How strong are soccer teams? The 'Host paradox'

and other counterintuitive properties of the FIFA's ranking.[*]

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Abstract: FIFA's ranking of national soccer teams is plagued with paradoxes. One surprising paradox is a dramatic underrating of the hosts of main tournaments. The hosts, who are absent from the preliminaries, for a long time, play only friendlies that award few points. Three models estimate the magnitude of the resulting "Host Effect" at 14.1-16.7 positions. Such an estimate goes against the intuition that a large investment in hosting a tournament should result in improvement of the host team's standing. Host's low ranking decreases the interest in the tournament and may result in a major loss of advertisement revenue.

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1. Introduction

The 2018 soccer World Cup took place in Russia. There were calls for a boycott following Russian annexation of Crimea and the "hybrid war" in Donbass. Ultimately, some presidents of competing teams skipped the Cup. But perhaps the biggest worry for President Putin was the poor standing of the Russian team. On June 7, just before the first match, FIFA rated *Sbornaya* at position 70, just between Côte d'Ivoire and FYR Macedonia, as the lowest ranked team of all 32 competitors. Opinionated comments pronounced that the Russian team, "arguably the poorest in the history of Russian football" (ESPN 2018a), was lucky to get a relatively easy first-round group but "this is even better news for Uruguay, Saudi Arabia and Egypt, because they get to face Russia — the worst Pot 1 team by a wide margin" (ESPN+ 2018).

Then, a miracle happened. Russia humiliated Saudi Arabia 5:0 and convincingly defeated Egypt 3:1 in the first group round-robin phase of the Cup. They became the first team that advanced to the last 16 knockout phase. Among the eight Pot 1 teams, Poland and Germany

failed to qualify; Argentina did it only thanks to a last-minute goal. Russia's 'safety margin' was

comfortable: it would advance even if any two of its goals were subtracted. Then, again, in two

dramatic matches Russia first beat the world superpower Spain in penalty shoot-out and then

narrowly lost penalty shoot-out to Croatia (the finalist and potential World Champion) while

being very close to advancing to semi-finals.

Was it really a "miracle"? Systems other the FIFA's ranking rated *Sbornaya* much

higher: from 42 (CTR 2018) to 45 (ELO 2018) and 49 (rankfootball 2018). Similar "miracles"

happened in previous tournaments and involved outperforming tournament hosts. The problem

that created this illusion of a "miracle" was that the FIFA ranking seriously undervalued the

tournament's hosts. Hosts qualify by default then, until the tournament's beginning, they only

play friendlies. At the same time, other teams play highly valued qualification matches. Since a

team gets fewer points in a friendly rather than in an official preliminary (for the same result

with the same opponent), the host is doomed to fall down in the ranking. Before the 2018

tournament, the preliminaries started as early as March 12, 2015 (in Asia) and as late as

September 4, 2016 (in Europe), and lasted until November 15, 2017. Since the weights for

recent matches are much higher than for older ones, at some point about ¾ of the host's score

may be awarded for friendlies only. Over the time preceding the World Cup, Russia had been

predictably sliding in the world rankings (see Figure 1).

FIGURE 1 ABOUT HERE

Figure 1: Russia's downfall in the FIFA ranking in the 30 months prior to the 2018 World Cup
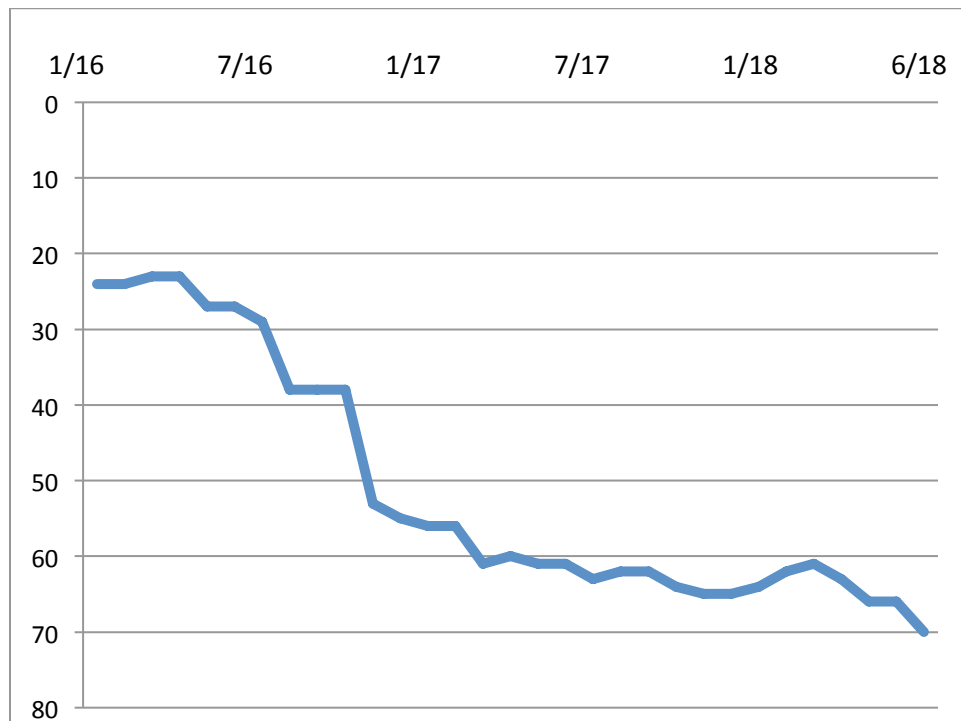
Note: Russia's position in the FIFA ranking from January 2016 to June 2018. A major slide

follows the start of UEFA preliminaries on September 4, 2016.

This paper investigates in more detail this perverse "Host Effect" leading to a "Host

Paradox," and extends the initial analysis in Kaminski (2012) xx [remove for submission]. I

begin with reconstructing the details of the FIFA ranking. Section 3 warms up the reader by

briefly describing a few paradoxical traits of the ranking. Section 4 describes the Host Effect

and examines its magnitude with the data from past tournaments. Section 5 discusses possible

solutions. The last section concludes with the assessment of the paradox's consequences.

