

**AN ESTIMATION OF THE NUMBER OF THE GENERAL  
SPECTATORS AT THE TOKYO OLYMPIC GAMES**

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On dealing with the problem of fixing the price of tickets at the time of the Olympic Games, we must, at first, consider the request from I.O.C. as the most basic requirement. I.O.C. has stipulated in its 'Materials for the Site of the Olympic Games' that the admission fee should be set inexpensive enough to admit as many people as possible. On the other hand, the Organizing Committee for the Tokyo Olympic Games has to expect the income of some twelve hundred and forty-five million yen in total from the collected admission fee. In order to fix a reasonable fee for admission considering these two factors above, we have estimated the total spectators at the Tokyo Olympic Games and have attempted to fix the prices based on this calculation.

Table I. Number of Spectators by Events &amp; Prices of Tickets

Event(Site)	Price of Tickets		3,000 円	2,000	1,904 ⑤	1,500	1,428 ⑤	1,000	952 ⑤
	Classes of Tickets & Days of Competition								
1. Opening Ceremony (Nation 1 Stadium)	7券種×1		432 (432)	3,770 (3,794)	931 (937) ⑤			5,397 (5,428)	
2. Athletics, Football & Field Hockey (National Stadium)	6 ×3							11,610 (13,353)	2,793 (2,811) ⑤
3. Athletics & Field Hockey (National Stadium)	6 ×1							3,727 (4,451)	931 (937) ⑤
4. Athletics (National Stadium)	6 ×1							4,310 (4,451)	931 (937) ⑤
5. Athletics, Field Hockey (National Stadium)	5 ×1							2,616 (4,451)	931 (937) ⑤
6. Athletics, Football カー (National Stadium)	5 ×1							3,331 (4,451)	931 (937) ⑤
7. Closing Ceremony, Athletics & Football (National Stadium)	6 ×1					4,411 (4,451)	931 (937) ⑤		
8. Basketball (Tokyo Gymnasium)	5 ×8								
9. Wrestling (Korakuen Ice Palace)	6 ×3								
10. Boxing (Korakuen Ice Palace)	7 ×4							237 (280)	
11. Volley-ball (Kamazawa Volley-ball Court)	4 ×7								
12. Cycling, Football (Korakuen Veleddrome)	5 ×4								
13. Football (Korakuen Veleddrome)	5 ×1								
14. Football (Koishikawa Football Field)	5 ×5H								
15. Judo (Kodokan)	1 ×1								
16. Swimming and Diving (Indoor Pool, Tokyo Gymnasium)	3 ×4								
17. Weight-lifting (National Gymnasium)	4 ×4							237	
18. Ping-pong (Waseda Memorial Hall)	4 ×7								
19. Tennis (National Tennis Court)	3 ×6								
20. Badminton (Toyama High School)	3 ×3								
Total			432	3,770		4,411		31,228	
Aggregate of the above amount			432	4,202		8,613		39,841	

Note, 1. Figures in ( ) show the number of issued tickets.

2. ⑤ indicates series-ticket for an event.

