698	1026	1136	990	1307	1488	661	2636	758	894	357	1044	917	116	398	547	811	125
CHE	313	436	553	0	745	530	493	464	596	621	443	744	343	440	208	361	430	56	330	217	414	81
DEU	340	622	568	484	0	1863	1268	1721	1534	2073	1176	2482	896	1354	360	1084	1434	165	540	450	846	193
DFS	398	506	701	450	803	0	869	1133	1217	1271	796	1519	657	971	367	733	975	125	513	368	716	147
ESP	375	508	649	400	599	595	0	908	973	1180	577	1371	630	783	355	765	773	104	404	389	708	121
FRA	350	558	549	383	522	501	621	0	1132	1344	709	1656	669	1067	290	848	987	111	442	368	654	122
GBR	576	626	1286	572	733	808	787	620	0	1396	743	1785	688	911	375	800	903	119	659	413	776	137
ITA	448	585	1106	553	986	901	850	597	1118	0	892	2191	830	1140	358	947	1141	139	487	503	872	165
NLD	340	543	627	405	727	717	487	466	678	781	0	857	407	731	196	375	777	112	331	227	513	142
USA	688	543	2489	639	826	896	829	695	1559	1483	703	0	1005	1310	445	1549	1350	158	513	689	1025	144
HUN	254	291	644	272	514	448	475	383	545	650	292	879	0	612	285	529	740	87	310	349	531	98
POL	266	372	593	303	673	606	483	512	646	763	601	1008	455	0	270	652	915	136	366	397	694	153
ZAF	240	197	328	178	249	283	321	205	346	309	167	464	237	189	0	295	282	43	227	206	297	48
JPN	220	193	317	184	222	257	258	216	284	292	192	366	208	196	181	0	663	89	308	406	508	87
CZE	266	343	599	298	831	544	528	541	617	781	739	950	622	600	209	184	0	104	372	399	645	141
EST	30	43	47	28	77	57	45	39	53	66	71	90	50	73	18	19	56	0	55	49	90	36
IRL	332	357	382	325	384	416	397	367	723	456	342	483	263	272	217	174	288	32	0	181	351	65

KOR	173	146	491	152	209	235	274	187	308	412	161	771	284	291	163	181	277	19	132	0	374	65
PRT	305	469	813	361	561	612	670	538	722	829	514	1048	510	632	283	236	527	55	309	316	0	106
SVN	51	79	91	63	171	118	91	81	104	138	128	109	71	120	32	39	102	22	54	41	85	0

HOL

common bulls below diagonal

common three quarter sib group above diagonal

	AUS	BEL	CAN	CHE	DEU	DFS	ESP	FRA	GBR	ITA	NLD	USA	HUN	POL	NZL	ZAF	JPN	CZE	EST	IRL	KOR	SVN	PRT
AUS	0	413	750	391	731	671	514	707	744	634	769	918	399	459	452	278	475	463	69	375	257	96	433
BEL	332	0	548	462	760	591	495	669	637	613	906	660	356	472	256	233	371	467	72	368	211	132	472
CAN	650	510	0	736	1700	1030	1120	1167	1311	1489	1117	2637	758	896	337	363	1047	918	117	399	555	150	817
CHE	315	461	583	0	843	544	489	523	610	647	732	800	351	463	232	211	363	453	60	333	222	107	429
DEU	341	633	568	545	0	1878	1228	1931	1537	2076	2185	2488	900	1366	417	366	1087	1441	166	541	456	228	866
DFS	398	511	701	460	806	0	837	1327	1231	1278	1495	1533	663	988	433	372	737	985	127	516	371	180	735
ESP	362	478	635	390	540	558	0	974	941	1147	925	1338	617	761	292	354	753	754	100	387	392	147	695
FRA	389	605	608	427	649	533	610	0	1294	1428	1647	2105	724	1163	459	347	1016	1042	118	503	411	146	712
GBR	576	636	1286	583	734	808	743	674	0	1400	1447	1795	692	923	445	382	803	910	122	670	416	171	793
ITA	449	587	1107	573	988	901	804	631	1120	0	1441	2194	832	1146	372	364	950	1143	141	488	509	199	887
NLD	583	997	924	685	1142	1049	756	784	1155	1113	0	1952	711	1103	556	372	819	1200	155	624	384	190	836
USA	689	552	2490	694	827	896	801	898	1560	1486	1455	0	1007	1317	505	452	1551	1359	159	518	699	175	1041
HUN	254	293	644	277	514	448	460	400	546	651	504	880	0	615	257	288	529	742	87	313	352	115	537
POL	266	377	593	324	673	609	454	555	650	765	783	1009	455	0	286	276	654	923	137	369	403	179	705
NZL	343	200	286	193	241	272	239	219	346	288	493	421	197	173	0	204	296	304	37	329	159	54	277
ZAF	242	198	331	181	252	286	319	238	349	312	326	469	239	193	182	0	300	289	45	231	210	69	302
JPN	222	195	320	185	224	258	257	225	288	293	273	371	208	196	134	184	0	664	89	309	413	110	512
CZE	266	347	599	311	833	549	501	576	619	781	986	953	622	604	197	212	185	0	108	375	400	170	658
EST	30	43	47	28	77	57	40	39	53	66	90	90	50	73	16	18	19	57	0	57	49	41	92
IRL	332	359	382	329	385	416	374	398	732	456	576	483	263	273	273	219	174	288	32	0	183	87	358
KOR	173	146	492	153	209	235	270	195	308	413	245	778	285	291	108	165	182	277	19	132	0	78	377
SVN	66	106	108	79	197	144	108	97	130	167	162	131	85	140	40	48	54	123	26	68	48	0	132
PRT	305	474	813	371	564	620	650	550	723	831	816	1050	510	640	214	285	238	535	56	309	318	105	0

HOL

common bulls below diagonal

common three quarter sib group above diagonal

	AUS	BEL	CAN	CHE	DEU	DFS	ESP	FRA	GBR	ITA	NLD	USA	HUN	POL	NZL	ZAF	JPN	CZE	EST	IRL	KOR	PRT	SVN
AUS	0	389	750	391	731	671	515	707	744	634	767	918	399	459	452	277	285	463	69	375	254	433	71
BEL	330	0	526	455	730	569	478	622	605	598	816	613	341	460	241	220	260	453	72	353	201	464	101
CAN	650	500	0	736	1700	1030	1121	1167	1311	1489	1114	2637	758	896	337	362	743	918	117	399	548	817	125
CHE	315	457	583	0	843	544	489	524	610	647	730	800	351	463	232	210	280	453	60	333	219	429	82
DEU	341	614	568	545	0	1878	1229	1932	1537	2076	2180	2488	900	1366	417	365	809	1441	166	541	451	866	194
DFS	398	506	701	460	806	0	839	1327	1231	1278	1487	1533	663	988	433	371	509	985	127	516	367	735	148
ESP	363	472	637	390	542	560	0	977	944	1150	924	1341	619	762	292	353	574	756	100	388	386	696	119
FRA	389	593	608	428	650	534	615	0	1294	1428	1636	2105	724	1163	459	346	679	1042	118	503	405	712	122
GBR	576	618	1286	583	734	808	747	674	0	1400	1445	1795	692	923	445	381	560	910	122	670	413	793	138
ITA	449	584	1107	573	988	901	808	631	1120	0	1440	2194	832	1146	372	363	785	1143	141	488	505	887	166
NLD	583	898	924	685	1141	1049	758	785	1154	1113	0	1945	711	1102	555	371	572	1200	154	623	378	836	151
USA	689	537	2490	694	827	896	805	898	1560	1486	1452	0	1007	1317	505	451	1030	1359	159	518	691	1041	144
HUN	254	289	644	277	514	448	461	400	546	651	504	880	0	615	257	287	411	742	87	313	349	537	98
POL	266	374	593	324	673	609	456	555	650	765	783	1009	455	0	286	275	549	923	137	369	398	705	154
NZL	343	194	286	193	241	272	240	219	346	288	493	421	197	173	0	203	182	304	37	329	157	277	44
ZAF	241	195	330	180	251	285	318	237	348	311	325	468	238	192	182	0	201	288	44	230	207	301	50
JPN	185	167	279	166	197	228	215	194	239	266	230	311	180	186	109	139	0	521	77	221	323	398	84
CZE	266	344	599	311	833	549	503	576	619	781	986	953	622	604	197	212	166	0	108	375	398	658	142
EST	30	43	47	28	77	57	40	39	53	66	90	90	50	73	16	18	19	57	0	57	49	92	37
IRL	332	353	382	329	385	416	375	398	732	456	576	483	263	273	273	218	150	288	32	0	181	358	65
KOR	173	146	492	153	209	235	272	195	308	413	245	774	285	291	108	164	167	277	19	132	0	375	65
PRT	305	471	813	371	564	620	652	550	723	831	816	1050	510	640	214	284	208	535	56	309	318	0	106
SVN	51	79	91	64	171	118	87	81	104	138	129	109	71	120	33	35	39	103	22	54	41	85	0