2. FIFA and its ranking

FIFA (Fédération Internationale de Football Association) is the international governing

body of 211 national soccer and similar sports associations. Founded in 1904 and headquartered

since its birth in Zürich, FIFA is managed by 25-member strong Executive Committee headed by

the President. FIFA's main activity is the organization of the FIFA World Cup, its preliminaries,

and other tournaments. It also coordinates the activities of six regional federations that supervise

local championships and friendlies (friendly matches) of their members. Territorially, the

federations approximately cover different continents and include Asian Football Confederation

(AFC, with Australia included), Confederation of African Football (CAF), Confederation of

North, Central American and Caribbean Association Football (CONCACAF), South American

Football Confederation (CONMEBOL), Oceania Football Confederation (OFC) and Union of

European Football Associations (UEFA).

Among the FIFA's highest profile activities is the monthly ranking of national soccer

teams. The positions of teams are duly noted by the media and may affect sponsor generosity.

More importantly, the ranking determines the teams' chances in drawing opponents in the

preliminaries and main tournaments of various Cups, including the World Cup. Teams are

bundled into "pots" that include the top-ranked teams (pot 1), the same number of teams ranked

immediately lower (pot 2), and so on. Each group includes exactly one team from each pot.

Thus, having a higher ranking implies the lower expected ranking of opponents, which is a proxy

for their strength.

FIFA's ranking has evolved over time. The recent 2006 version takes into account the

results of the official matches the national team played in the past four years, the opponent's

position in the ranking, the strength of opponent's federation and the match's importance.[1] For

every game the team receives points. About once a month, the average score is calculated for the

past 12 months, previous 12 months, etc. The position in ranking reflects the weighted average

score for the past 48 months. The details of the procedure are as follows:

1) Score **for every match:** The team receives the number of points equal to the product:

$$P = M \times I \times T \times C$$

where the factors are calculated according to the following rules:

- *M* (the match's result): 3 for victory, 1 for tie and 0 for defeat; in a penalty shoot-out, the

  winner receives 2 points and the loser 1 point. Earlier, if preliminaries included a two-

  match game, and the results were symmetric, the result of the second match was

  disregarded and the points were assigned as if penalty shots were applied. Supposedly, a

  change took place in 2012 but the exact new rules are unclear;

- *I* (importance) depends on the match's category and is equal to:

1 – A friendly or a minor tournament;

2.5 – Preliminaries to World Cup or a Federation's Cup;

3 – Federation's Cup and Confederations Cup;

4 – World Cup.

- T (opponent's strength) depends on the opponent's most recent position r in the FIFA ranking and is equal to $(200 - r)$. Exceptions: for the ranking's leader $T = 200$ and for teams ranked from position 150 downwards $T = 50$;

- C (correction for federation's strength) is equal to the average strength of the team and its opponents' federations. The strength of a federation is calculated from its members' results in the three most recent World Cups. As of June 2018, C was equal to: 1 for CONMEBOL; 0.99 for UEFA; 0.85 for CONCACAF, AFC, CAF and OFC.

2) Average **score for the year** (beginning at a certain date and ending exactly 12 months later) is equal to an arithmetic mean from all matches if the team played at least five times. With a smaller number m of matches, the average is multiplied by $0.2 \times m$.

3) Position **in ranking** r at a given moment represents the total weighted sum of points over the past four years according to the formula:

$$R = P_{-1} + 0.5\,P_{-2} + 0.3\,P_{-3} + 0.2\,P_{-4}$$

where every component P_{-i} is the average score for matches played over the period $12(i-1)$ and

$12i$ months back: P_{-1} – last 12 months; P_{-2} – between 12 and 24 months back; P_{-3} – between 24

and 36 months back; P_{-4} – between 36 and 48 months back.

3. Examples of paradoxes

FIFA's page declares that "The basic logic of these calculations [the ranking] is simple:

any team that does well in world football wins points which enable it to climb the world ranking"

(FIFA 2018). Unfortunately, the FIFA ranking sometimes violates this and other simple

properties, i.e., it is vulnerable to "paradoxes." The term "paradox" was made popular in voting

theory and social choice theory by books by Brams (1975) and Ordeshook (1986). It denotes a

situation when a ranking behaves contrary to our basic intuition, i.e., it doesn't satisfy certain

properties that are interpreted as "obvious," "desired" or "fair." Vulnerability to paradoxes is

closely related to vulnerability to manipulation.[2] Social choice theory taught us that every

ranking based on preferences must violate at least one of certain desired properties (Arrow

1951). Whether one can find an equivalent of Arrow's Theorem for ranking soccer teams, i.e.,

with the information that is available, remains an open question. Below, I provide examples of a

few striking paradoxes.

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2 Lasek et al. (2016) list several methods of „optimization" of a team's position in the FIFA ranking, including choosing the number of matches, choosing correct opponents, avoiding friendlies and creating score-improving coalitions. Wang and Vandebroek (2013) offer a similar analysis of strategic opportunities.

Certain features of the FIFA formula are bound to generate criticism from a soccer fan. For instance, the number of points doesn't depend on whether a team plays at home. Thus, in a match of a similar importance, a team receives more points for defeating Qatar at home (the controversial organizer of 2022 World Cup and ranked 98 on June 7, 2018) than for a tie with Brazil (#2) played on the famously intimidating Estádio do Maracanã in Rio. It is known that friendlies provide few points, so a team that did well in the preliminaries may choose to strategically avoid playing friendlies. For instance, Romania was criticized before the 2018 World Cup preliminaries for strategically playing only one friendly (and being seeded); similarly, Poland was criticized before the 2018 World Cup for not playing friendlies until the ranking was used to seed them in the top pot. Thanks to such quirks, a team may climb the ranking despite common wisdom placing it much lower. Notably, in September 1993 and July and August 1995, Norway was ranked second while in April 2006 USA was fourth. Sometimes paradoxical results happen systematically.

Violation of Weak Goal Monotonicity: losing a goal increases the score

An intuitive property should be that a team's score would increase or at least stay constant with every additional goal won by that team. Until 2012, FIFA's rules sometimes violated this property of "Weak Goal Monotonicity." A violation happened when preliminaries included a two-legged home-and-away game. When the results were symmetric, the result of second match was disregarded and the points were assigned as if penalty shots were applied.

