

Supplementary Table 1: Estimates of fixed effects with Model 2 fitted to each dataset. Temporal variation was modelled here by including year as a multilevel factor. Effects are considered nominally significant at $P < 0.05$ for $|Z| > 1.96$.

Dataset	Effect	Estimate (3d.p) \pm SE (3d.p)	z-statistic
2.1) Winning times of elite races 1850-2012	<i>distance(yards).no_runners</i>	$2 \times 10^{-5} \pm 2 \times 10^{-6}$	9.50
	<i>distance(yards).going</i>	$5 \times 10^{-7} \pm 9 \times 10^{-6}$	0.06
	<i>course</i>		
	11	-1.406 ± 0.138	-10.20
	12	-1.075 ± 0.137	-7.85
	33	-1.157 ± 0.138	-8.40
	13	-1.174 ± 0.139	-8.46
	16	-1.618 ± 0.137	-11.83
	10	-1.174 ± 0.136	-8.62
	32	-1.506 ± 0.137	-10.98
	23	-1.680 ± 0.139	-12.06
	29	-1.381 ± 0.138	-10.01
	28	-1.458 ± 0.140	-10.41
	6	-1.605 ± 0.147	-10.89
	26	-1.384 ± 0.368	-3.76
	19	-1.908 ± 0.477	-4.00
	15	-1.179 ± 0.187	-6.30
	2	-1.329 ± 0.144	-9.23
	9	-1.424 ± 0.168	-8.48
	24	-1.382 ± 0.174	-7.93
	21	-0.889 ± 0.292	-3.05
	35	-1.419 ± 0.186	-7.65
	27	-1.586 ± 0.284	-5.58
	1	-1.866 ± 0.188	-9.93
	<i>timing_method</i>		
	Hand	0 ± 0	
	Automated	-0.115 ± 0.032	-3.59
	<i>sex</i>		
	Male	0 ± 0	
	Female	-0.043 ± 0.016	-2.59
	<i>age (years)</i>		
	2	0 ± 0	
	3	0.125 ± 0.021	5.88
	4	0.226 ± 0.025	9.09
	5	0.198 ± 0.030	6.69
	6	0.197 ± 0.042	4.71
	7	0.265 ± 0.061	4.36
	8	0.290 ± 0.083	3.48
	9	0.357 ± 0.190	1.89
	10	0.091 ± 0.179	0.51
	<i>going²</i>	-0.076 ± 0.005	-14.70
	<i>going</i>	0.268 ± 0.012	22.91
	<i>no_runners²</i>	$-0.002 \pm 2 \times 10^{-4}$	-7.47

	<i>no_runners</i>	0.003 ± 0.003	1.07
	<i>distance(yards)</i> ²	$4 \times 10^{-8} \pm 3 \times 10^{-8}$	1.50
	<i>distance(yards)</i>	$5 \times 10^{-4} \pm 9 \times 10^{-5}$	-5.32
	<i>year.distance(yards)</i> ²	$9 \times 10^{-10} \pm 2 \times 10^{-10}$	4.27
	<i>year.distance(yards)</i>	$4 \times 10^{-6} \pm 7 \times 10^{-7}$	-6.14
	<i>year</i>		
	1850	0 ± 0	
	1851	-0.344 ± 0.135	-2.55
	1853	-0.353 ± 0.137	-2.58
	1855	-0.235 ± 0.134	-1.76
	1860	-0.247 ± 0.138	-1.79
	1861	0.080 ± 0.134	0.60
	1876	-0.329 ± 0.164	-2.01
	1880	0.217 ± 0.157	1.38
	1885	-0.068 ± 0.141	-0.48
	1895	0.567 ± 0.149	3.80
	1900	0.889 ± 0.138	6.46
	1903	0.657 ± 0.128	5.14
	1910	1.086 ± 0.128	8.49
	1919	1.195 ± 0.123	9.75
	1920	1.014 ± 0.148	6.84
	1930	1.219 ± 0.119	10.23
	1933	1.406 ± 0.120	11.76
	1935	1.320 ± 0.119	11.11
	1938	1.455 ± 0.121	12.05
	1940	1.090 ± 0.186	5.85
	1946	1.099 ± 0.120	9.14
	1947	1.421 ± 0.120	11.85
	1948	1.388 ± 0.119	11.63
	1949	1.456 ± 0.119	12.28
	1950	1.240 ± 0.118	10.47
	1951	1.346 ± 0.119	11.32
	1952	1.218 ± 0.120	10.16
	1953	1.462 ± 0.120	12.21
	1954	1.221 ± 0.118	10.32
	1955	1.318 ± 0.121	10.90
	1956	1.381 ± 0.120	11.55
	1959	1.390 ± 0.122	11.37
	1960	1.558 ± 0.120	12.95
	1962	1.505 ± 0.120	12.53
	1963	1.457 ± 0.121	12.09
	1964	1.516 ± 0.124	12.20
	1966	1.545 ± 0.121	12.79
	1967	1.498 ± 0.120	12.51
	1969	1.355 ± 0.120	11.27
	1970	1.586 ± 0.121	13.16
	1971	1.644 ± 0.122	13.50
	1975	1.652 ± 0.123	13.39
	1980	1.786 ± 0.124	14.39
	1985	1.883 ± 0.125	15.11