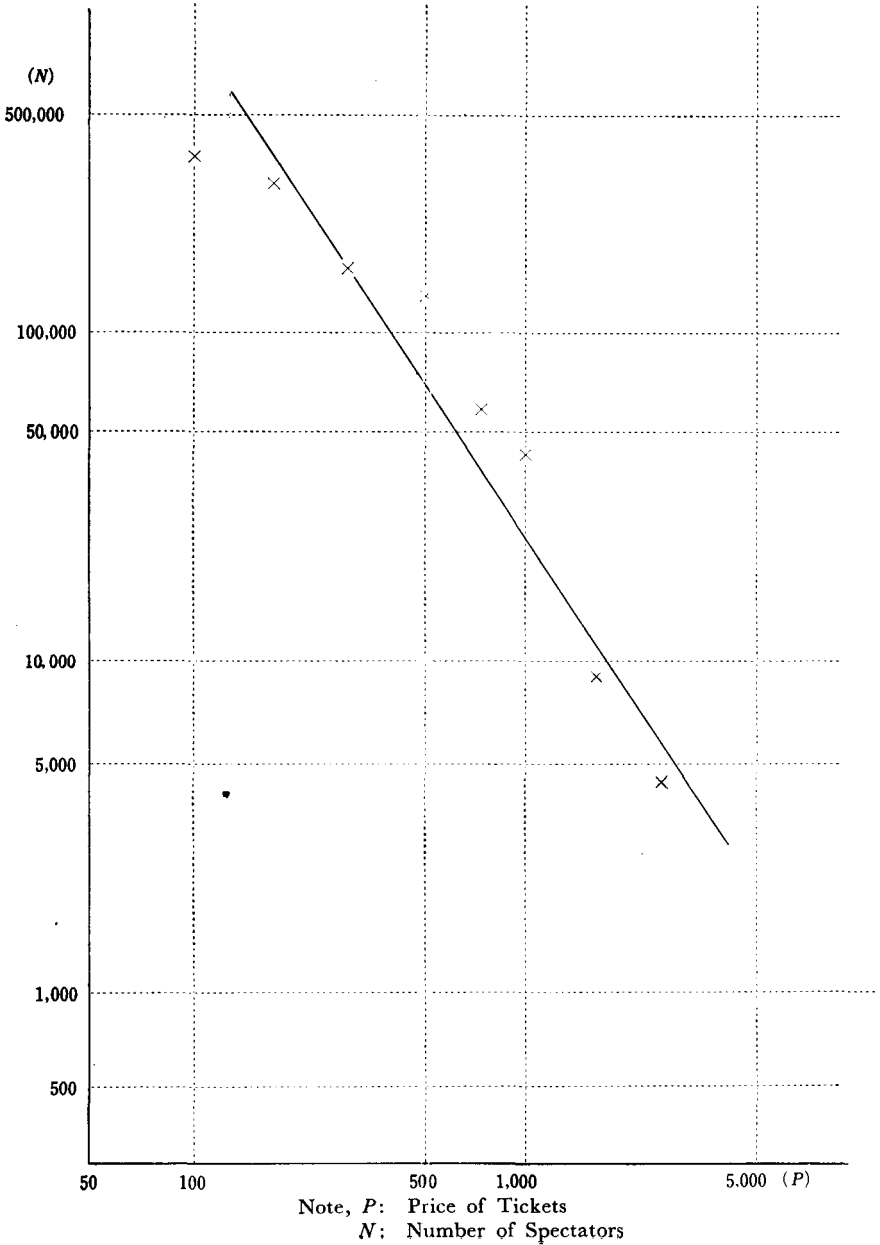
3. Figures 7 and after mean not specified free-seat ticket (except Badminton series-ticket).

4. Event. 18, 19 and 20 will not take place at the Tokyo Olympic Games.

*An Estimation of the Number of the General Spectators*

900	700	600	500	436	400	375	333	300	200	166	100
			32,965 (33,100)					5,179 (5,200)	9,965 (10,000)		
	7,876 (8,328)		7,806 (7,956)					15,018 (25,200)	20,873 (31,000)		
	2,360 (2,776)		2,391 (2,652)					3,327 (8,400)	4,326 (10,900)		
	2,674 (2,776)		2,638 (2,652)					5,850 (9,400)	6,296 (10,900)		
			3,877 (5,428)					2,751 (10,400)	3,354 (13,900)		
			5,235 (5,428)					4,010 (10,400)	4,572 (9,900)		
	5,304 (5,428)		7,040 (10,400)					5,451 (10,300)	6,072 (9,500)		
			6,149 (8,224)			2,240 (2,240)		5,928 (6,400)	18,738 (32,000)		5,787 (6,400)
	502 (684)	270 (324)	2,164 (2,508)					1,654 (2,052)	1,999 (2,400)		3,626 (4,500)
348 (400)	905 (1,184)	S 3	1,906 (3,344)					2,067 (2,736)	2,333 (3,200)		3,399 (6,000)
			1,058 (1,225)	1,820 (2,023)					8,651 (17,500)		9,354 (14,000)
			604 (1,050)				352 (1,676)	287 (2,800)	489 (10,000)		1,565 (4,000)
			201 (264)				88 (419)	311 (700)	725 (2,500)		885 (1,000)
			1,268 (1,935)		790 (1,935)			2,622 (18,000)	2,830 (9,750)		4,206 (6,500)
									2,352 (3,000)		
	902 (912)		5,539 (5,552)						8,022 (8,800)		
			245 (336)				204 (448)		1,219 (2,000)		1,095 (1,200)
	963 (2,436)		5,225 (9,968)						9,904 (12,600)		1,363 (1,400)
			1,903 (3,000)						3,589 (18,000)		1,309 (3,900)
									1,529 (2,100)	432 (432)	1,092 (1,200)
	21,486		88,214					54,455	117,838	S 9	33,681
	61,1327		149,541					203,996	321,834		355,515