Example: Team A plays with Team B in a two-match competition for advancing to the next round. A first defeats B at home 3:0, and then loses 0:3.[3]

If the match ends with 0:2, A would advance to the next round receiving zero points for the lost match. When A loses the third goal, the score becomes symmetric (3:0 and 0:3), and the result of the second match is decided by penalty shots. But A's score for this match increases with the loss of a third goal! If A loses the penalty shoot-out, it receives some points with a multiplier 1; if A wins, the multiplier is 2. In both cases the number is positive instead of getting zero for 0:2. As an effect, losing the third goal by A automatically increases A's FIFA score for the match and possibly its position in the ranking!

A mirror problem appears for Team B that receives more points for a match won 2:0 than for winning 3:0, regardless of the result of penalty shots.

The "Weak Goal Monotonicity" paradox appeared in several matches. In Jordan-Kyrgyzstan preliminaries on October 19, 2007, Jordan lost 0:2 and ten days later beat Kyrgyzstan at home 2:0. For winning 2:0 and then winning penalty shots Jordan received 284.75 points while for winning only 1:0 it would receive substantially more, i.e., 427.125 points.[4] A similar problem was noted when on July 12, 2011, Saint Lucia defeated Aruba 4:2 after losing earlier also 4:2. In November 2005 Australia beat Uruguay in penalty shoot-out after first losing 0:1 and then winning 1:0. Losing the goal guaranteed Uruguay the same score in the case of losing penalty shots or a better score in the case of winning.

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3 Apparently, FIFA fixed the problem although no correction to the rules could be found (Edgar 2012). See a comprehensive discussion of the problem on football-rankings (2012).
4 Ibidem.

In general, similar problems appear always when the result of a two-match competition is settled with penalty shots. It is not easy to eliminate the paradox. Penalty shots constitute an additional "mini-match" played after two symmetrically ended games. If penalty shots affect the score, then we get into difficulties similar to those described above. If penalty shots do not affect the score, then the fact that one team overall beat the second one is disregarded.

There are more problems. In all examples below, we assume that (a) all teams played exactly five matches in every twelve-month period used for calculations; (b) that the matches would not be re-classified to a different period after the ranking is modified; (c) that no other matches were played between the old and new rankings; (d) that the Federation strength $C = 1$.

Automatic Loss of Leadership: The ranking's leaders automatically lose their positions after a match

A is the ranking's leader, B is second, C is third. A and B play a friendly. Regardless of the score, after the match C becomes the new ranking leader.

Table 1: The scores before the Automatic Loss of Leadership

Teams	Ranking	P_{-1}	$P_{-2} = P_{-3} = P_{-4}$	Total score
A	1	700	500	1200
B	2	700	490	1190
C	3	645	540	1185

Note: P_{-i} is a mean score for year i back. In all periods, exactly five matches were played.

The table shows the scores before A and B play the match. After the match, the score changes. The maximum number of points that A can receive for defeating B is $P = M \times I \times T \times C = 3 \times 1 \times 198 \times 1 = 594$. As an effect, the average score for the last 12 months for A is 682 (after rounding), and the total score for the ranking is 1182. Similarly, the best-case scenario for B is defeating A. In such a case, B's score is equal to 1173. Both numbers are smaller than the total score of C, which remains unchanged. Thus C becomes the new ranking leader.

In the above example the problem appears due to a low weight for the friendly. Even glorious defeat of a high-ranked opponent may lower the total score and the position in the ranking.

Weak Ranking Reversal: Tie reversing the ranking

A is ranked higher than B. In a friendly, A ties with B. B is now ranked higher.

Table 2: The scores before the paradox of Weak Ranking Reversal

Teams	Ranking	P_{-1}	$P_{-2} = P_{-3} = P_{-4}$	Total score
A	20	780	500	1280
B	30	600	650	1250

Note: P_{-i} is a mean score for year i back. In all periods, exactly five matches were played.

For a tie in a match with B, A receives $M \times I \times T \times C = 1 \times 1 \times 170 \times 1 = 170$ points while B receives $1 \times 1 \times 180 \times 1 = 180$ points. After including the result of the tie in the mean for the last twelve months, the total score of Team A in the ranking is 1178 (after rounding) while B's score is 1180. As an effect, B is now ranked higher than A.

The problem is due to A being ranked higher thanks to a relatively better previous year. As an effect, the tie lowers A's score by more points than the B's score. What is interesting is that the paradox may appear even if the higher ranked A beats B (as shown below)! However, in order to obtain this stronger version of the paradox, greater differences between the teams' scores in different years are needed. This makes the occurrence of such a paradox less likely.

Strong Ranking Reversal: Victory reversing the ranking

Team A ranks higher than Team B. In a friendly, A beats B and, as an effect, B is now ranked higher than A.

Table 3: The scores before the paradox of Strong Ranking Reversal

Team	Ranking	P_{-1}	$P_{-2} = P_{-3} = P_{-4}$	Total score
A	20	1100	200	1300
B	30	200	1050	1250

Note: P_{-i} is a mean score for year i back. In all periods, exactly five matches were played.

A receives for a victory $3×1×170×1 = 510$ points while B gets 0. Consequently, A has after the match 1202 points while B has 1217. B is now higher ranked than A.

The core problem for all the examples above is the low score assigned to friendlies and the fact that the means for four years are computed independently. If a team's high ranking depends mostly on a fantastic previous year, then even a victory in a low-value friendly may ruin its position. On the other hand, for a team with a weak previous year, even a defeat may be negligible. The Reader, equipped with all this knowledge, should be able to construct the following paradoxes:

Round-robin reversal:

1. Teams A, B and C are in one group of a round-robin tournament in World Cup;

2. Ranking before the tournament: ABC;

3. Results of the tournament: A comes first, B is second, C is last;

4. Ranking after the tournament: CBA.

Double reversal:

1. Teams A and B play two consecutive matches;

2. There is tie in the first match and the relative ranking of both teams is reversed;

3. There is a tie in the second match and the relative ranking is reversed again.

4. The estimation of the Host Effect

The FIFA ranking treats the hosts of its tournaments especially poorly. The source of problems

is a low weight assigned to friendlies versus preliminaries to World Cup or regional Federation