	1990	2.082 ± 0.125	16.70
	1994	2.060 ± 0.125	16.48
	1996	2.125 ± 0.122	17.38
	1997	2.077 ± 0.122	17.01
	1998	2.073 ± 0.122	16.96
	1999	2.159 ± 0.123	17.55
	2000	2.038 ± 0.123	16.57
	2001	2.033 ± 0.123	16.56
	2002	2.145 ± 0.123	17.48
	2003	2.123 ± 0.123	17.33
	2004	2.103 ± 0.122	17.20
	2005	2.209 ± 0.122	18.06
	2006	2.219 ± 0.122	18.16
	2007	2.225 ± 0.122	18.19
	2008	2.191 ± 0.123	17.84
	2009	2.218 ± 0.123	18.11
	2010	2.273 ± 0.123	18.51
	2011	2.223 ± 0.123	18.09
	2012	2.256 ± 0.1233	18.30
	<i>mu</i>	17.69 ± 0.1763	100.34
2.2) Winning times of elite races 1997-2012	<i>distance(yards).no_runners</i>	2x10 ⁻⁶ ± 4x10 ⁻⁶	0.49
	<i>distance(yards).going</i>	4x10 ⁻⁵ ± 1x10 ⁻⁵	3.19
	<i>course</i>		
	10	0 ± 0	
	11	-0.252 ± 0.030	-8.28
	12	0.003 ± 0.031	0.11
	13	-0.039 ± 0.038	-1.03
	16	-0.454 ± 0.027	-16.79
	23	-0.602 ± 0.037	-16.40
	29	-0.198 ± 0.034	-5.89
	33	-0.008 ± 0.036	-0.23
	2	-0.216 ± 0.050	-4.28
	6	-0.239 ± 0.073	-3.29
	9	-0.257 ± 0.084	-3.05
	28	-0.355 ± 0.055	-6.50
	32	-0.306 ± 0.045	-6.78
	24	-0.093 ± 0.104	-0.90
	21	0.353 ± 0.227	1.55
	15	-0.001 ± 0.133	-0.01
	35	-0.334 ± 0.107	-3.11
	27	-0.338 ± 0.202	-1.68
	1	-0.682 ± 0.106	-6.44
	<i>timing_method</i>		
	Automated	0 ± 0	
	Hand	-0.012 ± 0.145	-0.08
	<i>sex</i>		
	Male	0 ± 0	
	Female	-0.033 ± 0.019	-1.79
	<i>age (years)</i>		
	2	0 ± 0	