Fig. 1. Relation between  $P$  and  $N$  (Overall)

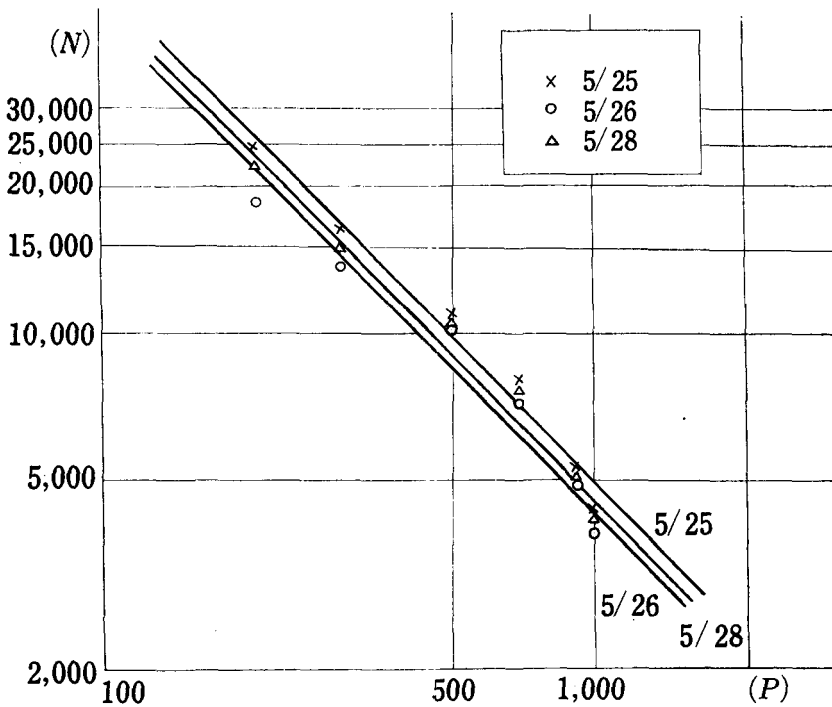


The data used for estimating the total spectators was mainly compiled for the statistics of the 3rd Asian Games, which took place from 24th May to 1st June, 1958 in Tokyo. We have analyzed these data, then, generalized the matter into some relations and modified them for the present purpose, and have made an estimation of the number of the general spectators at the Tokyo Olympic Games.

**I. An a lysis of the 3rd Asian Games.**

The number of the spectators, i. e. the same number as that of sold tickets for the games, is listed in Table 1 (not including children and student-groups).

Fig. 2. Relation between  $P$  and  $N$  (Event 2 in Table 1.)



By analyzing the relation between the number of the spectators  $N$  and the admission fee  $P$  for overall events (see Fig. 1), we found that the most adequate expression is

$$\log N = a - b \log P$$

,where  $N = \sum_{p_i \geq p} n_i$

Then, in the same way, we came to conclusion that the most suitable formula of  $P$  and  $N$  for each event is the same one for overall events (see Fig. 2).

Values of  $a$  and  $b$  of the above equation are listed in Table 2.

Table 2. Coefficient of Each Event

Event	Relation with Events in Table I.	$a$	$b$	$r$
Opening Ceremony	①	19.9	1.58	-0.93
Athletics	② ③ ④	15.2	0.98	-0.98
	⑤	14.7	0.97	-0.98
	⑥	15.3	1.02	-0.98
Closing Ceremony	⑦	15.4	0.94	-0.99
Basketball	⑧	14.3	1.23	-0.88
Wrestling	⑨	15.2	1.46	-0.90
Boxing	⑩	15.5	1.52	-0.90
Volley-ball	⑪	16.0	1.70	-0.93
Undecided	⑫	11.6	1.04	-0.97
Football	⑬	15.2	1.58	-0.96
	⑭	14.0	1.32	-0.86
Swimming	⑮	18.6	1.93	-0.88
Weight-lifting	⑰	13.8	1.55	-0.93

Note,  $r$ : Corelation Coefficient

It was found that coefficient  $a$  remains almost in every case constant and coefficient  $b$  varies with the popularity of the events, except for the case of being filled to capacity (the Opening Ceremony and Swimming were this case) or the case in which special conditions existed (Judo was of uniform price, consequently it was out of our consideration).