Cups (the multiplier of 1 versus 2.5). Since hosts advance to main tournaments automatically,

they do not play in the preliminaries that typically start about two years earlier. Thus, for about

two years before the tournament, the host plays only low-scoring friendlies. Recall that the score

is a weighted sum of scores from four years (with the weights equal to 0.2, 0.3, 0.5 and 1, from

the most distant to the most recent year). There is a moment when the friendlies have the total

weight of about 0.75 of all results from the past four years. Even when a host scores in such

friendlies very well, its position in the ranking may go down![5]

Example: Poland, the co-host of Euro 2012, played only friendlies in 2011. Out of 13

matches, Poland won 7, tied 3 and lost 3. They beat strong opponents such as Argentina (#10 at

the end of 2011) or Bosnia and Herzegovina (#20), losing in close games to Italy (#9) and France

(#15), and tying matches with Greece (#14), Germany (#2) and Mexico (#21). Overall, 2011

was a good year, much better than the previous two years (in 2010, victories-ties-defeats were 2-

6-3; 2009: 3-2-2). Despite a good year, Poland ended 2011 ranked 66th with 492 points, only

slightly better than at the end of the terrible 2010 (#73) and lower than in 2009 (58). The FIFA

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5 FIFA vaguely acknowledged that the host has "less opportunity for getting more points" (FIFA 2018b). Various
publications describe the problem with respect to specific hosts; e.g., Wang and Vandebroek show how their ranking
system and its variants avoid the Host Effect problem for the organizers of Euro 2012, Poland and Ukraine.

ranking punished Ukraine, the other co-host of Euro 2012, as well. At the end of 2009, Ukraine

was ranked 22nd, in 2010 it fell to 34th, and it ended 2011 at 55th.

If Poland had played all of its 2011 matches in the Euro 2012 preliminaries with identical

results then, at the end of 2011, it would have received approximately 1381 points instead of just

492. With such a score, it would have been ranked second instead of 66, behind Spain (1564)

and ahead of the Netherlands (1365)! The difference in weights for friendlies and preliminaries

is responsible for this disparity. I will later re-calculate Poland's hypothetical score using a more

subtle method that returns a more intuitively justified ranking.

The estimation of the Host Effect presents substantial methodological challenges. Below,

I discuss three alternative methods. The data included 26 hosts of eight World Cups, nine Asian

Cups and nine Euro Cups. There were four cases of partially missing data. After the change in

the ranking methodology in 2006, FIFA re-calculated its ranking back to 1993, which made

possible including tournaments taking place from 1994 onwards.[6]

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6 Certain regional tournaments were omitted: CAF and CONCACAF Cups take place bi-annually, and the
preliminaries take place in the same year as the main tournaments. This creates a short life span for a potential Host
Effect. CONMEBOL has a small number of members and no preliminaries while OFC is an amateurish federation
with 11 official members and the best team ranked at 119 (New Zealand).

The estimation involved a couple of methodological dilemmas. First, the data do not come from a
"representative sample" but are generated by three processes, i.e., non-random selection of the host, non-random
selection of matches and the random process with an unknown distribution, i.e., the results of matches. The author
believes that the first process could affect the analysis in a noticeable way mostly for the World Cup while the
second process doesn't introduce any systematic bias. However, Macmillan and Smith (2007) argue that such
sample selection bias introduces to the general studies of the FIFA ranking serious statistical problems. Second, I
used in calculations ranking positions rather than FIFA scores that creates a problem due to ordinal measurement.
However, the paradox in the Host Effect I am interested in is due to a host's subjectively low position in the ranking.
Any result obtained with the FIFA scores would have to be translated into mean ranking loss that would re-create
the ordinality problem.

Average dip in the ranking

The most obvious question is: what is the average dip (loss of positions) in the ranking due to the Host Paradox? Let's assume the following notation for the key variables:

T – year of the tournament;

r_T – last ranking before the tournament (in case of unclear timing, the ranking from the month immediately preceding the month of tournament);

r_P – the ranking immediately preceding the start of host's confederation preliminaries (missing data for USA 1994);

r_{T+4} – the first ranking in January or February of year T+4 (missing data for recent hosts Russia 2018 and France 2016; ranking for Australia 2015 from June 2018);

$\Delta = r_T - \frac{1}{2}(r_P + r_{T+4})$ – the estimated individual Host Effect (in case of r_P or r_T missing, the other number was used and the weight given to Δ in the mean was 1/2).

At the time of r_P, there were no negative consequences of future preliminaries while at the time of r_{T+4}, the preliminaries were too old for the calculation. The mean of both rankings was used to smooth random variations in the teams' performance and a potential effect of growing FIFA membership. Finally, r_T is the last ranking before the tournament where preliminaries still carry heavy weight that is publicized in the media and often used as the measure of a host's strength (see the Appendix).

A bar over a variable denotes its mean value. Table 1 shows the calculations of $\bar{r}_P$, $\bar{r}_{T+4}$

and $\bar{r}_T$ for the Euro, Asian Cup, World Cup and all three Cups combined. Hypothesis 1

operationalizes the conjecture of the Host Effect and states that a positive dip $\overline{\Delta}$ in the ranking

can be identified:

Hypothesis 1: $\overline{\Delta} > 0$

Table 4. The average positions and changes in the FIFA ranking for the hosts of major

tournaments since 1994.

Tournament	Number of hosts	$\bar{r}_P$	$\bar{r}_T$	$\bar{r}_{T+4}$	$\overline{\Delta}$
Euro+World+Asian	26	50.4	64.7	50.6	14.2
Euro	9	25.4	42.2	23.9	17.5
World Cup	8	32.0	36.1	17.0	11.6
Asian Cup	9	89.6	112.4	100.4	17.4

Note: Missing data and rounding are responsible for slight discrepancies in the means.

Nonparametric binomial tests were run with $r_T > r_P$ and $r_T > r_{T+4}$ counted as "successes" and $r_T <$

r_P and $r_T < r_{T+4}$ counted as "failures" (ties disregarded, q the probability of success). The p-

values for the one-sided test "H_0: $q = 0.5$" vs "H_A: $q > 0.5$": Euro+World+Asian – 0.000; Euro –

0.000; WC – 0.008; AC – 0.008. The Appendix includes the data for all 26 hosts.

The overall average dip in ranking, as represented by $\overline{\Delta}$, is equal to 14.2. For all cases, the estimated dips are positive and in double digits; the p-values are small despite low counts for regional tournaments. Hypothesis 1 is corroborated in all cases.