HOL

common bulls below diagonal																							
common three quarter sib group above diagonal																							
	AUS	BEL	CAN	CHE	DEU	DFS	ESP	FRA	GBR	ITA	NLD	USA	HUN	POL	NZL	ZAF	JPN	CZE	EST	IRL	KOR	SVN	PRT
AUS	0	413	750	391	731	671	520	707	744	634	769	918	399	459	452	278	474	463	69	375	254	96	433
BEL	332	0	548	462	760	591	502	669	637	613	906	660	356	472	256	233	369	467	72	368	210	132	472
CAN	650	510	0	736	1700	1030	1126	1167	1311	1489	1117	2637	758	896	337	363	1045	918	117	399	547	150	818
CHE	315	461	583	0	843	544	492	523	610	647	732	800	351	463	232	211	362	453	60	333	219	107	429
DEU	341	633	568	545	0	1878	1242	1931	1537	2076	2185	2488	900	1366	417	366	1085	1441	166	541	450	228	867
DFS	398	511	701	460	806	0	849	1327	1231	1278	1495	1533	663	988	433	372	736	985	127	516	368	180	736
ESP	366	485	639	394	557	568	0	985	952	1158	937	1348	621	769	296	355	756	761	102	392	384	148	700
FRA	389	605	608	427	649	534	623	0	1294	1428	1647	2105	724	1163	459	347	1014	1042	118	503	403	146	713
GBR	576	636	1286	583	734	808	755	674	0	1400	1447	1795	692	923	445	382	801	910	122	670	413	171	793
ITA	449	587	1107	573	988	901	818	631	1120	0	1441	2194	832	1146	372	364	948	1143	141	488	503	199	888
NLD	583	997	924	685	1142	1049	769	784	1155	1113	0	1952	711	1103	556	372	817	1200	155	624	378	190	837
USA	689	552	2490	694	827	897	810	898	1560	1486	1455	0	1007	1317	505	452	1549	1359	159	518	689	175	1042
HUN	254	293	644	277	514	448	463	400	546	651	504	880	0	615	257	288	529	742	87	313	349	115	538
POL	266	377	593	324	673	609	462	555	650	765	783	1009	455	0	286	276	654	923	137	369	396	179	706
NZL	343	200	286	193	241	272	242	219	346	288	493	421	197	173	0	204	296	304	37	329	158	54	277
ZAF	242	198	331	181	252	286	321	238	349	312	326	469	239	193	182	0	299	289	45	231	209	69	302
JPN	220	193	317	184	222	257	256	222	284	292	269	366	208	196	133	182	0	663	89	309	406	110	512
CZE	266	347	599	311	833	549	507	576	619	781	986	953	622	604	197	212	184	0	108	375	399	170	658
EST	30	43	47	28	77	57	41	39	53	66	90	90	50	73	16	18	19	57	0	57	49	41	92
IRL	332	359	382	329	385	416	379	398	732	456	576	483	263	273	273	219	174	288	32	0	181	87	358
KOR	173	146	491	153	209	235	271	193	308	412	244	771	284	291	108	164	181	277	19	132	0	78	373
SVN	66	106	108	79	197	144	110	97	130	167	162	131	85	140	40	48	54	123	26	68	48	0	132
PRT	305	475	813	371	564	620	659	550	725	833	818	1053	513	641	214	285	236	536	56	309	317	105	0

HOL

common bulls below diagonal																						
common three quarter sib group above diagonal																						
	AUS	BEL	CAN	CHE	DEU	DFS	ESP	FRA	GBR	ITA	NLD	USA	HUN	POL	ZAF	JPN	CZE	EST	IRL	KOR	SVN	PRT
AUS	0	334	567	350	585	528	429	412	601	547	565	644	330	367	210	350	317	62	324	167	92	378
BEL	318	0	496	443	698	540	469	501	575	587	756	580	331	428	193	325	377	69	330	156	129	454
CAN	539	489	0	701	1619	934	1059	841	1216	1461	977	2443	736	844	300	922	784	112	369	445	147	800
CHE	304	447	568	0	843	543	495	430	610	647	699	800	349	437	189	354	375	60	324	170	104	425
DEU	325	592	564	545	0	1877	1246	1491	1535	2076	2050	2488	897	1313	322	1050	1210	166	522	371	225	863
DFS	384	497	698	460	806	0	846	927	1225	1277	1378	1531	658	934	320	693	798	127	489	283	179	730
ESP	343	473	629	397	566	575	0	779	952	1165	888	1349	622	740	310	722	660	102	381	309	149	703
FRA	292	475	479	354	477	446	528	0	924	1203	1099	1317	589	996	220	696	811	101	360	289	138	587
GBR	523	597	1213	582	734	806	764	520	0	1398	1332	1786	689	878	328	753	756	121	624	326	168	787
ITA	428	579	1102	573	988	900	827	542	1118	0	1405	2192	830	1119	339	929	1024	141	480	427	196	885
NLD	493	835	847	656	1090	1020	736	591	1077	1091	0	1621	673	1029	305	714	1032	151	561	293	187	808
USA	571	527	2377	694	827	896	815	564	1559	1486	1183	0	1004	1265	386	1417	1151	159	490	558	172	1035
HUN	244	280	638	277	514	448	466	340	545	651	490	880	0	588	261	514	626	87	299	295	113	537
POL	251	360	572	311	652	585	439	505	627	754	748	979	437	0	237	618	820	135	332	349	176	684
ZAF	205	180	286	166	228	263	281	164	301	293	268	387	223	177	0	246	228	44	191	145	68	286
JPN	212	192	315	184	222	256	252	194	280	291	263	359	207	190	170	0	552	87	282	320	110	505
CZE	214	291	521	255	704	469	413	431	507	697	875	801	513	548	164	169	0	100	295	329	161	585
EST	30	42	47	28	77	57	41	35	53	66	89	90	50	72	18	19	52	0	55	44	41	92
IRL	312	344	379	326	383	414	381	309	697	454	546	477	261	260	189	173	233	32	0	128	86	344
KOR	120	122	403	127	174	192	209	168	234	347	189	619	236	269	107	149	233	17	98	0	70	317
SVN	66	103	107	78	195	144	111	93	129	165	159	130	84	139	48	54	119	26	68	46	0	131
PRT	301	465	792	368	564	618	662	493	722	832	796	1049	512	629	275	235	476	56	306	272	105	0

HOL

common bulls below diagonal																						
common three quarter sib group above diagonal																						
	AUS	BEL	CAN	CHE	DEU	DFS	ESP	FRA	GBR	ITA	NLD	USA	HUN	POL	ZAF	JPN	CZE	EST	IRL	KOR	SVN	PRT
AUS	0	384	742	390	430	665	521	697	738	634	734	910	397	455	278	473	460	67	372	254	94	435
BEL	330	0	522	453	531	563	494	613	603	597	806	610	340	458	221	345	451	70	352	202	131	467
CAN	649	500	0	735	1229	1029	1133	1151	1311	1489	1070	2637	755	891	363	1045	912	114	399	546	148	821

CHE	315	457	583	0	602	543	499	516	609	645	719	799	350	461	211	361	450	60	333	218	106	433
DEU	268	479	471	417	0	1178	948	1219	1029	1607	1445	1648	647	1060	224	725	1034	135	352	344	205	643
DFS	398	505	701	460	639	0	865	1297	1228	1275	1438	1529	658	982	372	736	977	124	515	368	178	739
ESP	372	498	647	402	424	585	0	991	969	1172	935	1365	626	777	359	761	770	102	402	389	149	716
FRA	388	588	608	427	425	533	652	0	1279	1423	1476	2064	720	1152	346	1000	1035	115	497	399	145	715
GBR	575	618	1286	583	551	808	780	674	0	1400	1402	1792	690	918	381	800	904	121	664	413	170	796
ITA	449	584	1107	572	780	901	841	630	1120	0	1423	2194	830	1143	364	948	1142	141	488	502	198	889
NLD	576	893	911	682	830	1045	789	742	1134	1110	0	1780	693	1078	360	775	1185	152	610	371	188	831
USA	687	537	2490	694	607	896	826	862	1560	1486	1402	0	1004	1310	452	1548	1354	158	516	687	173	1044
HUN	254	288	644	277	379	445	471	400	546	651	501	880	0	612	287	528	738	85	312	349	113	538
POL	266	373	593	323	570	606	474	555	648	765	774	1009	453	0	275	652	915	133	367	396	176	707
ZAF	242	196	331	181	161	286	323	238	349	312	320	469	239	193	0	298	288	45	231	209	69	307
JPN	220	193	317	184	182	257	257	221	283	292	266	365	208	196	181	0	660	88	309	406	108	516
CZE	266	342	599	310	633	548	523	576	618	781	983	953	620	601	212	184	0	104	374	398	168	657
EST	30	42	47	28	63	56	43	39	52	66	89	90	49	70	18	19	55	0	56	49	40	91
IRL	332	353	382	329	285	416	393	398	726	456	572	483	263	273	219	174	288	32	0	181	86	359
KOR	173	146	490	153	176	235	272	193	308	412	240	764	284	291	164	181	277	19	132	0	78	375
SVN	66	105	108	79	186	142	114	97	130	167	161	131	84	138	48	54	122	25	68	48	0	131
PRT	307	475	816	375	465	624	675	553	730	834	816	1057	515	644	286	236	539	55	310	317	105	0