	3	0.163 ± 0.025	6.57
	4	0.240 ± 0.023	8.94
	5	0.205 ± 0.030	6.78
	6	0.229 ± 0.039	5.85
	7	0.286 ± 0.055	5.21
	8	0.302 ± 0.073	4.14
	9	0.265 ± 0.156	1.70
	10	-0.009 ± 0.149	-0.06
	<i>going</i> ²	-0.080 ± 0.007	-11.01
	<i>going</i>	0.232 ± 0.015	15.96
	<i>no_runners</i> ²	-0.002 ± 4x10 ⁻⁴	-5.39
	<i>no_runners</i>	0.018 ± 0.005	4.05
	<i>distance(yards)</i> ²	1x10 ⁻⁷ ± 3x10 ⁻⁸	5.51
	<i>distance(yards)</i>	9x10 ⁻⁴ ± 7x10 ⁻⁶	-13.23
	<i>year.distance(yards)</i> ²	6x10 ⁻⁹ ± 3x10 ⁻⁹	2.23
	<i>year.distance(yards)</i>	3x10 ⁻⁵ ± 7x10 ⁻⁶	-3.70
	<i>year</i>		
	1997	0 ± 0	
	1998	0.017 ± 0.047	0.35
	1999	0.114 ± 0.048	2.35
	2000	0.006 ± 0.049	0.11
	2001	0.022 ± 0.049	0.44
	2002	0.154 ± 0.050	3.06
	2003	0.145 ± 0.051	2.86
	2004	0.124 ± 0.051	2.41
	2005	0.257 ± 0.053	4.86
	2006	0.270 ± 0.055	4.95
	2007	0.284 ± 0.056	5.08
	2008	0.256 ± 0.058	4.41
	2009	0.300 ± 0.060	5.03
	2010	0.373 ± 0.062	6.01
	2011	0.337 ± 0.064	5.23
	2012	0.381 ± 0.067	5.68
	μ	18.36 ± 0.051	362.42
2.3) Times of all runners in elite races 1997-2012	<i>distance(yards).no_runners</i>	-1x10 ⁻⁶ ± 1x10 ⁻⁶	-1.03
	<i>distance(yards).going</i>	6x10 ⁻⁵ ± 5x10 ⁻⁶	11.55
	<i>course</i>		
	10	0 ± 0	
	11	-0.181 ± 0.012	-14.98
	12	-0.011 ± 0.012	-0.94
	13	-0.022 ± 0.015	-1.45
	16	-0.507 ± 0.010	-50.08
	23	-0.561 ± 0.015	-36.90
	29	-0.204 ± 0.013	-15.37
	33	0.030 ± 0.014	2.15
	2	-0.211 ± 0.012	-10.68
	6	-0.180 ± 0.033	-5.48
	9	-0.229 ± 0.036	-6.37
	24	-0.069 ± 0.044	-1.57
	28	-0.342 ± 0.025	-13.45

	32	-0.308 ± 0.017	-17.71
	21	0.381 ± 0.106	3.58
	15	0.010 ± 0.064	1.55
	35	-0.355 ± 0.042	-8.47
	27	-0.305 ± 0.096	-3.16
	1	-0.558 ± 0.042	-13.42
	<i>timing_method</i>		
	Automated	0 ± 0	
	Hand	-0.077 ± 0.061	-1.27
	<i>sex</i>		
	Male	0 ± 0	
	Female	-0.069 ± 0.008	-8.75
	<i>age (years)</i>		
	2	0 ± 0	
	3	0.172 ± 0.010	17.23
	4	0.251 ± 0.011	23.08
	5	0.242 ± 0.013	19.17
	6	0.203 ± 0.015	13.12
	7	0.201 ± 0.020	9.95
	8	0.154 ± 0.027	5.73
	9	0.151 ± 0.040	3.74
	11	0.251 ± 0.114	2.19
	12	0.446 ± 0.297	1.50
	10	0.176 ± 0.060	2.91
	13	0.592 ± 0.421	1.41
	<i>going²</i>	-0.088 ± 0.003	-29.99
	<i>going</i>	0.239 ± 0.005	44.04
	<i>no_runners²</i>	-0.001 ± 1x10 ⁻⁴	-8.20
	<i>no_runners</i>	-0.002 ± 0.002	-0.99
	<i>distance(yards)²</i>	1x10 ⁻⁷ ± 1x10 ⁻⁸	11.62
	<i>distance(yards)</i>	-8x10 ⁻⁴ ± 3x10 ⁻⁵	-29.64
	<i>year.distance(yards)²</i>	-8x10 ⁻⁹ ± 1x10 ⁻⁹	7.36
	<i>year.distance(yards)</i>	-3x10 ⁻⁶ ± 3x10 ⁻⁷	-10.80
	<i>year</i>		
	1997	0 ± 0	
	1998	0.030 ± 0.020	1.48
	1999	0.094 ± 0.020	4.61
	2000	0.019 ± 0.020	0.92
	2001	0.035 ± 0.021	1.69
	2002	0.174 ± 0.021	8.25
	2003	0.145 ± 0.021	6.81
	2004	0.137 ± 0.021	6.43
	2005	0.271 ± 0.022	12.32
	2006	0.269 ± 0.022	11.94
	2007	0.309 ± 0.023	13.51
	2008	0.314 ± 0.024	13.31
	2009	0.331 ± 0.024	13.53
	2010	0.404 ± 0.025	15.96
	2011	0.367 ± 0.026	14.07
	2012	0.431 ± 0.027	15.88