The exact estimates for specific tournament types have to be treated with caution due to small counts. The smallest effect appears in the World Cup (the change of +11.6). One mitigating factor may be the fact that all recent World Cup host teams, except for Russia, were very strong in their regions. One or two years before the World Cup, all eight teams took part in main regional cups, where it was relatively easy to qualify. Six out of eight host teams also took part in the previous World Cup. Thus, the Host Effect is partially offset by the non-random process of selecting the hosts, i.e., the higher probability of offering the World Cup organization to regionally strong teams, which have more opportunity to play in highly weighted matches than weak teams, and which lose less often due to not playing in preliminaries. Moreover, one year before its main Cup, FIFA organizes a small Confederations Cup. The host and the World Champion play with the champions of regional confederations. This gives the strong host teams an opportunity to relatively easily score highly weighted points against the champions of smaller confederations.

There are many more teams that play in regional Confederation Cups than in the World Cup. Thus, non-participation in the World Cup preliminaries is offset to a greater degree by participation in Confederation Cups than vice versa. One would expect a stronger effect for the

hosts of regional preliminaries than for the hosts of the World Cup. The data confirm this conjecture.

A strong Host Effect appears for the Asian Cup (+17.4). One can speculate that the effect is relatively less polluted by the participation in other main tournaments since the teams of the organizers of Asian Cup are substantially weaker than the organizers of the World Cup or Euro (see the Appendix). While every host of the World Cup took part in the earlier Confederation Cups, no host of Asian Cup except for China participated in the earlier World Cup. China didn't gain anything from their participation since they scored no points and no goals. Thus, the hosts of Asian Cup earned their ranking points only in Federation preliminaries, Federation main tournaments, World Cup preliminaries as well as in friendlies. The only non-systematic effect influencing the results was non-participation in the regional championship.

In the case of Euro organized by UEFA, the high Host Effect of 17.5 could be somewhat reduced by the fact that five out of nine hosts participated in the earlier World Cup. Similarly to the World Cup, the hosts of Euro have much stronger teams than the hosts of Asian Cup, and have more chances of playing highly valued matches. Nevertheless, playing friendlies decreases the average score quickly for the high-ranked UEFA teams. Given typically high positions of the European teams in the ranking, the Euro effect seems to be most consequential.

## Estimated dip as a function of a team's position

Another question, implicitly present in the earlier discussion, is whether the dip depends on a team's strength. A strong team has more chances of playing in highly valued tournaments

than a weak team due to a higher probability of advancing to regional Cups and the World Cup.

Stronger teams are separated by many more points than weaker ones. Moreover, a strong host

may additionally benefit from the FIFA's Confederations Cup, organized a year before the

World Cup. All those effects suggest that the ranking of a strong team is less vulnerable to the

Host Effect.

An assessment of how the Host's Effect depends on the host's initial ranking would allow for a

more precise estimation of the losses. An examination of the scatter plot should help to quickly

decide whether the relationship is linear (see Fig. 2).[7]

Figure 2: Scatter plot of host rankings at P and T

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7 For the alternative explanatory variable r_{T+4} all results are almost identical; the disadvantage is that for T+4 there are three data points missing versus one for P. Due to strong multicollinearity (Spearman's rho correlation 0.965), r_{T+4} and r_P couldn't be used jointly.
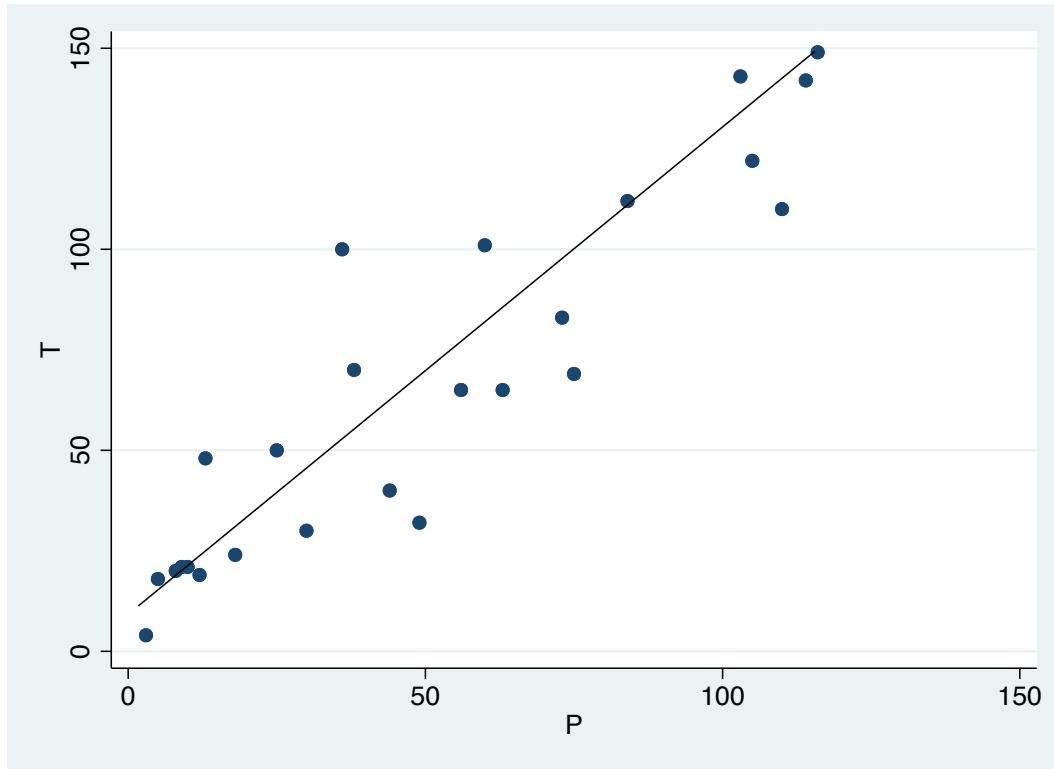
Note: The position in the ranking r_T is estimated with the ranking preceding the preliminaries r_P

(for all three Cups); an approximate regression line is displayed.