HOL

common bulls below diagonal
common three quarter sib group above diagonal

	AUS	BEL	CAN	CHE	DEU	DFS	ESP	FRA	GBR	ITA	NLD	USA	HUN	POL	NZL	ZAF	JPN	CZE	EST	IRL	KOR	SVN	PRT
AUS	0	406	750	391	731	670	528	661	744	634	716	918	399	458	452	278	474	463	69	375	255	96	433
BEL	332	0	543	461	754	586	513	643	631	610	851	646	353	469	252	231	362	465	72	366	210	132	472
CAN	650	510	0	736	1699	1030	1133	1089	1311	1489	1042	2637	758	896	337	363	1045	918	117	399	549	150	818
CHE	315	460	583	0	843	544	499	514	610	647	709	800	351	463	232	211	362	453	60	333	220	107	429
DEU	341	632	568	545	0	1878	1259	1895	1537	2076	2096	2488	900	1365	417	366	1085	1441	166	541	452	228	867
DFS	398	510	701	460	806	0	865	1248	1230	1277	1416	1532	662	987	432	372	736	985	127	515	369	180	736
ESP	372	506	647	402	582	585	0	965	970	1172	922	1365	629	781	304	359	762	773	104	402	391	151	711
FRA	388	601	605	427	646	531	652	0	1239	1413	1441	1905	710	1151	426	332	936	1032	115	485	388	146	705
GBR	576	636	1286	583	734	808	780	669	0	1400	1382	1794	692	923	445	382	801	910	122	668	414	171	793
ITA	449	587	1107	573	988	901	841	630	1120	0	1413	2194	832	1146	372	364	948	1143	141	488	506	199	888
NLD	555	933	868	661	1103	1024	763	731	1102	1089	0	1718	690	1081	529	353	747	1183	152	610	365	190	819
USA	689	551	2490	694	827	897	826	827	1560	1486	1216	0	1007	1317	505	452	1549	1359	159	517	693	175	1042
HUN	254	293	644	277	514	448	471	399	546	651	487	880	0	615	257	288	529	742	87	313	351	115	538
POL	266	377	593	324	673	609	475	555	650	765	774	1009	455	0	286	276	654	923	137	369	399	179	706
NZL	343	200	286	193	241	272	248	217	346	288	471	421	197	173	0	204	296	304	37	329	158	54	277
ZAF	242	198	331	181	252	286	323	236	349	312	306	469	239	193	182	0	299	289	45	231	209	69	302
JPN	220	193	317	184	222	257	258	222	284	292	266	366	208	196	133	182	0	663	89	309	407	110	512
CZE	266	347	599	311	833	549	523	574	619	781	970	953	622	604	197	212	184	0	108	375	399	170	658
EST	30	43	47	28	77	57	43	39	53	66	89	90	50	73	16	18	19	57	0	57	49	41	92
IRL	332	359	382	329	385	416	393	396	730	456	561	483	263	273	273	219	174	288	32	0	182	87	358
KOR	173	146	491	153	209	235	274	193	308	412	235	773	285	291	108	164	181	277	19	132	0	78	375
SVN	66	106	108	79	197	144	114	97	130	167	160	131	85	140	40	48	54	123	26	68	48	0	132
PRT	305	475	813	371	564	620	669	548	724	832	802	1051	512	641	214	285	236	535	56	309	317	105	0

HOL

common bulls below diagonal
common three quarter sib group above diagonal

	AUS	BEL	CAN	CHE	DEU	DFS	ESP	FRA	GBR	ITA	NLD	USA	HUN	POL	NZL	ZAF	JPN	CZE	EST	IRL	KOR	SVN	PRT
AUS	0	406	750	391	731	626	521	704	744	634	746	918	399	459	452	278	475	463	69	375	255	96	433
BEL	332	0	543	461	754	575	501	655	631	610	867	646	353	469	252	231	363	465	72	366	210	132	471
CAN	650	510	0	736	1700	952	1127	1152	1311	1489	1086	2637	758	896	337	363	1046	918	117	399	550	150	815
CHE	315	460	583	0	843	525	494	520	610	647	724	800	351	463	232	211	362	453	60	333	220	107	429
DEU	341	632	568	545	0	1791	1244	1919	1537	2076	2144	2488	900	1366	417	366	1086	1441	166	541	453	228	864
DFS	398	510	701	460	805	0	808	1217	1172	1259	1419	1439	646	966	405	345	683	954	123	498	356	180	725
ESP	366	487	640	396	559	570	0	975	954	1159	924	1350	622	771	297	357	758	762	102	393	389	148	699
FRA	389	604	608	427	647	533	626	0	1281	1424	1525	2066	722	1159	455	346	1002	1038	117	498	403	146	708
GBR	576	635	1285	583	733	807	755	673	0	1400	1419	1794	692	923	445	382	802	910	122	668	414	171	791
ITA	449	587	1107	573	988	900	820	631	1119	0	1433	2194	832	1146	372	364	949	1143	141	488	507	199	886

NLD	580	966	917	684	1134	1048	769	760	1142	1112	0	1825	702	1094	543	362	784	1196	154	617	377	190	830
USA	689	551	2490	694	827	896	812	863	1560	1486	1418	0	1007	1317	505	452	1550	1359	159	517	695	175	1039
HUN	254	293	644	277	514	448	465	400	546	651	504	880	0	615	257	288	529	742	87	313	351	115	537
POL	266	377	593	324	673	609	464	555	650	765	782	1009	455	0	286	276	654	923	137	369	400	179	703
NZL	343	200	286	193	241	272	242	219	346	288	491	421	197	173	0	204	296	304	37	329	158	54	277
ZAF	242	198	331	181	252	286	322	238	349	312	324	469	239	193	182	0	300	289	45	231	209	69	301
JPN	220	194	318	184	223	258	258	223	285	293	269	367	208	196	133	183	0	664	89	309	408	110	512
CZE	266	347	599	311	833	549	509	576	619	781	986	953	622	604	197	212	184	0	108	375	399	170	657
EST	30	43	47	28	77	57	41	39	53	66	90	90	50	73	16	18	19	57	0	57	49	41	91
IRL	332	359	382	329	385	416	380	398	730	456	573	483	263	273	273	219	174	288	32	0	182	87	358
KOR	173	146	492	153	209	235	273	195	308	413	242	775	285	291	108	165	182	277	19	132	0	78	376
SVN	66	106	108	79	197	144	110	97	130	167	162	131	85	140	40	48	54	123	26	68	48	0	132
PRT	305	474	813	371	564	617	658	550	723	831	813	1050	510	640	214	285	237	535	56	309	318	105	0

HOL

common bulls below diagonal
common three quarter sib group above diagonal

	AUS	BEL	CAN	CHE	DEU	DFS	ESP	FRA	GBR	ITA	NLD	USA	HUN	POL	NZL	ZAF	JPN	CZE	EST	IRL	KOR	SVN	PRT
AUS	0	406	750	391	731	671	531	707	744	634	769	918	399	459	452	278	474	463	69	375	253	96	433
BEL	332	0	543	461	754	587	514	658	631	610	875	646	353	469	252	231	362	465	72	366	209	132	472
CAN	650	510	0	736	1700	1030	1135	1167	1311	1489	1117	2637	758	896	337	363	1045	918	117	399	546	150	818
CHE	315	460	583	0	843	544	499	523	610	647	732	800	351	463	232	211	362	453	60	333	218	107	429
DEU	341	632	568	545	0	1878	1267	1931	1537	2076	2185	2488	900	1366	417	366	1085	1441	166	541	449	228	867
DFS	398	510	702	460	806	0	871	1327	1231	1278	1495	1533	663	988	433	372	736	985	127	516	367	180	736
ESP	373	508	648	402	595	592	0	1009	974	1180	966	1369	631	787	306	359	765	777	105	405	387	151	714
FRA	389	604	608	427	649	534	664	0	1294	1428	1647	2105	724	1163	459	347	1014	1042	118	503	402	146	713
GBR	576	636	1286	583	734	808	785	674	0	1400	1447	1795	692	923	445	382	801	910	122	670	412	171	793
ITA	449	587	1107	573	988	901	850	631	1120	0	1441	2194	832	1146	372	364	948	1143	141	488	502	199	888
NLD	583	973	924	685	1142	1049	804	784	1155	1113	0	1952	711	1103	556	372	817	1200	155	624	377	190	837
USA	689	551	2490	694	827	898	828	898	1560	1486	1455	0	1007	1317	505	452	1549	1359	159	518	687	175	1042
HUN	254	293	644	277	514	449	474	400	546	651	504	880	0	615	257	288	529	742	87	313	348	115	538
POL	266	377	593	324	673	609	481	555	650	765	783	1009	455	0	286	276	654	923	137	369	395	179	706
NZL	343	200	286	193	241	272	249	219	346	288	493	421	197	173	0	204	296	304	37	329	157	54	277
ZAF	242	198	331	181	252	287	323	238	349	312	326	469	239	193	182	0	299	289	45	231	208	69	302
JPN	220	193	317	184	222	257	258	222	284	292	269	366	208	196	133	182	0	663	89	309	405	110	512
CZE	266	347	599	311	833	549	526	576	619	781	986	953	622	604	197	212	184	0	108	375	399	170	658
EST	30	43	47	28	77	57	44	39	53	66	90	90	50	73	16	18	19	57	0	57	49	41	92
IRL	332	359	382	329	385	416	396	398	732	456	576	483	263	273	273	219	174	288	32	0	180	87	358
KOR	172	145	490	152	208	234	272	192	307	411	243	769	283	291	107	163	180	277	19	131	0	78	372
SVN	66	106	108	79	197	144	114	97	130	167	162	131	85	140	40	48	54	123	26	68	48	0	132
PRT	305	475	813	371	564	620	671	550	725	833	818	1053	513	641	214	285	236	536	56	309	316	105	0

