

# OLYMPIC WINNING PERFORMANCES : TRENDS AND PREDICTIONS (1952 - 1992)

(Part One)

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This paper uses trends in past Olympic winning performances to examine rates of improvement in different types of events and to predict winning performances for 1992. Previously, predictions were published for the 1976, 1980, 1984 and 1988 Olympics (see OR Nos. 176 and 215). Percent differences between winning men and women are compared for swimming and for athletics (track and field) in Part Two next month.

*«Citius, Altius, Fortius», a motto continually being redefined.*

Nearly one third of the 237 Seoul Olympic events permit meaningful comparisons with previous Olympics. The remaining events involve elimination by head-to-head competition (boxing and wrestling, for example), subjective scoring (such as in diving and gymnastics) or distances and other conditions that change over each Olympiad (as in the marathon and yachting).

## COMPUTING RATES OF IMPROVEMENT

Rates of improvement, as before, can best be evaluated starting with the re-entry of the USSR in 1952. From 1952 to 1988, 27 athletics (track and field) events, 11 swimming events and 7 weightlifting events were contested during the Games of each Olympiad. From 1972 to 1988, 5 additional athletics events, 15 additional swimming events, and 2 additional weightlifting events were contested. These 67 events permit meaningful trends to be computed.

Special attention must be focused on weightlifting data and on the Mexico City Olympic data for 1968. Prior to 1976, weightlifting competition was based on a three lift total. That data was replaced by the best two lift total to compare with the rules effective in 1976.

The high altitude of Mexico City tended to provide exceptional performances in short-duration events (such as Bob Beamon's remarkable long jump) and



to diminish performance in long-duration events (such as the 10 km run and the marathon). Intermediate-duration events were unaffected. Each 1968 winning performance (in each event studied) was replaced by the geometric mean of the 1964 and 1972 winning performances to fit the assumption that the Olympic winning performance in Olympiad number  $n$  should be related to the winning performance in the previous Olympiad (numbered  $n-1$ ) by a multiplying factor  $m$ , that is

$$x_n = m \times x_{n-1} + \text{random error}$$

where  $x$  represents the winning performance in some event. If the error is random, then the actual winning performance in the next Olympics would exceed  $m \times x_{n-1}$  half the time and be less than  $m \times x_{n-1}$  half the time. One way to estimate  $m$  would be to take the ratio of two successive winning performances; however, the random error could diminish accuracy. It is usually better to use data over several successive Olympiads. It is beyond the scope of this paper to derive the following least-squares estimates for  $m$ . The interested reader may investigate any text on statistical inference.

$$m = [n x_n - (n-1) x_{n-1}] / [x_n^2 - x_{n-1}^2]$$

For example, if three successive winning performances are 10, 14 and 16,

$$m = (14 \times 10 + 16 \times 14) / (10^2 + 14^2) = 1.23.$$

The predicted winning performance for the next Olympics would be  $1.23 \times 16 = 19.7$ .

In accordance with the Olympic motto, the performance in timed events should become faster (*Citius*) so that  $m$  should be smaller than 1. Conversely, in measured events, the measurement should become longer or higher (*Altius*) ( $m$  should exceed 1). Greater strength (*Fortius*) implies that total weight lifted should increase ( $m$  exceeds 1) for weightlifting.

The percent improvement per Olympiad ( $\%I/O$ ) provides a common measure of performance for all events. For events where  $m$  should exceed 1,  $\%I/O$  is  $100(m-1)$ . For timed events where  $m$  is less than 1,  $\%I/O$  becomes  $100(1-m)$ . As an example, if  $m = 1.05$  for a weightlifting event, the percent improvement per Olympiad would be 5%. For a swimming event with  $m = 0.95$ , the percent improvement per Olympiad would also be 5%.

## PREDICTIONS FOR 1988 AND 1992

Table 1 contains data for 32 athletics events (the new men's javelin caused that event to be deleted). Shown in Table 1 are the  $\%I/O$  for each event using the period 1952-1988 or 1972-1988, the actual winning performance in 1988, the predicted 1988 winning performance made after the 1984 Olympics, the percent error, and the prediction for 1992. Table 2 contains a similar treatment for 26 swimming events while Table 3 covers 9 weightlifting events. A negative percent error means that the actual performance was worse than the predicted performance (the actual performance was longer in time, shorter in distance, or less in weight lifted).