The scatter plot shows a clear linear relationship but also suggests heteroscedasticity problem

that is confirmed by tests. Thus, the estimated standard errors are biased and OLS results should

be treated as representing the parameters of the population of all hosts so far but one should be

cautious with interpreting them as the estimates of the general relationship.[8]

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[8] Heteroscedasticity arises at least partially due to the one-sided constraints of the ranking, i.e., the fact that high-ranked teams can fall in rankings but their rise is limited (for the #1 team, it cannot go up at all). Heteroskedastic

Table 5: Ranking before the tournament predicted by ranking preceding preliminaries (regression

$r_T = B \times r_P + C$)

Variable	Coef.	SE(B)	t	p	Number of obs
r_P	1.078	0.098	10.94	0.000	25
constant C	12.1	6.18	1.95	0.063	

Note: $R^2 = 0.84$; Adj $R^2 = 0.83$; F(1, 23) = 119.78. See the Appendix for the data for all 26 hosts.

For the United States 1994, the preliminaries started before the FIFA's oldest ranking.

The change of the Host Effect is surprisingly weakly dependent of the initial team's

position. The intercept of 12.1 and slope of 1.078 means that the host team with a certain

position in the ranking at time P can expect to slide down in the last pre-tournament ranking by

12.1 plus 0.078 of its pre-preliminaries ranking. Thus, knowing the host's ranking r_P, one can

estimate that the position at time T increased by $12.1 + 0.078\ r_P$. The average estimated dip in

the ranking according to this method is 16.0. The results confirm that stronger teams in fact slide

less than weaker ones but the difference is small.

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two-step GLS estimation returns a significant constant of 4.42 and a borderline significant exponential coefficient of 0.023. However, the estimates used this way are mostly unreasonable, e.g., for $r_P = 25$, $\hat{r}_T \approx 10.7$ (negative host effect); for $r_P = 50.4$ (mean), $\hat{r}_T \approx 96$ (very big mean effect); for $r_P = 60$, $\hat{r}_T \approx 289$ (beyond the range of r_T). Since the OLS intercept has substantial variance, a linear regression suppressing intercept was also run. Suppressing intercept to zero would be equivalent to assumption that for high-ranked teams the Host Effect is almost non-existent, which has no justification in theory or data. The estimate of a mean Host Effect in this case was similar.

Comparative analysis of the FIFA and alternative rankings

While the FIFA ranking is the most popular, alternative rankings use different methodologies for ordering national teams. If the Host Effect is caused by factors specific to the FIFA ranking, we should not be able to see it in other rankings. Otherwise, if some external intervening factors are responsible for the Effect, we should be able to identify it in the alternative rankings as well. Table 3 below repeats the values of FIFA aggregate rankings for tournament hosts in the first row and shows the respective indicators compiled from the rankings produced by two alternative systems. The Elo ranking, named after a Hungarian physicist and chess player Árpád Élö, is most notably used for ranking chess players.[9]

Table 6. The average positions and changes in the FIFA and alternative rankings for the 26 hosts of Euro, World Cup and Asian Cup tournaments since 1994.

Ranking	$\bar{r}_P$	$\bar{r}_T$	$\bar{r}_{T+4}$	$\bar{\Delta}$
FIFA (repeated from Table 1)	50.4	64.7	50.6	14.2
Elo	52.1	50.9	52.8	− 1.5
rankfootball	53.6	52.5	51	0.1

9 Alternative rankings are cited after the websites Elo (2018) and rankfootball (2018). Elo: the rankings were available for the beginning of years T–2 and T+4, and for the last month preceding the tournament in year T for all cases except at T+4 for recent hosts France 2016 and Russia 2018; rankfootball: the rankings were available for the beginning of years T–2, T and T+4 from the end of 1996 and except at T+4 for recent hosts France 2016 and Russia 2018.

Note: Nonparametric binomial tests run for $r_T > r_P$ and $r_T > r_{T+4}$ counted as "success" and $r_T < r_P$ and $r_T < r_{T+4}$ counted as "failure" (ties disregarded, q the probability of success). The p-values for the one-sided test "H_0: $q = 0.5$" vs "H_A: $q > 0.5$": ELO – 0.93; rankfootball – 0.17;

The two alternative rankings seem to be immune to Host-like effects. The average rankings of all three systems are very close for the times P and T+4, when the Host Effect was not present. However, ELO and rankfootball provide similar averages for the time T before the beginning of the tournament but FIFA displays a big dip. Both alternative estimates of the size of the Host Effect are insignificant. ELO is closer to significance (0.12 for a change in direction "H_A: $q < 0.5$") and estimates that the host's position is slightly higher at the start of their tournaments than the average of rankings at P and T+4.

If we estimate the Host Effect as a difference between the average estimates of the ranking at time T for FIFA and the two alternative rankings, we will get two numbers: 14.1 (for rankfootball) and 16.7 (for ELO).

Solutions

The Host Paradox can be essentially eliminated or reduced with two simple solutions.

Freezing the host's score

The simplest method of dealing with the Host paradox is to freeze the host's score at about the time the preliminaries start. The European confederation UEFA applies an equivalent solution.

UEFA uses its proprietary scoring system in order to assign teams to pots and allocate club

tournament spots to countries. The rules for the UEFA ranking make an explicit provision for

tournament hosts (UEFA 2018, p. 53):

> In the case of an association that has hosted a UEFA EURO or FIFA World Cup final
>
> tournament during one of the reference periods as mentioned under Annex D.1.2 and
>
> therefore has no points from the respective qualifying competition, the points earned in
>
> the most recent qualifying competition in which the association has taken part are used.

The preliminaries to the 2018 World Cup started almost 3.5 years before the main tournament

and the most important European preliminaries started about two years before the tournament.

The moment of freeze could be a subject of discussion but for main regional confederations it

could happen at the start of preliminaries and end with their last match. About ½ year before the

tournament, when the preliminaries are over, the calculation could be unfrozen, and the score

computed as if the period of freeze didn't exist. About 3.5 years after the tournament, the host's

score would be back to the usual calculations, i.e., with the use of matches from the past four

years. Freezing could be also annulled if a host declared in advance such a desire.

Substituting friendlies with preliminaries

The second solution is more complicated but has an advantage of using actual recent scores. It is

motivated by the question asked earlier for Poland: what would be its position, if some of the

matches played in 2010 and 2011 had been assigned a higher multiplier in order to compensate

for the higher multiplier of 2.5 used in the preliminaries for an average number of matches played in the preliminaries?