HOL

common bulls below diagonal
common three quarter sib group above diagonal

	AUS	BEL	CAN	CHE	DEU	DFS	ESP	FRA	GBR	ITA	NLD	USA	HUN	POL	ZAF	JPN	CZE	EST	IRL	KOR	SVN	PRT
AUS	0	408	742	390	729	667	510	699	738	634	765	910	399	457	278	474	462	69	372	255	96	431
BEL	331	0	543	460	753	586	497	662	631	610	898	654	353	469	230	367	465	72	363	207	132	471
CAN	649	506	0	736	1700	1030	1123	1167	1311	1489	1117	2637	758	896	363	1047	918	117	399	549	150	817
CHE	315	459	583	0	843	544	490	523	610	647	732	800	351	463	211	363	453	60	333	220	107	429
DEU	341	629	568	545	0	1878	1234	1931	1537	2076	2185	2488	900	1366	366	1087	1441	166	541	452	228	866
DFS	398	510	702	460	806	0	843	1327	1231	1278	1495	1533	663	988	372	737	985	127	516	368	180	735
ESP	364	480	637	392	548	563	0	980	948	1153	932	1344	619	765	354	757	758	101	390	387	147	698
FRA	389	603	608	427	649	534	617	0	1294	1428	1647	2105	724	1163	347	1016	1042	118	503	406	146	712
GBR	575	632	1286	583	734	808	750	674	0	1400	1447	1795	692	923	382	803	910	122	667	414	171	793
ITA	449	587	1107	573	988	901	812	631	1120	0	1441	2194	832	1146	364	950	1143	141	488	506	199	887
NLD	583	985	924	685	1142	1049	763	784	1155	1113	0	1952	711	1103	372	819	1200	155	624	380	190	836
USA	687	548	2490	694	827	898	807	898	1560	1486	1455	0	1007	1317	452	1551	1359	159	518	693	175	1041
HUN	254	292	644	277	514	449	461	400	546	651	504	880	0	615	288	529	742	87	313	350	115	537
POL	266	377	593	324	673	609	458	555	650	765	783	1009	455	0	276	654	923	137	369	399	179	705
ZAF	242	198	331	181	252	287	319	238	349	312	326	469	239	193	0	300	289	45	231	209	69	302
JPN	222	195	320	185	224	258	258	225	288	293	273	371	208	196	184	0	664	89	309	408	110	512

CZE	266	347	599	311	833	549	504	576	619	781	986	953	622	604	212	185	0	108	375	399	170	658
EST	30	43	47	28	77	57	40	39	53	66	90	90	50	73	18	19	57	0	57	49	41	92
IRL	332	358	382	329	385	416	376	398	729	456	576	483	263	273	219	174	288	32	0	182	87	358
KOR	173	146	492	153	209	235	272	195	308	413	245	775	285	291	165	182	277	19	132	0	78	376
SVN	66	106	108	79	197	144	108	97	130	167	162	131	85	140	48	54	123	26	68	48	0	132
PRT	305	473	813	371	564	620	654	550	723	831	816	1050	510	640	285	238	535	56	309	318	105	0

HOL

common bulls below diagonal
common three quarter sib group above diagonal

	AUS	BEL	CAN	CHE	DEU	DFS	ESP	FRA	GBR	ITA	NLD	USA	HUN	POL	NZL	ZAF	JPN	CZE	EST	IRL	KOR	SVN	PRT
AUS	0	406	750	391	731	671	521	707	744	634	769	918	399	459	452	278	475	463	69	375	255	94	433
BEL	332	0	543	461	754	587	501	658	631	610	875	646	353	469	252	231	364	465	72	366	210	130	472
CAN	650	510	0	736	1700	1030	1126	1167	1311	1489	1117	2637	758	896	337	363	1047	918	117	399	550	148	817
CHE	315	460	583	0	843	544	493	523	610	647	732	800	351	463	232	211	363	453	60	333	220	105	429
DEU	341	632	568	545	0	1878	1243	1931	1537	2076	2185	2488	900	1366	417	366	1087	1441	166	541	453	226	866
DFS	398	510	702	460	806	0	849	1327	1231	1278	1495	1533	663	988	433	372	737	985	127	516	369	179	735
ESP	366	487	639	395	558	569	0	986	953	1158	938	1349	621	770	297	356	757	761	102	392	388	147	700
FRA	389	604	608	427	649	534	625	0	1294	1428	1647	2105	724	1163	459	347	1016	1042	118	503	407	144	712
GBR	576	636	1286	583	734	808	756	674	0	1400	1447	1795	692	923	445	382	803	910	122	670	414	169	793
ITA	449	587	1107	573	988	901	819	631	1120	0	1441	2194	832	1146	372	364	950	1143	141	488	507	197	887
NLD	583	973	924	685	1142	1049	770	784	1155	1113	0	1952	711	1103	556	372	819	1200	155	624	382	188	836
USA	689	551	2490	694	827	897	811	898	1560	1486	1455	0	1007	1317	505	452	1551	1359	159	518	695	173	1041
HUN	254	293	644	277	514	449	464	400	546	651	504	880	0	615	257	288	529	742	87	313	351	113	537
POL	266	377	593	324	673	609	463	555	650	765	783	1009	455	0	286	276	654	923	137	369	400	177	705
NZL	343	200	286	193	241	272	242	219	346	288	493	421	197	173	0	204	296	304	37	329	158	54	277
ZAF	242	198	331	181	252	287	321	238	349	312	326	469	239	193	182	0	300	289	45	231	209	68	302
JPN	221	195	319	185	223	258	258	224	287	293	272	369	208	196	133	184	0	664	89	309	408	109	512
CZE	266	347	599	311	833	549	508	576	619	781	986	953	622	604	197	212	184	0	108	375	399	168	658
EST	30	43	47	28	77	57	41	39	53	66	90	90	50	73	16	18	19	57	0	57	49	40	92
IRL	332	359	382	329	385	416	379	398	732	456	576	483	263	273	273	219	174	288	32	0	182	86	358
KOR	173	146	492	153	209	235	272	195	308	413	245	775	285	291	108	165	182	277	19	132	0	77	376
SVN	66	105	108	79	196	144	110	97	130	166	161	130	84	139	40	48	54	123	26	68	48	0	131
PRT	305	474	813	371	564	620	657	550	723	831	816	1050	510	640	214	285	238	535	56	309	318	105	0

HOL

common bulls below diagonal
common three quarter sib group above diagonal

	AUS	BEL	CAN	CHE	DEU	DFS	ESP	FRA	GBR	ITA	NLD	USA	HUN	POL	ZAF	JPN	CZE	EST	IRL	KOR	SVN	PRT
AUS	0	411	742	390	729	667	510	699	738	634	765	910	388	457	278	467	462	69	372	257	94	431
BEL	332	0	548	462	760	591	499	669	637	613	906	660	349	472	233	369	467	72	368	211	130	472
CAN	649	510	0	736	1700	1030	1123	1167	1311	1489	1117	2637	744	896	363	1039	917	117	399	554	148	817
CHE	315	461	583	0	843	544	490	523	610	647	732	800	345	463	211	363	453	60	333	222	105	429
DEU	341	633	568	545	0	1878	1234	1931	1537	2076	2185	2488	882	1366	366	1084	1441	166	541	455	226	866
DFS	398	511	702	460	806	0	843	1327	1231	1278	1495	1533	648	988	372	731	985	127	516	371	179	735
ESP	364	482	637	392	549	563	0	980	948	1153	932	1344	609	765	354	747	758	101	390	392	146	698
FRA	389	605	608	427	649	534	617	0	1294	1428	1647	2105	706	1163	347	1003	1042	118	503	410	144	712
GBR	575	636	1286	583	734	808	751	674	0	1400	1447	1795	677	923	382	797	910	122	667	416	169	793
ITA	449	587	1107	573	988	901	813	631	1120	0	1441	2194	828	1146	364	945	1143	141	488	509	197	887
NLD	583	997	924	685	1142	1049	764	784	1155	1113	0	1952	693	1103	372	812	1200	155	624	383	188	836
USA	687	552	2490	694	827	898	807	898	1560	1486	1455	0	977	1317	452	1531	1358	159	518	698	173	1041
HUN	246	284	630	273	505	440	447	392	530	644	491	854	0	609	279	519	729	87	306	349	113	535
POL	266	377	593	324	673	609	458	555	650	765	783	1009	451	0	276	652	923	137	369	402	177	705
ZAF	242	198	331	181	252	287	319	238	349	312	326	469	228	193	0	297	289	45	231	210	68	302
JPN	221	195	319	185	223	258	258	224	287	293	272	369	202	196	184	0	663	88	307	412	109	512
CZE	266	347	599	311	833	549	505	576	619	781	986	953	610	604	212	184	0	108	375	399	168	658
EST	30	43	47	28	77	57	40	39	53	66	90	90	50	73	18	19	57	0	57	49	40	92
IRL	332	359	382	329	385	416	377	398	729	456	576	483	255	273	219	174	288	32	0	183	86	358
KOR	173	146	492	153	209	235	272	195	308	413	245	778	283	291	165	182	277	19	132	0	77	377
SVN	66	105	108	79	196	144	108	97	130	166	161	130	84	139	48	54	123	26	68	48	0	131
PRT	305	474	813	371	564	620	655	550	723	831	816	1050	507	640	285	238	535	56	309	318	105	0