The average percent error for the 58 athletics and swimming events was nearly zero (0.2%). Exactly half of the events were underestimated and the other half were overestimated. The percent error was within 1 % for 31 of the 58 athletics and swimming events and within 0.2% for 6 events (an error equivalent to 0.02 seconds for a 100 m run). In the men's 200 m backstroke, Igor Polianski (USSR) came within 0.03 sec of the prediction. Heike Friedrich (GDR) was within 0.11 sec for the women's 200 m swim. The GDR women's 4 X 100 m medley relay swim was within 0.37 sec. The error for the men's 400 m swim was 0.36 sec by Uwe Dassler (GDR). Sergei Bubka (URS) jumped within 0.01 m in the men's pole vault. Carl Lewis (USA) was within 0.02 sec in the 100 m run.

*(continued in page 161)*

Table 1

## ATHLETICS PREDICTIONS (32 EVENTS)

Event	%I/O	1988 Actual	1988 Predict	% Error	1992 Predict
<i>Men</i>					
100 m	0,54	9"92	9"94	0,2	9"87
200 m	0,52	19"75	19"69	-0,3	19"65
400 m	0,51	43"87	44"06	0,4	43"65
800 m	0,62	1'43"45	1'42"24	-1,2	1'42"81
1,500 m	0,48	3'35"96	3'30"98	-2,3	3'34"92
5,000 m	0,76	13'11"70	12'58"20	-1,7	13'05"66
10,000 m	0,77	27'21"46	27'36"35	0,9	27'08"86
4 X 100 m relay	0,56	38"19	37"55	-1,7	37"98
4 X 400 m relay	0,48	2'56"16	2'57"17	0,6	2'55"32
110 m hurdles	0,6	12"98	13"14	1,2	12"90
400 m hurdles	0,83	47"19	47"37	0,4	46"80
3,000 m steeplechase	0,88	8'05"51	8'07"68	0,4	8'01"22
High jump	1,68	2,38	2,39	-0,4	2,42
Triple jump	0,9	17,61	17,39	1,2	17,77
Long jump	1,54	8,72	8,66	0,7	8,85
Pole vault	2,81	5,90	5,91	-0,2	6,07
Shot put	2,68	22,47	21,74	3,2	23,07
Discus	2,39	68,81	68,10	1,0	70,46
Hammer throw	3,66	84,8	80,36	5,2	87,90
<i>Women</i>					
100 m	0,97	10"54	10"9	3,4	10"44
200 m	1,15	21"34	21"58	1,1	21"09
400 m (*)	1,25	48"65	48"08	-1,2	48"04
800 m (*)	0,57	1'56"10	1'57"22	1,0	1'55"44
1,500 m (*)	0,81	3'53"96	4'03"78	4,2	3'52"08
100 m hurdles (*)	0,44	12"38	12"92	4,4	12"33
4 X 100 m relay	1,03	41"98	41"13	-2,0	41"55
4 X 400 m relay (*)	0,98	3'15"18	3'16"73	0,8	3'13"27
High jump	2,05	2,03	2,07	-2,0	2,07
Long jump	1,91	7,40	7,05	4,7	7,54
Shot put	3,69	22,24	21,09	5,2	23,06
Discus	3,6	72,3	67,06	7,2	74,90
Javelin	4,33	74,68	72,22	3,3	77,91

(\*) %I/O computed 1972-1988. For all others, %I/O computed 1952-1988

Table 1A

## PREDICTIONS FOR 1992 IN FEET AND INCHES

<i>Mens' events</i>		<i>Women's events</i>	
High jump	7' 11-1/4"	High jump	6' 9-1/4"
Triple jump	58' 3-1/2"	Long jump	24' 8-3/4"
Long jump	29' 1/4"	Shot put	75' 7-3/4"
Pole vault	19' 10-3/4"	Discus	245' 8-3/4"
Shot put	75' 8-1/4"	Javelin	255' 7-1/4"
Discus	231' 2"		
Hammer throw	288' 4-1/2"		

1 (Foot) - 30, 48 cm  
1 (Inch) - 2.54 cm.

