

# Winning Isn't Everything: Corruption in Sumo Wrestling

Mark Duggan and Steven D. Levitt (2002)  
American Economic Review, 92:5, 1594-1605.

2022.3.29.

Introduction

Strong Performance on the Bubble

Match Rigging or Effort?

- A sumo wrestler involves 66 wrestlers participating in 15 bouts each.
- A wrestler who achieves a winning record (8 wins or more) is guaranteed to rise up the official ranking.
- A wrestler who achieves a losing record falls in the rankings.

## Incentive of the sumo wrestler

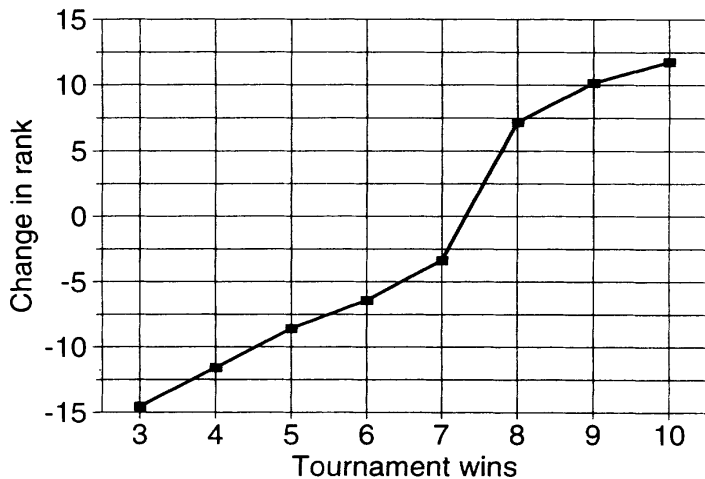


FIGURE 1. PAYOFF TO TOURNAMENT WINS

# Data

- January 1989 to January 2000, 6 tournament per year, nearly 70 wrestlers per tournament, and 15 bouts per wrestler.
- A total of 281 wrestlers in the data.
- For each observation, identity of the two competitors, who wins, month and year of the tournament, day of the match (Day 1- Day 15), and what wrestling stable the wrestlers belong to are known.

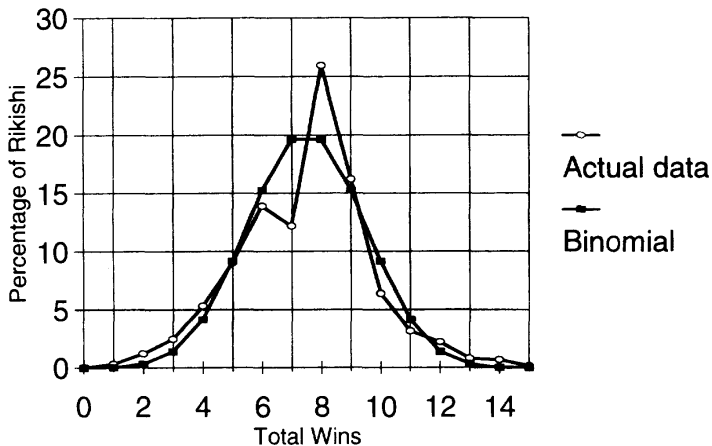


FIGURE 2. WINS IN A SUMO TOURNAMENT  
(ACTUAL VS. BINOMIAL)

# Econometric Model

$$\begin{aligned} \text{Win}_{ijtd} = & \beta \mathbf{Bubble}_{ijtd} + \gamma \mathbf{Rankdiff}_{ijt} \\ & + \lambda_{ij} + \delta_{it} + \epsilon_{ijtd} \end{aligned}$$

- $i$  and  $j$ : two wrestlers.
- $t$ : a particular tournament.
- $d$ : day of the tournament.
- **Bubble** is a vector of **indicator variables** capturing whether wrestler  $i$  and  $j$  in the on the margin for reaching eight wins.

- **Bubble** is coded **1** if only the wrestler is on the margin, **-1** if only the opponent is on the margin, and **0** if neither or both of the combatants are on the margin.
- **Rankdiff** is the gap between the ranking of wrestlers  $i$  and  $j$ .
- **Fixed-effects** for each wrestler and opponent, and wrestler-opponent **interactions**.