HOL

common bulls below diagonal

common three quarter sib group above diagonal

	AUS	BEL	CAN	CHE	DEU	DFS	ESP	FRA	GBR	ITA	NLD	USA	POL	NZL	JPN	CZE	EST	IRL	KOR	SVN	PRT	ZAF	HUN
AUS	0	319	510	320	504	439	388	446	521	493	494	522	316	289	251	294	58	278	139	89	305	142	230
BEL	306	0	534	436	717	529	502	643	550	602	758	540	384	247	261	381	72	306	129	130	400	131	241
CAN	502	505	0	700	1632	872	1128	1165	1130	1484	962	2224	790	330	743	787	115	333	372	148	698	211	586
CHE	288	436	553	0	732	480	489	509	556	621	604	688	375	226	279	361	58	285	144	103	361	123	257
DEU	303	610	556	479	0	1634	1219	1827	1320	2048	1899	2032	1202	387	806	1200	162	442	310	226	740	203	662
DFS	348	472	671	418	751	0	746	1095	986	1201	1272	1135	829	344	496	769	118	401	224	175	608	200	457
ESP	314	491	642	394	553	521	0	993	844	1161	843	1180	673	297	576	657	101	323	260	148	604	205	461
FRA	321	601	608	418	580	495	636	0	1009	1419	1247	1409	1000	448	679	861	115	389	263	144	587	181	520
GBR	473	569	1128	527	661	704	649	566	0	1302	1148	1418	778	336	545	728	110	475	263	167	648	208	478
ITA	397	586	1105	553	979	852	825	631	1041	0	1362	1974	1048	362	785	1020	140	430	349	197	780	228	654
NLD	442	827	808	571	1016	949	694	667	920	1056	0	1340	942	431	563	1012	147	486	236	185	683	201	497
USA	489	512	2218	613	732	797	706	632	1339	1412	1014	0	1120	331	991	1099	149	392	454	170	835	242	708
POL	219	313	534	259	576	529	372	469	556	691	675	888	0	207	527	787	124	285	300	167	603	173	472
NZL	255	198	284	190	234	240	243	219	278	284	393	292	129	0	180	213	35	264	89	53	208	100	137
JPN	184	167	279	166	197	227	216	194	239	266	230	311	173	109	0	494	76	204	253	97	376	155	356
CZE	206	291	521	246	702	464	413	447	500	696	868	785	528	147	162	0	98	281	271	161	548	188	541
EST	30	43	47	28	76	54	41	39	50	66	86	87	64	16	19	51	0	50	40	40	84	37	75
IRL	280	320	339	292	344	354	327	332	501	412	479	408	221	230	150	230	32	0	101	84	285	120	203
KOR	107	103	336	109	146	157	169	141	189	286	152	514	234	67	125	191	17	80	0	65	252	106	226
SVN	65	105	108	78	196	142	111	97	128	166	160	130	129	40	50	119	26	68	43	0	124	59	104
PRT	254	397	670	305	483	507	536	452	578	720	658	844	554	161	195	446	51	249	221	98	0	191	389
ZAF	135	119	188	101	140	172	172	139	179	186	166	236	136	88	112	140	16	113	75	41	181	0	158
HUN	175	199	504	204	371	320	311	291	368	490	343	628	361	106	156	452	43	178	184	77	377	133	0

HOL

common bulls below diagonal

common three quarter sib group above diagonal

	AUS	BEL	CAN	CHE	DEU	DFS	ESP	FRA	GBR	ITA	NLD	USA	HUN	POL	NZL	JPN	CZE	EST	IRL	KOR	SVN	PRT
AUS	0	413	750	391	731	671	524	590	744	634	769	915	399	458	452	475	463	69	375	257	71	433
BEL	332	0	546	460	759	589	506	612	635	611	904	655	356	471	256	370	467	72	367	211	100	471
CAN	650	510	0	736	1700	1030	1129	1008	1311	1489	1117	2624	758	895	337	1047	918	117	399	557	125	817
CHE	315	461	583	0	843	544	496	485	610	647	732	796	351	461	232	363	453	60	333	222	82	429
DEU	341	633	568	545	0	1878	1250	1748	1537	2076	2185	2478	900	1361	417	1087	1441	166	541	456	193	865
DFS	398	511	702	460	806	0	856	1162	1231	1278	1495	1531	663	985	433	737	985	127	515	372	147	734
ESP	367	493	642	397	567	575	0	916	962	1165	949	1352	625	777	303	760	768	102	398	396	120	707
FRA	373	579	575	413	555	526	628	0	1157	1362	1365	1680	679	1080	380	862	998	113	458	382	122	672
GBR	576	636	1286	583	734	808	765	662	0	1400	1447	1789	692	922	445	803	910	122	669	416	138	791
ITA	449	587	1107	573	988	901	827	622	1120	0	1441	2189	832	1146	372	950	1143	141	488	510	166	887
NLD	583	997	924	685	1142	1049	781	715	1155	1113	0	1947	711	1101	556	819	1200	155	624	384	151	836
USA	686	550	2467	689	820	895	814	740	1552	1481	1448	0	1005	1312	504	1548	1354	158	515	701	144	1038
HUN	254	293	644	277	514	449	466	397	546	651	504	879	0	614	257	529	742	87	313	352	98	537
POL	266	377	593	324	673	609	467	523	650	765	783	1005	455	0	286	653	923	137	369	403	154	705
NZL	343	200	286	193	241	272	246	213	346	288	493	419	197	173	0	296	304	37	329	160	44	277
JPN	220	194	318	185	224	258	258	224	287	293	272	369	208	196	133	0	664	89	309	414	87	512
CZE	266	347	599	311	833	549	514	560	619	781	986	948	622	604	197	185	0	108	375	400	142	657
EST	30	43	47	28	77	57	41	39	53	66	90	90	50	73	16	19	57	0	57	49	37	92
IRL	332	359	382	329	385	416	385	394	732	456	576	481	263	273	273	174	288	32	0	183	65	358
KOR	173	146	492	153	209	235	274	192	308	413	245	778	285	291	108	182	277	19	132	0	65	377
SVN	51	79	91	64	170	117	89	81	104	138	129	109	71	120	33	39	103	22	54	41	0	106
PRT	305	474	813	371	564	620	663	541	723	831	816	1043	510	640	214	237	535	56	309	318	85	0

HOL

common bulls below diagonal

common three quarter sib group above diagonal

	AUS	BEL	CAN	CHE	DEU	DFS	ESP	FRA	GBR	ITA	NLD	USA	HUN	POL	NZL	JPN	CZE	EST	IRL	SVN	PRT
AUS	0	413	750	391	731	671	524	707	744	634	769	918	399	459	452	475	463	69	363	71	433

BEL	332	0	548	462	760	591	508	669	637	613	906	660	356	472	256	371	467	72	356	100	472
CAN	650	510	0	736	1700	1030	1129	1167	1311	1489	1117	2637	758	896	337	1047	918	117	385	125	817
CHE	315	461	583	0	843	544	496	523	610	647	732	800	351	463	232	363	453	60	324	83	429
DEU	341	633	568	545	0	1878	1250	1931	1537	2076	2185	2488	900	1366	417	1087	1441	166	523	194	866
DFS	398	511	702	460	806	0	856	1327	1231	1278	1495	1533	663	988	433	737	985	127	492	148	735
ESP	367	493	642	397	567	575	0	995	962	1165	949	1357	625	777	303	760	768	102	384	120	707
FRA	389	605	608	427	649	534	636	0	1294	1428	1647	2105	724	1163	459	1016	1042	118	474	122	712
GBR	576	634	1285	583	732	807	762	673	0	1400	1447	1795	692	923	445	803	910	122	631	139	793
ITA	449	587	1107	573	988	901	827	631	1118	0	1441	2194	832	1146	372	950	1143	141	480	167	887
NLD	583	997	924	685	1142	1049	781	784	1153	1113	0	1952	711	1103	556	819	1200	155	588	152	836
USA	689	552	2490	694	827	898	818	898	1560	1486	1455	0	1007	1317	505	1551	1359	159	492	145	1041
HUN	254	293	644	277	514	449	466	400	546	651	504	880	0	615	257	529	742	87	302	98	537
POL	266	377	593	324	673	609	467	555	650	765	783	1009	455	0	286	654	923	137	358	155	705
NZL	343	200	286	193	241	272	246	219	346	288	493	421	197	173	0	296	304	37	315	44	277
JPN	220	194	318	185	224	258	258	225	287	293	272	369	208	196	133	0	664	89	295	87	512
CZE	266	347	599	311	833	549	514	576	618	781	986	953	622	604	197	185	0	108	360	143	658
EST	30	43	47	28	77	57	41	39	53	66	90	90	50	73	16	19	57	0	56	37	92
IRL	331	358	381	327	383	415	382	393	707	454	568	477	261	273	269	174	287	32	0	65	347
SVN	51	79	91	64	170	117	89	81	104	139	130	109	71	120	33	39	103	22	54	0	106
PRT	305	475	813	371	564	620	664	550	723	831	817	1050	511	640	214	237	535	56	309	85	0