# OLYMPIC PERFORMANCES

Table 2

## SWIMMING PREDICTIONS (26 EVENTS)

<i>Event</i>	<i>%I/O</i>	<i>1988 Actual</i>	<i>1988 Predict</i>	<i>% Error</i>	<i>1992 Predict</i>
<i>Men</i>					
100 m	1,88	48"63	48"89	0,5	47"72
200 m (*)	1,27	1'47"25	1'45"71	-1,4	1'45"89
400 m	1,99	3'46"95	3'46"59	-0,2	3'42"43
1,500 m	2,43	15'00"40	14'41"48	-2,1	14'38"55
100 m backstroke	2,01	55"05	54"63	-0,8	53"94
200 m backstroke (*)	0,73	1'59"37	1'59"34	—	1'58"49
100 m breaststroke (*)	1,17	1"02"04	1"00"58	-2,4	1'01"31
200 m breaststroke	1,63	2'13"52	2'10"93	-1,9	2'11"35
100 m butterfly (*)	0,6	53"00	52"69	-0,6	52"68
200 m butterfly (*)	0,79	1'56"94	1'55"85	-0,9	1'56"01
400 m 4 indiv. medley (*)	1,65	4'14"75	4'12"68	-0,8	4'10"56
4 X 100 m medley relay (*)	1,27	3'36"93	3'36"38	-0,3	3'34"17
4 X 200 m relay	1,89	7'12"51	7'06"91	-1,3	7'04"33
<i>Women</i>					
100 m	2,34	54"93	54"58	-0,6	53"65
200 m (*)	1,25	1'57"65	1'57"76	0,1	1'56"17
400 m	2,87	4'03"85	3'59"63	-1,7	3'56"86
800 m (*)	1,64	8'20"20	8'15"55	-0,9	8'11"99
100 m backstroke	2,29	1'00"89	1'01"14	0,4	59"49
200 m backstroke (*)	1,88	2'09"29	2'10"09	0,6	2'06"86
100 m breaststroke (*)	1,99	1'07"95	1'08"66	1,0	1'06"60
200 m breaststroke	1,7	2'26"71	2'27"93	0,8	2'24"21
100 m butterfly (*)	1,83	59"00	57"92	-1,8	57"92
200 m butterfly (*)	1,2	2'09"51	2'04"12	-4,2	2'07"96
400 m indiv. medley (*)	2,32	4'37"76	4'31"21	-2,4	4'31"33
4 X 100 m medley relay (*)	1,74	4'03"74	4'04"11	0,2	3'59"50
4 X 100 m relay	2,07	3'40"63	3'38"61	-0,9	3'36"06

(\*) %I/O Computed 1972-1988. For all others, %I/O computed 1952-1988

Table 3

## WEICHTLIFTING PREDICTIONS (9 EVENTS)

<i>Event</i>	<i>%I/O</i>	<i>1988 Actual</i>	<i>1988 Predict</i>	<i>% Error</i>	<i>1992 Predict</i>
Flyweight (52 kg)(*)	4,59	270,0	238,0	11,9	282,5
Bantamweight (56 kg)	2,98	292,5	273,0	6,7	301,0
Featherweight (60 kg)	4,23	342,5	288,0	15,9	357,0
Lightweight (67,5 kg)	2,85	340,0	327,5	3,7	349,5
Middleweight (75 kg)	3,08	375,0	347,0	7,5	386,5
Light heavyw. (82,5 kg)	2,53	377,5	362,0	4,1	387,0
Middle heavyw. (90 kg)	3 ' 1	412,5	403,5	2,2	425,5
Heavyweight (110 kg)(*)	5,05	455,0	395,0	13,2	481,5
Superheavyw. (110 + kg)	4,09	462,5	424,5	8,2	478,0

(\*) %I/O computed 1972-1988. For all others, %I/O computed 1952-1988



*(From page 158)*

A confidence interval was published after the 1984 Olympics intended to contain 95% of the 1988 percent errors for the 58 athletics and swimming events. Exactly 95% (55 of 58) of the predictions fit that interval. For 1992, 95% of the 32 athletics predictions should have a percent error of  $-0.7 \pm 5.6$ . For the 26 swimming and 9 weightlifting predictions, the percent error confidence intervals should be  $-1.1 \pm 3.5$  and  $+0.3 \pm 9.3$  respectively.

The average percent errors for athletics and swimming combined were as follows (beginning with 1964 and excluding 1968): 1964 ( $-0.3\%$ ), 1972 ( $-0.7\%$ ), 1976

( $-0.3\%$ ), 1980 ( $-1.3\%$ ), 1984 ( $-2.1\%$ ), 1988 ( $+0.2\%$ ). These average percent errors were near zero except for 1980 when the absence of western bloc athletes diminished winning performances by 1% (primarily in men's running and men's swimming). In 1984, the absence of eastern bloc athletes diminished winning performances by 2% (primarily in throwing events and women's swimming). The 1988 data represents a return to normalcy.

*Next month, the second and final part of this study with a comparison between male and female performances and improvement statistics.*