TABLE 1—EXCESS WIN PERCENTAGES FOR WRESTLERS ON THE MARGIN FOR ACHIEVING AN EIGHTH WIN, BY DAY OF THE MATCH

On the Margin on:	(1)	(2)	(3)	(4)	(5)	(6)
Day 15	0.244 (0.019)	0.249 (0.019)	0.249 (0.018)	0.255 (0.019)	0.260 (0.022)	0.264 (0.022)
Day 14	0.150 (0.016)	0.155 (0.016)	0.152 (0.016)	0.157 (0.016)	0.168 (0.019)	0.171 (0.019)
Day 13	0.096 (0.016)	0.107 (0.016)	0.110 (0.016)	0.118 (0.016)	0.116 (0.019)	0.125 (0.019)
Day 12	0.038 (0.017)	0.061 (0.018)	0.064 (0.017)	0.082 (0.018)	0.073 (0.020)	0.076 (0.021)
Day 11	0.000 (0.018)	0.018 (0.018)	0.015 (0.018)	0.025 (0.018)	0.010 (0.021)	0.012 (0.021)
Rank difference	—	0.0053 (0.0003)	—	0.0020 (0.0003)	—	-0.0020 (0.0004)
Constant	0.500 (0.000)	0.500 (0.000)	—	—	—	—
$R^2$	0.008	0.018	0.030	0.031	0.0634	0.0653
Number of observations	64,272	62,708	64,272	62,708	64,272	62,708
Wrestler and opponent fixed effects	No	No	Yes	Yes	Yes	Yes
Wrestler-opponent interactions	No	No	No	No	Yes	Yes

*Notes:* The dependent variable in all regressions is an indicator variable corresponding to whether or not a wrestler wins the match. The unit of observation is a wrestler-match. Values reported in the table are coefficients associated with an indicator variable taking the value 1 if only the wrestler is on the margin for achieving eight wins, -1 if only the opponent is on the margin for achieving eight wins, and 0 otherwise. On day 15, only wrestlers with seven wins are on the margin. On day 14, wrestlers with six or seven wins are on the margin. On day 13, wrestlers with five, six, or seven wins are on the margin, and so on. The omitted category in all regressions is all wrestlers who are not on the margin for achieving eight wins, as well as wrestlers in matches in which both participants are on the margin for eight wins. When a full set of wrestler and opponent fixed effects are included, the constant is omitted. In all cases, standard errors are corrected to account for the fact that there are two observations per bout (one for each wrestler). The differences in the wrestler rank variable is the numerical rank order of the wrestler minus that of his opponent, based on official rankings published prior to each tournament. This variable is missing for part of our sample.

# Distinguishing Between Match Rigging and Effort

Three approaches.

- 1 Determinants of winning on the bubble.
- 2 What happens when wrestlers meet again in the future?
- 3 Public allegations of cheating by sumo insiders.

# Likelihood of Winning When on the Bubble

1. Probability that match rigging will be detected.
  - April and May 1996. Two former sumo wrestlers came forward with allegations of match rigging. Both died a few weeks later, just hours apart, in the same hospital.
  - Another allegation in late 1999 and early 2000.

2. Frequency the two wrestlers expect to meet in the future, which should be **positively related** to successful collusion.
  - Number of meetings between the two wrestlers in the preceding year.
  - Whether the wrestler is in the last year of his career.
  - Years in sumo for wrestler on bubble. (reputation for collusion.)
3. Opponent is in the running for monetary prizes.
4. Collusion between two stables.
  - Winning percentage in other bubble matches between the two stables.