Using the multiplier of 2.5 to all matches would be too generous to the host team. Let's estimate the modified score for Poland for 2010 and 2011, when the preliminaries took place, under the following assumptions:

(1) The points and positions in the ranking of all other teams remain unchanged;

(2) Each of the 26 matches of Poland played in 2010-11 receives the multiplier (preliminary versus friendly) equal to $(26-9.725)/26 \times 1 + (9.725/26) \times 2,5 = 1.56$ (see explanation below);

(3) Some actual opponents in friendlies, such as Mexico or Argentina, were non-European and couldn't be in the same preliminary group; in the case of friendly opponents such as Germany, France and Italy, only one team could be in the same group with Poland in the preliminaries. This aspect is disregarded since an implicit assumption is that specific teams are less important and the results in friendlies are only proxies for actual results;

(4) The possibly lower incentive to play in a friendly is also disregarded. This may make it easier for weaker teams to score well against teams that are stronger but less motivated and may also experiment with reserve players;

(5) All friendlies played in 2010-11 are included.[10]

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10 I am grateful to Marcin Malawski for discussing problems described in (3)-(5). He suggested another alternative method of estimation that would take into consideration only those teams with whom Poland could actually be competing in the preliminaries.

In point (2) the weights were calculated using the average number of matches played by the European teams that played in groups of six or five, and with some additional rounds. Since 51 teams played 248 matches, the average is equal to 9.725. The weight of 1.56 uniformly distributes the extra weight of 14.59 from 9.725 hypothetical preliminary matches to 26 actual friendly matches.

Under such assumptions, Poland's score would look as follows:

2008: 288.74 (unchanged);

2009: 171.4 (unchanged);

2010: 347.52 (estimated) instead of 222.8;

2011: 389.1 (estimated) instead of 249.4.

The total number of points at the end of 2011 would be equal to $288.74 \times 0.2 + 171.4 \times 0.3 + 347.52 \times 0.5 + 389.1 \approx 672$.   Such a score would give Poland 39th position in the December 2011 ranking, i.e., 27 positions higher than the actual ranking.[11] This would be closer to the FIFA ranking's competitors that rated Poland substantially higher: ELO – 38; RoonBa – 23; Rankfootball – 31; CTR – 33; AQB – 28.


Conclusion

The Host Paradox is deeply unintuitive. Countries hosting soccer cups invest massive amounts of money to show off. The cost of the 2018 World Cup in Russia was (probably under)

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11 The scores of all teams were recorded as of February 17, 2012, when Poland's position in the FIFA ranking was 70.

estimated from $14.2bn to $20bn (ESPN 2018b) while the economic impact was (probably over)

estimated at $30.8bn over the ten years from 2013 to 2023 (Simpson 2018). Major soccer

tournaments provide an opportunity for a thriving democracy to promote it achievements and for

an autocracy to soften its image. One would expect that the host's team would benefit from the

resulting bonanza and, on average, would improve its quality and position in rankings.[12]

However, instead of slightly climbing up, as predicted by ranking ELO, hosts of tournaments

begin their steep slide down to end the ride – according to our estimates – between 14.1 and 16.7

positions lower (see Figure 3).

Figure 3: Average slide down of 25 tournament hosts over the 30 months preceding the

tournament in the FIFA ranking

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[12] Leeds and Leeds (2009) found that having hosted a World Cup in the past strengthens the FIFAs score of a
country by adding on average 218 points; the estimate wasn't significant though. Other papers analyzing the
determinants of the FIFA score include Hoffmann et al. (2002), Houston and Wilson (2002) and Macmillan and
Smith (2007).

Average host ranking for 30 months before the tournament
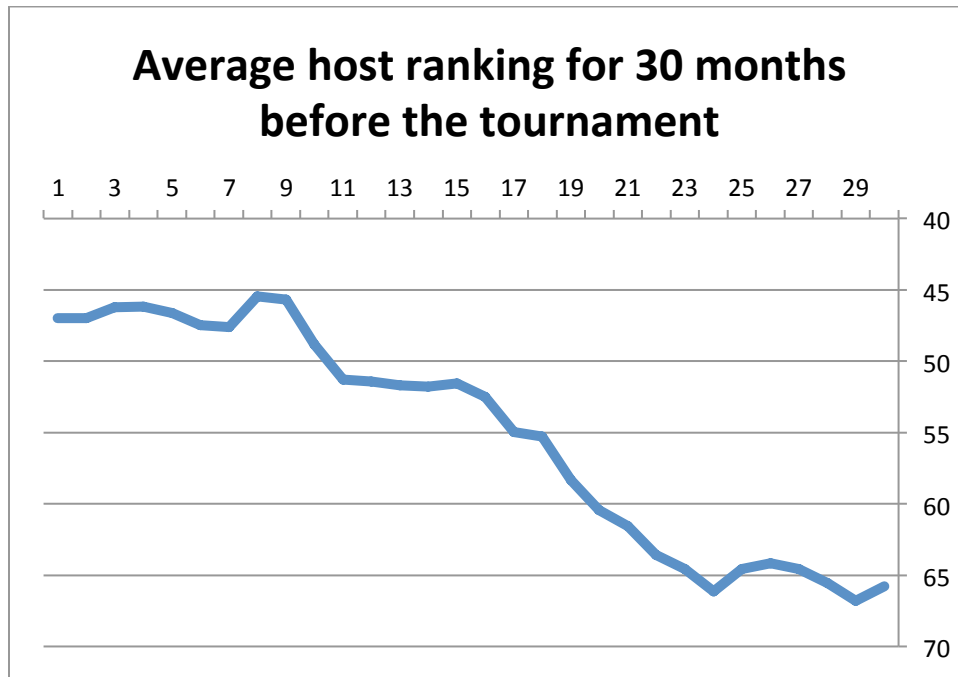
Note: n.d. for 1994 United States. Y-axis: position in the ranking; x-axis: subsequent months

starting 30 months before the tournament.

Over the first half a year little happens; then there is about 1.5 year of steep ride down; finally,

the last half a year is quiet again. The period of steepest moves coincides with a typical timing

of preliminaries; some kinks in the graph can likely be attributed to other tournaments taking

place at about that time.