	μ	18.05 \pm 0.021	867.37
2.4) Times of winners in all races 1997-2012	<i>distance(yards).no_runners</i>	1.88x10 ⁻⁶ \pm 6.12x10 ⁻⁷	3.07
	<i>distance(yards).going</i>	5.72x10 ⁻⁶ \pm 2.46x10 ⁻⁶	2.32
	<i>course</i>		
	1	-7.998 \pm 0.701	-11.41
	2	-7.738 \pm 0.701	-11.04
	3	-8.098 \pm 0.701	-11.55
	4	-7.825 \pm 0.701	-11.16
	5	-7.809 \pm 0.701	-11.14
	6	-7.304 \pm 0.701	-10.42
	7	-7.840 \pm 0.701	-11.18
	8	-7.467 \pm 0.701	-10.65
	9	-7.803 \pm 0.701	-11.13
	10	-7.352 \pm 0.701	-10.49
	11	-7.658 \pm 0.701	-10.92
	12	-7.326 \pm 0.701	-10.45
	13	-7.576 \pm 0.701	-10.81
	14	-8.010 \pm 0.701	-11.42
	15	-7.619 \pm 0.701	-10.86
	16	-7.805 \pm 0.701	-11.13
	17	-7.656 \pm 0.701	-10.92
	18	-7.454 \pm 0.701	-10.63
	19	-7.671 \pm 0.701	-10.94
	20	-8.450 \pm 0.701	-12.05
	21	-7.534 \pm 0.701	-10.75
	22	-7.721 \pm 0.701	-11.01
	23	-7.963 \pm 0.701	-11.36
	24	-7.615 \pm 0.701	-10.86
	25	-7.962 \pm 0.701	-11.36
	26	-7.850 \pm 0.701	-11.20
	27	-7.180 \pm 0.701	-10.24
	28	-7.681 \pm 0.701	-10.96
	29	-7.576 \pm 0.701	-10.81
	30	-7.659 \pm 0.701	-10.93
	31	-7.201 \pm 0.701	-10.27
	32	-7.249 \pm 0.701	-10.34
	33	-7.426 \pm 0.701	-10.59
	34	-8.212 \pm 0.702	-11.71
	35	-7.915 \pm 0.701	-11.29
	36	-7.497 \pm 0.702	-10.69
	<i>timing_method</i>		
	Automated	0 \pm 0	
	Hand	0.068 \pm 0.007	9.80
	<i>sex</i>		
	Male	0 \pm 0	
	Female	-0.025 \pm 0.004	-6.52
	<i>age (years)</i>		
	2	0 \pm 0	
	3	0.165 \pm 0.005	34.47
	4	0.231 \pm 0.006	40.70

	5	0.214 ± 0.007	32.94
	6	0.211 ± 0.008	27.13
	7	0.188 ± 0.010	19.63
	8	0.176 ± 0.012	14.18
	9	0.167 ± 0.017	9.93
	10	0.113 ± 0.024	4.68
	11	0.112 ± 0.036	3.07
	12	0.191 ± 0.059	3.25
	13	0.064 ± 0.132	0.48
	14	0.037 ± 0.371	0.10
	<i>going</i> ²	-0.068 ± 0.001	-56.61
	<i>going</i>	0.286 ± 0.002	116.64
	<i>no_runners</i> ²	2x10 ⁻⁴ ± 6x10 ⁻⁵	-3.06
	<i>no_runners</i>	0.006 ± 6x10 ⁻⁴	9.09
	<i>distance(yards)</i> ²	2x10 ⁻⁷ ± 6x10 ⁻⁹	38.69
	<i>distance(yards)</i>	-0.001 ± 1x10 ⁻⁵	-85.39
	<i>year.distance(yards)</i> ²	1x10 ⁻⁹ ± 7x10 ⁻¹⁰	2.05
	<i>year.distance(yards)</i>	7x10 ⁻⁶ ± 2x10 ⁻⁶	-4.41
	<i>year</i>		
	1997	0 ± 0	
	1998	0.005 ± 0.010	0.51
	1999	0.093 ± 0.010	9.51
	2000	0.070 ± 0.010	6.99
	2001	0.037 ± 0.010	3.72
	2002	0.073 ± 0.010	7.07
	2003	0.121 ± 0.011	10.85
	2004	0.078 ± 0.011	6.93
	2005	0.137 ± 0.012	11.84
	2006	0.185 ± 0.012	15.37
	2007	0.167 ± 0.012	13.55
	2008	0.145 ± 0.013	11.52
	2009	0.202 ± 0.013	15.82
	2010	0.194 ± 0.013	14.75
	2011	0.204 ± 0.014	15.02
	2012	0.188 ± 0.014	13.31
	μ	25.63 ± 0.701	36.56
2.5) Times of all runners in all races 1997-2012	<i>distance(yards).no_runners</i>	3x10 ⁻⁶ ± 2x10 ⁻⁷	12.62
	<i>distance(yards).going</i>	1x10 ⁻⁵ ± 9x10 ⁻⁷	15.19
	<i>course</i>		
	1	0 ± 0	
	2	0.233 ± 0.005	47.17
	3	-0.086 ± 0.005	-17.03
	4	0.196 ± 0.006	34.09
	5	0.229 ± 0.005	41.74
	6	0.738 ± 0.005	141.24
	7	0.198 ± 0.005	37.19
	8	0.572 ± 0.005	111.98
	9	0.231 ± 0.005	43.19
	10	0.575 ± 0.005	118.42
	11	0.348 ± 0.005	73.22