HOL

common bulls below diagonal

common	three	quarter	sib	group	above	diagonal															
	AUS	BEL	CAN	CHE	DEU	DFS	ESP	FRA	GBR	ITA	NLD	USA	HUN	POL	JPN	CZE	EST	IRL	SVN	PRT	
AUS	0	403	742	390	729	667	518	573	738	634	746	908	388	455	467	462	69	360	71	437	
BEL	332	0	540	457	750	584	505	592	628	607	857	639	345	466	356	464	72	353	100	475	
CAN	649	509	0	736	1700	1030	1130	991	1311	1489	1086	2629	744	895	1030	917	117	385	125	826	
CHE	315	458	583	0	843	544	497	469	610	647	721	798	345	461	361	453	60	324	82	436	
DEU	341	630	568	545	0	1878	1253	1722	1537	2076	2147	2482	882	1360	1079	1441	166	523	193	875	
DFS	398	509	702	460	806	0	859	1140	1231	1278	1468	1519	648	985	726	985	127	492	147	744	
ESP	367	498	643	399	572	579	0	896	963	1168	934	1355	615	778	749	769	103	385	120	717	
FRA	350	558	549	388	522	501	599	0	1134	1345	1319	1651	664	1070	842	987	113	433	122	673	
GBR	575	633	1285	583	732	807	767	619	0	1400	1423	1788	677	922	790	910	122	628	138	799	
ITA	449	587	1107	573	988	901	832	597	1118	0	1426	2191	828	1146	943	1143	141	480	166	893	
NLD	560	937	877	663	1112	1026	757	654	1115	1090	0	1843	686	1090	780	1190	153	583	151	834	
USA	687	547	2490	694	825	898	818	695	1559	1486	1249	0	977	1314	1498	1356	159	490	144	1050	
HUN	246	284	630	273	505	440	453	379	530	644	475	854	0	608	518	729	87	297	98	538	
POL	266	376	593	324	673	609	469	512	650	765	775	1009	451	0	651	923	137	358	154	712	
JPN	220	194	318	184	223	258	259	217	285	293	268	367	202	196	0	661	88	291	87	518	
CZE	266	346	599	311	833	549	516	541	618	781	970	952	610	604	184	0	108	360	142	662	
EST	30	43	47	28	77	57	42	39	53	66	89	90	50	73	19	57	0	56	37	92	
IRL	331	358	381	327	383	415	384	365	704	454	558	477	254	273	174	287	32	0	65	351	
SVN	51	79	91	64	170	117	89	81	104	138	129	109	71	120	39	103	22	54	0	106	
PRT	308	480	818	377	569	627	674	542	731	835	810	1058	512	646	237	540	56	311	85	0	

HOL

common bulls below diagonal

common	three	quarter	sib	group	above	diagonal												
	BEL	CAN	CHE	DEU	DFS	ESP	FRA	GBR	ITA	NLD	USA	CZE	IRL	KOR	SVN	PRT	EST	HUN
BEL	0	493	363	561	535	446	552	572	445	700	579	366	328	115	82	387	40	239
CAN	489	0	588	1291	933	1016	961	1214	1191	896	2440	765	369	315	104	683	65	585
CHE	369	474	0	580	425	394	398	490	482	518	622	329	258	123	64	333	36	248
DEU	499	488	389	0	1326	990	1308	1125	1344	1533	1801	1058	384	253	142	631	97	621
DFS	493	699	372	676	0	767	1135	1218	856	1233	1510	777	489	194	118	603	71	462
ESP	446	574	303	440	530	0	840	861	882	792	1227	642	346	221	99	588	60	458
FRA	540	547	324	428	501	573	0	1131	901	1124	1650	829	432	228	98	567	67	518
GBR	596	1212	452	579	805	662	620	0	999	1157	1776	737	623	224	112	654	72	485
ITA	453	935	429	654	678	599	486	835	0	940	1537	797	330	285	126	642	83	586
NLD	765	776	483	859	944	631	612	923	792	0	1365	980	503	206	119	657	89	490
USA	527	2375	532	647	897	684	695	1557	1161	986	0	1115	489	380	122	852	84	723
CZE	287	508	226	642	455	411	430	491	571	840	774	0	284	226	113	527	58	538

IRL	344	378	253	302	415	342	365	698	339	490	477	225	0	89	50	283	30	205
KOR	92	295	97	126	141	153	129	163	244	135	436	159	72	0	53	212	19	194
SVN	66	81	51	130	98	78	68	93	108	102	96	84	44	37	0	90	20	79
PRT	387	664	285	453	502	520	447	569	607	632	840	426	245	190	71	0	48	384
EST	23	24	14	37	31	21	24	32	37	50	34	31	18	9	11	27	0	48
HUN	198	501	196	361	321	309	289	365	461	339	626	446	177	161	58	371	26	0

HOL

common bulls below diagonal
common three quarter sib group above diagonal

	BEL	CHE	DEU	DFS	FRA	GBR	ITA	NLD	USA	CZE	JPN	IRL	KOR	CAN	PRT	ESP	SVN	EST	HUN
BEL	0	420	551	299	405	575	465	760	578	336	204	302	127	394	274	454	100	52	198
CHE	426	0	659	261	359	570	545	668	752	336	225	280	142	555	258	456	81	47	220
DEU	490	449	0	773	1100	1130	1481	1585	1810	997	614	340	293	1141	499	996	188	124	539
DFS	239	205	321	0	421	627	524	788	685	436	218	278	131	323	261	412	83	57	224
FRA	380	296	383	172	0	722	876	863	1052	639	484	258	224	683	381	661	115	83	422
GBR	600	544	582	352	431	0	1086	1304	1741	670	436	560	263	909	459	887	137	95	417
ITA	471	477	673	356	444	886	0	1050	1702	828	593	330	338	1136	522	952	155	108	546
NLD	834	631	887	504	501	1044	848	0	1575	936	430	495	234	751	468	840	150	118	417
USA	518	663	649	343	470	1547	1238	1130	0	1025	795	446	453	1810	615	1277	143	112	634
CZE	264	233	615	231	350	451	585	807	721	0	395	234	265	638	392	588	138	78	455
JPN	135	136	162	106	156	197	222	190	259	139	0	142	229	555	257	476	77	56	293
IRL	320	286	280	206	239	631	330	480	441	186	110	0	90	261	173	332	60	36	157
KOR	101	109	146	77	138	190	282	152	517	187	124	72	0	339	223	253	63	34	214
CAN	416	483	474	246	415	953	920	723	1945	464	233	291	323	0	473	823	121	80	485
PRT	274	219	352	190	324	399	488	431	634	317	152	152	194	472	0	417	99	64	296
ESP	463	367	431	270	450	711	636	688	758	362	181	339	168	511	352	0	118	76	400
SVN	79	64	171	58	79	104	132	129	109	102	38	50	41	91	78	88	0	34	92
EST	33	22	55	24	33	43	55	72	55	44	17	24	17	40	44	32	21	0	62
HUN	164	169	312	146	244	317	412	283	551	378	131	133	177	449	296	264	69	38	0

JER

common bulls below diagonal
common three quarter sib group above diagonal

	AUS	CAN	DFS	GBR	ITA	NZL	USA	ZAF	NLD	CHE
AUS	0	126	67	81	40	137	215	117	14	11
CAN	131	0	64	109	48	69	351	131	12	15
DFS	43	47	0	84	52	75	121	100	14	28
GBR	81	113	75	0	49	71	140	94	11	29
ITA	38	46	49	49	0	36	64	57	14	16
NZL	131	71	52	72	32	0	141	94	15	13
USA	203	346	86	147	68	149	0	230	25	26
ZAF	121	131	79	93	57	92	237	0	22	21
NLD	11	8	9	9	11	13	26	18	0	3
CHE	9	13	27	27	17	11	26	21	2	0

JER

common bulls below diagonal
common three quarter sib group above diagonal

	AUS	CAN	DFS	GBR	ITA	NZL	USA	ZAF	NLD	CHE
AUS	0	126	67	81	40	137	215	110	14	18
CAN	131	0	64	109	48	69	351	120	12	21
DFS	43	47	0	84	52	75	121	91	14	39
GBR	81	113	75	0	49	71	140	89	11	37
ITA	38	46	49	49	0	36	64	57	14	24
NZL	131	71	52	72	32	0	141	85	15	20
USA	203	346	86	147	68	149	0	210	25	34
ZAF	116	122	73	89	57	84	219	0	22	34
NLD	11	8	9	9	11	13	26	18	0	7
CHE	16	19	37	35	24	17	34	33	5	0

JER

common bulls below diagonal
common three quarter sib group above diagonal

	AUS	CAN	DFS	GBR	ITA	NZL	ZAF	NLD	USA	CHE
AUS	0	124	66	79	40	136	110	14	214	22
CAN	129	0	64	109	48	69	120	12	351	25
DFS	42	47	0	84	52	75	91	14	121	41
GBR	79	113	75	0	49	71	89	11	140	40
ITA	38	46	49	49	0	36	57	14	64	27
NZL	130	71	52	72	32	0	85	15	141	24
ZAF	116	122	73	89	57	84	0	22	210	38
NLD	11	8	9	9	11	13	18	0	25	9
USA	202	346	86	147	68	149	219	26	0	38
CHE	19	21	39	38	26	21	36	6	38	0