Though several other important factors affecting the number of spectators should be taken into consideration, they can not be derived from the analysis of the 3rd Asian Games, and therefore we made use of other data available.

## **II. Popularity Index.**

The figure  $b$  obtained by the analysis is found to have relation to the popularity of each event. We may regard this figure as an index of popularity. There is, however, an obvious difference between the popularity of the Asian Games and that of the Tokyo Olympic Games. Then the figure should be sought for by another methods, in order to make closer estimate for all the events of the Tokyo Olympic Games.

'Survey of 138 journalists by Ticket Division, the Organizing Committee for the Tokyo Olympic Games' is regarded as an adequate material to estimate the popularity index, and the results of 'Survey by National High School's Athletic Association' and 'Population in Sports Games' are also considerably in agreement with this.

We have, after study, adopted the following expression for the relation between popularity index  $E$  and coefficient  $b$

$$\log b = c - d \log E.$$

The Tokyo Olympic Games, as a matter of course, is expected to be much more popular among people than the Asian Games, and consequently we must take this into account to make a precise calculation.

The result of an analysis of Gymnastics and Volleyball in a Domestic Meeting without foreign participants is shown in Table 4.

From this result, the figure  $E$  of the Asian Games is seemed to be greater than that of the Domestic Meeting, and hence the value of  $E$  for the Tokyo Olympic Games will be much greater.

Table 3. Popularity Index

Event	Popularity Index	Event	Popularity Index
Opening Ceremony	8.32	Equestrian Sports	3.26
Swimming	7.35	Modern Pentathlon	3.23
Athletics	7.34	Demonstrations	3.21
Closing Ceremony	6.27	Field Hockey	3.11
Gymnastics	6.04	Weight-lifting	3.08
Judo	5.17	Water-polo	3.06
Football	4.62	Yachting	3.03
Basketball	4.51	Cycling	3.02
Boxing	4.43	Canoeing	3.02
Wrestling	4.16	Shooting	3.01
Volley-ball	4.06	Fencing	2.81
Rowing	3.86		

Fig. 3. Relation between  $E$  and  $b$

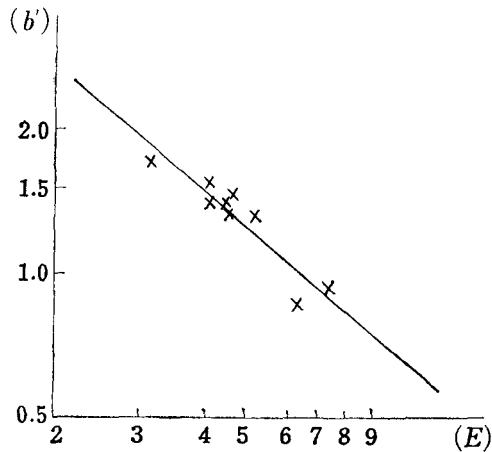




Table. 4. Comparison of the Value of  $b$  for the Domestic Meeting with that for the 3rd Asian Games

Event	Domestic Meeting	the 3rd Asian Games
Gymnastics	1.71	1.07
Volley-ball	2.74	1.70

Note, Since Gymnastics did not take part in the 3rd Asian Games, the figure is taken from Fig. 3.