	12	0.556 ± 0.005	111.13
	13	0.324 ± 0.005	67.77
	14	0.028 ± 0.006	4.46
	15	0.362 ± 0.006	58.51
	16	0.064 ± 0.005	12.39
	17	0.308 ± 0.005	56.71
	18	0.578 ± 0.005	105.84
	19	0.324 ± 0.005	60.62
	20	-0.508 ± 0.005	-97.67
	21	0.463 ± 0.005	92.82
	22	0.326 ± 0.006	58.94
	23	0.043 ± 0.005	8.32
	24	0.373 ± 0.005	78.85
	25	0.063 ± 0.005	12.31
	26	0.153 ± 0.005	31.43
	27	0.857 ± 0.006	151.43
	28	0.272 ± 0.006	46.96
	29	0.357 ± 0.005	74.13
	30	0.367 ± 0.005	72.58
	31	0.842 ± 0.005	164.45
	32	0.728 ± 0.006	121.89
	33	0.546 ± 0.005	112.42
	34	-0.163 ± 0.012	-13.70
	35	0.080 ± 0.006	14.56
	36	0.517 ± 0.013	38.68
	<i>timing_method</i>		
	Automated	0 ± 0	
	Hand	0.071 ± 0.003	26.18
	<i>sex</i>		
	Male	0 ± 0	
	Female	-0.062 ± 0.003	-23.79
	<i>age (years)</i>		
	2	0 ± 0	
	3	0.138 ± 0.002	69.28
	4	0.166 ± 0.002	68.36
	5	0.168 ± 0.003	58.75
	6	0.146 ± 0.003	43.72
	7	0.105 ± 0.004	26.76
	8	0.060 ± 0.005	12.56
	9	0.027 ± 0.006	4.37
	10	-0.009 ± 0.008	-1.08
	11	-0.058 ± 0.012	-4.69
	12	-0.079 ± 0.020	-3.89
	13	-0.238 ± 0.033	-7.31
	14	-0.273 ± 0.066	-4.11
	15	-1.199 ± 0.332	-3.62
	<i>going²</i>	-0.077 ± 5x10 ⁻⁴	-170.38
	<i>going</i>	0.312 ± 9x10 ⁻⁴	338.25
	<i>no_runners²</i>	1x10 ⁻⁴ ± 2x10 ⁻⁵	7.70
	<i>no_runners</i>	-0.005 ± 2x10 ⁻⁴	-24.78

	$distance(yards)^2$	$2 \times 10^{-7} \pm 3 \times 10^{-9}$	84.71
	$distance(yards)$	$-0.001 \pm 7 \times 10^{-6}$	-170.68
	$year.distance(yards)^2$	$9 \times 10^{-10} \pm 3 \times 10^{-10}$	2.82
	$year.distance(yards)$	$7 \times 10^{-6} \pm 8 \times 10^{-7}$	-8.70
	<i>year</i>		
	1997	0 ± 0	
	1998	0.014 ± 0.004	3.43
	1999	0.100 ± 0.004	23.95
	2000	0.091 ± 0.004	20.68
	2001	0.031 ± 0.004	6.90
	2002	0.083 ± 0.005	17.84
	2003	0.128 ± 0.005	25.39
	2004	0.108 ± 0.005	21.01
	2005	0.159 ± 0.005	29.92
	2006	0.204 ± 0.006	36.59
	2007	0.204 ± 0.006	35.54
	2008	0.189 ± 0.006	31.92
	2009	0.242 ± 0.006	39.42
	2010	0.243 ± 0.006	38.00
	2011	0.263 ± 0.007	39.19
	2012	0.253 ± 0.007	35.70
	μ	17.21 ± 0.006	2917.94