JER

common bulls below diagonal
common three quarter sib group above diagonal

	AUS	CAN	DFS	GBR	ITA	USA	ZAF	NLD	CHE
AUS	0	126	65	80	40	215	116	2	22
CAN	131	0	64	109	48	351	131	4	25
DFS	41	47	0	82	52	121	99	4	41
GBR	80	113	73	0	49	140	94	5	40
ITA	38	46	49	49	0	64	57	5	27
USA	203	346	86	147	68	0	229	8	38
ZAF	120	131	78	93	57	236	0	7	38
NLD	1	3	4	4	4	7	6	0	4
CHE	19	21	39	38	26	38	36	4	0

JER

common bulls below diagonal
common three quarter sib group above diagonal

	AUS	CAN	DFS	GBR	ITA	NZL	USA	ZAF	NLD	CHE
AUS	0	126	67	81	40	137	215	117	14	22
CAN	131	0	64	109	48	69	351	131	12	25
DFS	43	47	0	84	52	75	121	100	14	41
GBR	81	113	75	0	49	71	140	94	11	40
ITA	38	46	49	49	0	36	64	57	14	27
NZL	131	71	52	72	32	0	141	94	15	24
USA	203	346	86	147	68	149	0	230	25	38
ZAF	121	131	79	93	57	92	237	0	22	38
NLD	11	8	9	9	11	13	26	18	0	9
CHE	19	21	39	38	26	21	38	36	6	0

JER

common bulls below diagonal
common three quarter sib group above diagonal

	AUS	CAN	DFS	GBR	ITA	NZL	USA	ZAF	NLD	CHE
AUS	0	126	67	81	40	137	215	117	14	22
CAN	131	0	64	109	48	69	351	131	12	25
DFS	43	47	0	84	52	75	121	100	14	41
GBR	81	113	75	0	49	71	140	94	11	40
ITA	38	46	49	49	0	36	64	57	14	27
NZL	131	71	52	72	32	0	141	94	15	24
USA	203	346	86	147	68	149	0	230	25	38
ZAF	121	131	79	93	57	92	237	0	22	38
NLD	11	8	9	9	11	13	26	18	0	9

CHE 19 21 39 38 26 21 38 36 6 0

JER

common bulls below diagonal
common three quarter sib group above diagonal

	AUS	CAN	DFS	GBR	ITA	NZL	USA	ZAF	NLD	CHE
AUS	0	126	67	81	40	137	215	117	14	22
CAN	131	0	64	109	48	69	351	131	12	25
DFS	43	47	0	84	52	75	121	100	14	41
GBR	81	113	75	0	49	71	140	94	11	40
ITA	38	46	49	49	0	36	64	57	14	27
NZL	131	71	52	72	32	0	141	94	15	24
USA	203	346	86	147	68	149	0	230	25	38
ZAF	121	131	79	93	57	92	237	0	22	38
NLD	11	8	9	9	11	13	26	18	0	9
CHE	19	21	39	38	26	21	38	36	6	0

JER

common bulls below diagonal
common three quarter sib group above diagonal

	AUS	CAN	DFS	ITA	ZAF	NLD	USA	CHE
AUS	0	87	42	32	77	9	128	21
CAN	86	0	64	48	106	12	351	25
DFS	31	47	0	52	70	14	121	41
ITA	29	46	49	0	51	14	64	27
ZAF	80	102	55	49	0	19	176	38
NLD	7	8	9	11	13	0	25	9
USA	125	346	86	68	173	26	0	38
CHE	18	21	39	26	36	6	38	0

JER

common bulls below diagonal
common three quarter sib group above diagonal

	AUS	CAN	DFS	GBR	ITA	USA	ZAF	NLD	CHE
AUS	0	124	65	79	40	214	116	14	22
CAN	129	0	64	109	48	351	131	12	25
DFS	41	47	0	82	52	121	99	14	41
GBR	79	113	73	0	49	140	94	11	40
ITA	38	46	49	49	0	64	57	14	27
USA	202	346	86	147	68	0	229	25	38
ZAF	120	131	78	93	57	236	0	22	38
NLD	11	8	9	9	11	26	18	0	9
CHE	19	21	39	38	26	38	36	6	0

JER

common bulls below diagonal
common three quarter sib group above diagonal

	AUS	CAN	DFS	GBR	ITA	NZL	USA	ZAF	NLD	CHE
AUS	0	126	67	81	40	137	215	117	14	22
CAN	131	0	64	109	48	69	351	131	12	25
DFS	43	47	0	84	52	75	121	100	14	41
GBR	81	113	75	0	49	71	140	94	11	40
ITA	38	46	49	49	0	36	64	57	14	27
NZL	131	71	52	72	32	0	141	94	15	24
USA	203	346	86	147	68	149	0	230	25	38
ZAF	121	131	79	93	57	92	237	0	22	38
NLD	11	8	9	9	11	13	26	18	0	9
CHE	19	21	39	38	26	21	38	36	6	0

JER

common bulls below diagonal
common three quarter sib group above diagonal

	AUS	CAN	DFS	GBR	ITA	NZL	USA	ZAF	NLD	CHE
AUS	0	126	65	81	40	137	215	117	14	22
CAN	131	0	58	109	48	69	351	131	12	25
DFS	42	45	0	75	52	68	114	93	14	41
GBR	81	113	70	0	49	70	140	93	11	40
ITA	38	46	49	49	0	36	64	57	14	27
NZL	131	71	46	71	32	0	141	93	15	24
USA	203	346	81	147	68	149	0	230	25	38
ZAF	121	131	76	92	57	91	237	0	22	38
NLD	11	8	9	9	11	13	26	18	0	9
CHE	19	21	39	38	26	21	38	36	6	0

JER

common bulls below diagonal
common three quarter sib group above diagonal

	AUS	CAN	DFS	GBR	ITA	NZL	USA	ZAF	NLD	CHE
AUS	0	126	67	81	40	137	215	117	14	22
CAN	131	0	64	109	48	69	351	131	12	25
DFS	43	47	0	84	52	75	121	100	14	41
GBR	81	113	75	0	49	71	140	94	11	40
ITA	38	46	49	49	0	36	64	57	14	27
NZL	131	71	52	72	32	0	141	94	15	24
USA	203	346	86	147	68	149	0	230	25	38
ZAF	121	131	79	93	57	92	237	0	22	38
NLD	11	8	9	9	11	13	26	18	0	9
CHE	19	21	39	38	26	21	38	36	6	0

JER

common bulls below diagonal
common three quarter sib group above diagonal

	AUS	CAN	DFS	GBR	ITA	USA	ZAF	NLD	CHE
AUS	0	124	65	79	40	214	116	14	22
CAN	129	0	64	109	48	348	131	12	25
DFS	41	47	0	82	52	121	99	14	41
GBR	79	112	73	0	49	140	94	11	40
ITA	38	46	49	49	0	64	57	14	27
USA	202	344	86	147	68	0	229	25	38
ZAF	120	131	78	93	57	236	0	22	38
NLD	11	8	9	9	11	26	18	0	9
CHE	19	21	39	38	26	38	36	6	0

JER

common bulls below diagonal
common three quarter sib group above diagonal

	AUS	CAN	DFS	GBR	ITA	NZL	USA	ZAF	NLD	CHE
AUS	0	126	67	81	40	137	215	117	14	22
CAN	131	0	64	109	48	69	351	131	12	25
DFS	43	47	0	84	52	75	121	100	14	41
GBR	81	113	75	0	49	71	140	94	11	40
ITA	38	46	49	49	0	36	64	57	14	27
NZL	131	71	52	72	32	0	141	94	15	24
USA	203	346	86	147	68	149	0	230	25	38
ZAF	121	131	79	93	57	92	237	0	22	38
NLD	11	8	9	9	11	13	26	18	0	9

CHE 19 21 39 38 26 21 38 36 6 0

JER

common bulls below diagonal
common three quarter sib group above diagonal

	AUS	CAN	DFS	GBR	ITA	USA	ZAF	NLD	CHE
AUS	0	124	65	79	40	214	109	14	22
CAN	129	0	64	109	48	351	120	12	25
DFS	41	47	0	82	52	121	90	14	41
GBR	79	113	73	0	49	140	89	11	40
ITA	38	46	49	49	0	64	57	14	27
USA	202	346	86	147	68	0	209	25	38
ZAF	115	122	72	89	57	218	0	22	38
NLD	11	8	9	9	11	26	18	0	9
CHE	19	21	39	38	26	38	36	6	0

JER

common bulls below diagonal
common three quarter sib group above diagonal

	AUS	CAN	DFS	NZL	ZAF	NLD	USA	CHE
AUS	0	83	38	83	76	9	119	20
CAN	80	0	53	69	117	12	351	25
DFS	25	42	0	61	82	14	107	41
NZL	73	71	42	0	80	15	141	24
ZAF	80	116	65	75	0	22	205	38
NLD	7	8	9	13	18	0	25	9
USA	115	346	76	149	206	26	0	38
CHE	17	21	39	21	36	6	38	0