TABLE 2—DETERMINANTS OF EXCESS WIN LIKELIHOODS  
FOR WRESTLERS ON THE BUBBLE

Variable	(1)	(2)	(3)
Wrestler on bubble	0.126 (0.026)	0.117 (0.026)	0.155 (0.029)
Wrestler on bubble interacted with:			
High media scrutiny	-0.188 (0.071)	-0.177 (0.071)	-0.146 (0.080)
Opponent in running for a prize this tournament	-0.149 (0.047)	-0.129 (0.046)	-0.156 (0.052)
Number of meetings between two opponents in the last year	-0.0048 (0.0082)	-0.0031 (0.0081)	-0.0024 (0.0096)
Wrestler on bubble in his last year of competing	-0.0361 (0.0398)	-0.0195 (0.0395)	-0.0346 (0.0493)
Years in sumo for wrestler on bubble	0.0077 (0.0036)	0.0077 (0.0036)	0.0091 (0.0043)
Winning percentage in other bubble matches between these two stables	0.272 (0.059)	0.293 (0.058)	—
$R^2$	0.016	0.074	0.246
Wrestler and opponent fixed effects?	No	Yes	Yes
Wrestler-opponent interactions?	No	No	Yes

# What Happens When Meet Again in the Future

- Compensation for loosing the match— cash or promises to **return the favor** in the future.
- 74% of the wrestlers who meet when one is on the margin for eight wins will face one another again within a year.

TABLE 3—WIN PERCENTAGES IN PRECEDING AND SUBSEQUENT MATCHES  
(For Two Wrestlers Who Meet When One is on the Margin in the Final Three Days of a Tournament)

Variable	All Matches on the Margin		Only Matches in Which the Wrestler on the Margin Wins		Only Matches in Which the Wrestler on the Margin Loses	
	(1)	(2)	(3)	(4)	(5)	(6)
One or two matches prior to the bubble match	-0.002 (0.009)	0.005 (0.012)	0.020 (0.011)	0.019 (0.017)	-0.041 (0.016)	-0.035 (0.022)
Bubble match	0.151 (0.010)	0.164 (0.014)	—	—	—	—
First meeting after bubble match	-0.073 (0.011)	-0.062 (0.015)	-0.082 (0.015)	-0.079 (0.020)	-0.056 (0.020)	-0.040 (0.027)
Second meeting after bubble match	-0.002 (0.013)	0.005 (0.016)	0.031 (0.017)	0.028 (0.022)	-0.061 (0.023)	-0.039 (0.030)
Three or more meetings after bubble match	-0.010 (0.006)	0.012 (0.011)	0.013 (0.007)	0.022 (0.014)	-0.045 (0.008)	-0.013 (0.017)
Constant	0.500 (0.000)	—	0.500 (0.000)	—	0.500 (0.000)	—
Wrestler-opponent interactions?	No	Yes	No	Yes	No	Yes
R <sup>2</sup>	0.008	0.271	0.002	0.279	0.002	0.279

## Do the Data Confirm Public Allegations of Cheating by Sumo Insiders?

- Two former sumo wrestlers have made public the names of 29 wrestlers who they allege to be corrupt and 14 wrestlers who they claim refuse to rig matches.
- Classify each wrestler and his opponent as either "corrupt," "clean," or "status unknown."
- Include a full set of interactions between whether a match is on the bubble and the classification of each wrestler and his opponent.



TABLE 4—EXCESS WIN PERCENTAGES ON THE BUBBLE FOR WRESTLERS LABELED BY SUMO INSIDERS AS “CORRUPT” OR “CLEAN”

		Wrestler on the Bubble Is Identified as:		
		Corrupt	Status Unknown	Clean
Opponent of wrestler on the bubble is identified as:	Corrupt	0.260 (0.037)	0.270 (0.021)	-0.010 (0.038)
	Status unknown	0.271 (0.021)	0.181 (0.019)	0.041 (0.031)
	Clean	0.036 (0.027)	-0.033 (0.035)	0.022 (0.074)

*Notes:* Entries in the table are coefficients from a regression with full set of interactions between whether a match is on the bubble and the classification of a wrestler and his opponent as clean, corrupt, or status unknown by two sumo insiders (Itai, 2000; Onaruto, 2000; *Shukan Post*, 2000). The regression is identical to equation (1) in the text, except for the inclusion of the aforementioned interactions. Twenty-nine wrestlers are categorized as corrupt, 14 are classified as clean. The remainder of wrestlers are not specifically named and are categorized as status unknown. Standard errors are corrected to take into account that there are two observations per bout (one for each wrestler). Number of observations is equal to 64,273.