Since it was necessary to determine the value of  $E$ , we sought the opinion of journalists, who are in charge of the Olympic Games, on the difference of the two Games. By showing them the list of the relation

Table 5.  $\frac{E_0}{E_A}$  : Ratio of Popularity Index

Event	Answerer $E_A$	1	2	3	4	5	6	7	8	9	10	Average
		Athletics (morning)	7.34	1.498	1.294	1.566	1.771	1.226	1.226	1.089	1.089	
Athletics (afternoon)	7.34	2.179	1.566	1.702	2.179	1.771	1.362	1.362	1.302			1.678
Athletics	7.34	1.839	1.430	1.634	1.975	1.499	1.294	1.226	1.226	1.158	1.430	1.471
Basket-ball	4.51	1.552	1.662	1.773	1.330	1.330	1.330	1.552	1.330	1.274	1.441	1.457
Gymnastics	6.04	2.317	1.572	1.655	1.407	1.324	1.324	1.490	1.490	1.117	1.241	1.494
Rowing	3.86	1.554	1.165	1.554	1.554	1.295	1.295	1.295	1.554	1.295	1.295	1.386
Fencing	2.84	1.760	1.584	1.584	1.760	1.408	1.056	1.760	1.056	1.408	1.760	1.514
Average		1.804	1.483	1.640	1.605	1.371	1.260	1.465	1.336	1.250	1.433	1.464

Note,  $E_0$ : Popularity Index for the Tokyo Olympic Games.  
 $E_A$ : Popularity Index for the 3rd Asian Games.

between  $N$  and  $P$  as a function of  $E$  and informing them the value of  $E$  for the 3rd Asian Games, we obtained the estimated value of  $E$  at the Tokyo Olympic Games. Analyzing the data of this survey, we reached the conclusion that the popularity index for the Tokyo Olympic Games will amount to 1.250 times as large as that for the 3rd Asian Games independent of the kind of events, and this figure is rather underestimated. We adopted the lower limit of the estimated value.

### III. Other factors to be considered.

1. Increase in Population of Tokyo and its suburbs and the change of economic situation in Japan from 1958 to 1964.

Population: 1.205 times (Sources: Tokyo Metropolitan Government & Welfare Ministry)

Economic growth: 1.372 times (Data from Institute for Research on National Economic)

2. Change of the number of the spectators by the time when the games are held.

The opinions of experts in the Shochiku and Toho movie theatre companies were surveyed and came to an agreement that we should multiply the total number a day by 0.5 or 0.7 for the morning or the afternoon and/or evening events respectively, to get the number of spectators for each time.

3. Difference between preliminary heats and finals.

We adopted 1.1  $E$  for finals and 0.9  $E$  for heats as the result of Athletics shown in Table 5. Since it was scheduled that the heats were held in the morning, whereas the finals were held in the afternoon, we considered that the difference between the popularity of finals and that of heats revealed itself.

4. Scale and Site of Stadia.

No conclusion was obtained, because there were few cases that the same event had been held at different stadia.

5. Days of the Week.

If the admission fee were to be varied according to the day of the

week, a lot of complication would be anticipated in the sales of tickets, and accordingly the fee is kept unchanged throughout the week. It is not necessary for us to study the effect of the day of the week.

6. Weather.

Since almost all tickets are to be sold in advance and weather conditions are only likely to influence the number of tickets issued on the day when the games take place, the effect of this factor may be left out of consideration.

7. Number of events held at the same time and that of the same event held at different times.

An analysis of the data of professional baseball games gave no definite conclusions, because of more complicated factors, such as the popularity of the game and the day of the week when the game was held, other than these factors.

**IV. Conclusions.**

As is outlined above, the number of spectators at the Tokyo Olympic games has been estimated mainly from the result of the analysis of the data at the 3rd Asian Games. Equations and constants used for this estimation may be written as

$$\log_{10} b = c - d \log_{10} E_0 \quad E_0 = E_{.1} \times 1.25 \times \begin{cases} 1.1 & \text{for finals} \\ 1.0 & \text{for semi-finals} \\ 0.9 & \text{for heats} \end{cases}$$

$$\log_{10} \frac{N}{\alpha'} = a - b \log_{10} \frac{P}{\beta} \quad \alpha' = \alpha \times \begin{cases} 1 & \text{for a day} \\ 0.5 & \text{for the morning} \\ 0.7 & \text{for the afternoon and/or the evening} \end{cases}$$

$$a = 6.367 \quad c = 0.676 \quad d = 0.828$$

$$\alpha = 1.205 \quad \beta = 1.372$$

The result of this estimation is given in Table 6.

Since we could not afford to make a more accurate estimation, we do not think this is a complete study. But we think that it might be the first time in the history of the Olympic Games to estimate the number of spectators in relation to admission fee by a statistical method. This is the reason why we dare to publish this report.