JER

common bulls below diagonal
common three quarter sib group above diagonal

	AUS	CAN	DFS	GBR	ITA	NZL	USA	NLD	CHE
AUS	0	126	67	33	40	137	215	14	18
CAN	131	0	64	37	48	69	351	12	21
DFS	43	47	0	30	52	75	121	14	39
GBR	37	43	28	0	14	37	37	4	3
ITA	38	46	49	15	0	36	64	14	24
NZL	131	71	52	41	32	0	141	15	20
USA	203	346	86	40	68	149	0	25	34
NLD	11	8	9	5	11	13	26	0	7
CHE	16	19	37	4	24	17	34	5	0

JER

common bulls below diagonal
common three quarter sib group above diagonal

	AUS	CAN	DFS	GBR	NZL	USA	NLD	CHE
AUS	0	126	65	81	137	215	14	18
CAN	131	0	58	109	69	348	12	21
DFS	42	45	0	75	68	114	14	39
GBR	81	112	70	0	68	140	11	37
NZL	131	71	46	69	0	141	15	20
USA	203	344	81	147	149	0	25	34
NLD	11	8	9	9	13	26	0	7
CHE	16	19	37	35	17	34	5	0

JER

common bulls below diagonal

common three quarter sib group above diagonal

	AUS	CAN	DFS	GBR	ITA	USA	NLD	CHE
AUS	0	124	65	79	40	213	14	18
CAN	129	0	64	109	48	351	12	21
DFS	41	47	0	82	52	121	14	39
GBR	79	112	73	0	49	140	11	37
ITA	38	46	49	49	0	64	14	24
USA	201	346	86	147	68	0	25	34
NLD	11	8	9	9	11	26	0	7
CHE	16	19	37	35	24	34	5	0

JER

JER

RDC

common bulls below diagonal

common three quarter sib group above diagonal

	AUS	CAN	DEU	DFS	GBR	NOR	NZL	USA	NLD	CAM
AUS	0	24	10	48	9	14	20	13	9	2
CAN	24	0	7	107	59	4	33	133	3	0
DEU	10	7	0	30	0	7	3	0	8	0
DFS	36	106	20	0	43	68	54	65	26	0
GBR	8	58	0	40	0	0	24	48	1	0
NOR	10	4	7	46	0	0	6	0	16	0
NZL	20	31	3	52	21	5	0	21	2	1
USA	13	126	0	60	43	0	20	0	2	0
NLD	9	3	8	26	1	16	2	2	0	0
CAM	2	0	0	0	0	0	1	0	0	0

RDC

common bulls below diagonal

common three quarter sib group above diagonal

	AUS	CAN	DEU	DFS	GBR	NZL	USA	NLD	CAM	NOR
AUS	0	24	10	48	9	20	13	9	2	4
CAN	24	0	7	107	59	33	133	3	0	1
DEU	10	7	0	30	0	3	0	6	0	2
DFS	36	106	20	0	43	52	65	24	0	26
GBR	8	58	0	40	0	24	48	1	0	0
NZL	20	31	3	50	21	0	21	2	1	1
USA	13	126	0	60	43	20	0	2	0	0
NLD	9	3	6	24	1	2	2	0	0	5
CAM	2	0	0	0	0	1	0	0	0	0
NOR	3	1	2	12	0	1	0	5	0	0

RDC

common bulls below diagonal

common three quarter sib group above diagonal

	AUS	CAN	DEU	DFS	GBR	NOR	NZL	USA	NLD	CAM
AUS	0	24	10	48	9	5	20	13	9	2
CAN	24	0	7	107	59	1	33	131	3	0
DEU	10	7	0	30	0	2	3	0	7	0
DFS	36	106	20	0	43	42	52	65	24	0
GBR	8	58	0	40	0	0	24	47	1	0
NOR	4	1	2	24	0	0	2	0	11	0
NZL	20	31	3	50	21	2	0	21	2	1
USA	13	125	0	60	42	0	20	0	2	0
NLD	9	3	7	24	1	11	2	2	0	0

CAM 2 0 0 0 0 0 1 0 0 0

RDC

common bulls below diagonal
common three quarter sib group above diagonal

	AUS	CAN	DEU	DFS	GBR	USA	NLD	CAM
AUS	0	24	10	48	9	13	9	2
CAN	24	0	7	107	59	133	3	0
DEU	10	7	0	30	0	0	6	0
DFS	36	106	20	0	43	65	22	0
GBR	8	58	0	40	0	48	1	0
USA	13	126	0	60	43	0	2	0
NLD	9	3	6	22	1	2	0	0
CAM	2	0	0	0	0	0	0	0

RDC

common bulls below diagonal
common three quarter sib group above diagonal

	AUS	CAN	DEU	DFS	GBR	NOR	NZL	USA	NLD	CAM
AUS	0	24	10	48	9	14	20	13	9	2
CAN	24	0	7	107	59	4	33	133	3	0
DEU	10	7	0	30	0	8	3	0	8	0
DFS	36	106	20	0	43	77	51	65	25	0
GBR	8	58	0	40	0	0	24	48	1	0
NOR	10	4	8	53	0	0	6	0	16	0
NZL	20	31	3	47	21	5	0	21	2	1
USA	13	126	0	60	43	0	20	0	2	0
NLD	9	3	8	25	1	16	2	2	0	0
CAM	2	0	0	0	0	0	1	0	0	0

RDC

common bulls below diagonal
common three quarter sib group above diagonal

	AUS	CAN	DEU	DFS	GBR	NZL	USA	NLD	CAM	NOR
AUS	0	24	10	48	9	20	13	9	2	4
CAN	24	0	7	107	59	33	133	3	0	1
DEU	10	7	0	30	0	3	0	8	0	2
DFS	36	106	20	0	43	52	65	25	0	26
GBR	8	58	0	40	0	24	48	1	0	0
NZL	20	31	3	50	21	0	21	2	1	1
USA	13	126	0	60	43	20	0	2	0	0
NLD	9	3	8	25	1	2	2	0	0	5
CAM	2	0	0	0	0	1	0	0	0	0
NOR	3	1	2	12	0	1	0	5	0	0

RDC

common bulls below diagonal
common three quarter sib group above diagonal

	AUS	CAN	DEU	DFS	GBR	NOR	NZL	USA	NLD	CAM
AUS	0	24	10	48	9	14	20	13	9	2
CAN	24	0	7	107	59	4	33	133	3	0
DEU	10	7	0	30	0	8	3	0	8	0
DFS	36	106	20	0	43	80	54	65	26	0
GBR	8	58	0	40	0	0	24	48	1	0
NOR	10	4	8	55	0	0	6	0	16	0
NZL	20	31	3	52	21	5	0	21	2	1
USA	13	126	0	60	43	0	20	0	2	0
NLD	9	3	8	26	1	16	2	2	0	0

CAM 2 0 0 0 0 0 1 0 0 0

RDC

common bulls below diagonal
common three quarter sib group above diagonal

	AUS	CAN	DEU	DFS	NOR	NLD	USA	CAM
AUS	0	13	10	36	13	9	6	1
CAN	13	0	7	106	4	3	133	0
DEU	10	7	0	30	8	6	0	0
DFS	27	105	20	0	77	23	65	0
NOR	10	4	8	53	0	16	0	0
NLD	9	3	6	23	16	0	2	0
USA	6	126	0	60	0	2	0	0
CAM	1	0	0	0	0	0	0	0

RDC

common bulls below diagonal
common three quarter sib group above diagonal

	AUS	CAN	DEU	DFS	GBR	NOR	USA	NLD	CAM
AUS	0	24	7	48	9	14	13	9	2
CAN	24	0	4	107	59	4	133	3	0
DEU	7	4	0	18	0	6	0	6	0
DFS	36	106	12	0	43	77	65	24	0
GBR	8	58	0	40	0	0	48	1	0
NOR	10	4	6	53	0	0	0	16	0
USA	13	126	0	60	43	0	0	2	0
NLD	9	3	6	24	1	16	2	0	0
CAM	2	0	0	0	0	0	0	0	0

RDC

common bulls below diagonal
common three quarter sib group above diagonal

	AUS	CAN	DEU	DFS	GBR	NOR	NZL	USA	NLD	CAM
AUS	0	24	10	48	9	14	20	13	9	2
CAN	24	0	7	107	59	4	33	133	3	0
DEU	10	7	0	30	0	8	3	0	6	0
DFS	36	106	20	0	43	80	54	65	24	0
GBR	8	58	0	40	0	0	24	48	1	0
NOR	10	4	8	55	0	0	6	0	16	0
NZL	20	31	3	52	21	5	0	21	2	1
USA	13	126	0	60	43	0	20	0	2	0
NLD	9	3	6	24	1	16	2	2	0	0
CAM	2	0	0	0	0	0	1	0	0	0

RDC

common bulls below diagonal
common three quarter sib group above diagonal

	AUS	CAN	DEU	DFS	GBR	NOR	NZL	USA	NLD	CAM
AUS	0	24	10	48	9	13	20	13	9	2
CAN	24	0	7	107	59	4	33	133	3	0
DEU	10	7	0	30	0	7	3	0	7	0
DFS	36	106	20	0	43	70	52	65	24	0
GBR	8	58	0	40	0	0	24	48	1	0
NOR	9	4	7	46	0	0	5	0	12	0
NZL	20	31	3	49	21	4	0	21	2	1
USA	13	126	0	60	43	0	20	0	2	0
NLD	9	3	7	24	1	10	2	2	0	0
CAM	2	0	0	0	0	0	1	0	0	0