The Host Effect is especially important for the host teams and their fans; non-hosts may

jump in the ranking over one or two hosts. The deterioration of the host's position negatively

affects the organizers and turns away sponsors' money. Perhaps the most salient effect is the

lowering of interest in the tournament among the fans and sponsors! When the author traveled to

Poland during Euro 2012, his casual conversation with a cabbie about the chances of the Polish

team started with a resigned statement: "Mister, they are so low in the [FIFA] ranking that

nothing will help them." Later that day, the author's father repeated this gloomy prognosis using

the same FIFA ranking to make his point. Clearly, a low position leads fans and sponsors to

underestimate their team's chances and lowers their interest in the tournament.

The Host Effect leads to substantial fluctuations in the host team's position before and

after the tournament. It contradicts the FIFA's intention that the ranking provides a universal

and objective tool for evaluating teams' strengths.[13] The low ranking of the team translates into

lower chances in the next preliminaries since the lower-ranked teams are bundled in the lower

pots for drawing, and expect facing stronger opponents.[14] The erroneous placing of hosts lowers

the ranking's power for predicting results of single matches.[15]

Offensive public comments of high-profile commentators that preceded the 2018

tournament in Russia are also nothing new. Before the 2012 Euro Cup, a typical opinion was

that of Peter Schmeichel, a former Danish goalkeeper and the coach of Manchester United, who

belittled the Polish team: „[In Euro 2012] 15 best European teams will play and also Poland – the

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13 FIFA (2012c).

14 In the preliminaries for the 2010 World Cup, CONCACAF, CAF and UEFA used FIFA rankings from various months preceding the drawing for separating teams from different pots; for 2010 World Cup the October 2009 ranking was used; for the preliminaries to the 2012 Olympics CAF used the ranking of March, 2011 (Wikipedia 2012); before the 2018 World Cup one could observe strategic behavior of some teams in order to maximize their position in the rankings.

15 The FIFA ranking's predictive power is estimated below almost all alternative rankings, including the Elo ranking (Lasek et al., 2013); Luckner et al. find that 'prediction markets' outperform the FIFA ranking in terms of forecast accuracy; the FIFA ranking was found to be somewhat accurate in predicting the success of subsets of top teams in the World Cup finals (Suzuki and Ohmori 2008) but no comparison with other methods was offered.

28th team in the ranking."[16] (Gazeta 2012). While Poland didn't make a splash in the

tournament, missing advancing higher by one goal, it soon started climbing in the ranking until it

reached its all-time high 5th in the world in 2017.

While pretending to be a "neutral" tool that promotes some objective standards in

evaluating national teams, the FIFA ranking actually disheartens host's fans and discourages the

sponsors. The flaws in the ranking are not impossible to eliminate or restrict. The obvious

solutions would be to freeze the host's position for about 1.5-2.5 year or to introduce higher

weights for friendlies played by the hosts. While the details of such arrangements introduce

certain obvious dilemmas, a sensible solution of this sort would greatly limit the negative effects

of the present formula used by FIFA.

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16 28th in Europe and 75th in the world at about the time of the interview – MMK.

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Appendix

Appendix: The hosts of World Cup, Euro (UEFA) and Asian Cup (AFC) from 1998 and their
positions in the FIFA ranking

Championship (date$_P$; date$_T$)	Host	r_P	r_T	r_{T+4}	Δ
2018 World Cup (8/16; 6/18)	Russia	38	70	n.d.	32
2014 World Cup (5/11; 5/14)	Brazil	3	4	2	1.5
2010 World Cup (9/07; 5/10)	South Africa	73	83	54	19.5
2006 World Cup (7/04; 5/06)	Germany	12	19	6	10
2002 World Cup (10/00; 5/02)	South Korea	44	40	29	3.5

2002 World Cup (10/00; 5/02)	Japan	49	32	15	0
1998 World Cup (4/96; 5/98)	France	5	18	1	15
1994 World Cup (2/92; 5/94)	United States	n.d.	23	12	11
2015 Asian Cup (1/13; 12/14)	Australia	36	100	36*	64
2011 Asian Cup (12/08; 12/10)	Qatar	84	112	92	24
2007 Asian Cup (11/05; 6/07)	Indonesia	103	143	125	29
2007 Asian Cup (11/05; 6/07)	Malaysia	116	149	142	20
2007 Asian Cup (11/05; 6/07)	Thailand	105	122	119	10
2007 Asian Cup (11/05; 6/07)	Vietnam	114	142	136	17
2004 Asian Cup (2/03: 6/04)	China	63	65	82	-7.5
2000 Asian Cup (7/99; 9/00)	Lebanon	110	110	118	-4
1996 Asian Cup (12/95; 11/96)	Un. Arab Em.	75	69	54	4.5
2016 Euro (8/14; 5/16)	France	10	21	n.d.	11
2012 Euro (7/10; 5/12)	Poland	56	65	35	19.5
2012 Euro (7/10; 5/12)	Ukraine	25	50	29	23
2008 Euro (7/06; 5/08)	Austria	60	101	71	35.5
2008 Euro (7/06; 5/08)	Switzerland	13	48	16	33.5
2004 Euro (8/02; 5/04)	Portugal	8	20	8	12
2000 Euro (8/98; 5/00)	Belgium	30	30	16	7
2000 Euro (8/98; 5/00)	Netherlands	9	21	4	14.5

1996 Euro (7/94; 5/96)	England	18	24	12	9

Note: [*]6/18 ranking instead of 1/19; n.d. – no data (too early or the ranking is not available)

$date_P$, $date_T$ – the dates for rankings at the start of preliminaries of the host's confederation and the main tournament, respectively;

r_P – last ranking before the start of preliminaries (at $date_P$);

r_T – last ranking before the tournament (at $date_T$);

r_{T+4} – first ranking (January or February) four years after the tournament year (missing data for recent hosts);

$\Delta = r_T - \frac{1}{2}(r_P + r_{T+4})$ – estimated Host Effect for individual hosts; if one of the numbers was not available, the other was used instead of the mean;

For r_P and r_T, same month or the month preceding the month of the beginning of tournament if it was unclear which ranking was the last one;

Data from the Appendix were used for calculating the averages in Tables 4 and 6, and running the regression in Table 5. Some championships had two and more hosts. Minor matches played before the main preliminaries were disregarded.

Sources: FIFA ranking (FIFA 2018a); starting dates for tournament and preliminaries: Wikipedia.