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Achim Zeileis, Christoph Leitner, Kurt Hornik

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History Repeating: Spain Beats Germany in the EURO 2012 Final

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Abstract

Four years after the last European football championship (EURO) in Austria and Switzerland, the two finalists of the EURO 2008 – Spain and Germany – are again the clear favorites for the EURO 2012 in Poland and the Ukraine. Using a bookmaker consensus rating – obtained by aggregating winning odds from 23 online bookmakers – the forecast winning probability for Spain is 25.8% followed by Germany with 22.2%, while all other competitors have much lower winning probabilities (The Netherlands are in third place with a predicted 11.3%). Furthermore, by complementing the bookmaker consensus results with simulations of the whole tournament, we can infer that the probability for a rematch between Spain and Germany in the final is 8.9% with the odds just slightly in favor of Spain for prevailing again in such a final (with a winning probability of 52.9%). Thus, one can conclude that – based on bookmakers' expectations – it seems most likely that history repeats itself and Spain defends its European championship title against Germany. However, this outcome is by no means certain and many other courses of the tournament are not unlikely as will be presented here.

All forecasts are the result of an aggregation of quoted winning odds for each team in the EURO 2012: These are first adjusted for profit margins ("overrounds"), averaged on the log-odds scale, and then transformed back to winning probabilities. Moreover, team abilities (or strengths) are approximated by an "inverse" procedure of tournament simulations, yielding estimates of all pairwise probabilities (for matches between each pair of teams) as well as probabilities to proceed to the various stages of the tournament. This technique correctly predicted the EURO 2008 final (Leitner, Zeileis, and Hornik 2008), with better results than other rating/forecast methods (Leitner, Zeileis, and Hornik 2010a), and correctly predicted Spain as the 2010 FIFA World Champion (Leitner, Zeileis, and Hornik 2010b). Compared to the EURO 2008 forecasts, there are many parallels but two notable differences: First, the gap between Spain/Germany and all remaining teams is much larger. Second, the odds for the predicted final were slightly in favor of Germany in 2008 whereas this year the situation is reversed.

Keywords: consensus, agreement, bookmakers odds, sports tournaments, EURO 2012.

1. Bookmaker consensus

In order to forecast the winner of the EURO 2012, we obtained long-term winning odds from 23 online bookmakers (see Table 2 at the end). These quoted odds of the bookmakers do not represent the true chances that a team will win the tournament, because they include the stake and a profit margin, better known as the "overround" on the "book" (for further details

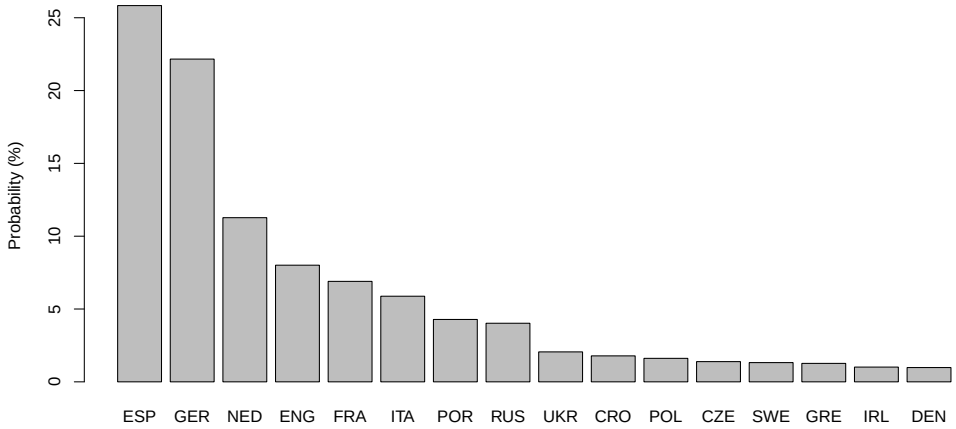

Figure 1: EURO 2012 winning probabilities from the bookmaker consensus rating.

Team	FIFA code	Probability	Log-odds	Log-ability	Group
Spain	ESP	25.8	−1.055	−2.025	C
Germany	GER	22.2	−1.256	−2.140	B
Netherlands	NED	11.3	−2.063	−2.464	B
England	ENG	8.0	−2.441	−2.654	D
France	FRA	6.9	−2.602	−2.700	D
Italy	ITA	5.9	−2.773	−2.776	C
Portugal	POR	4.3	−3.107	−2.857	B
Russia	RUS	4.0	−3.172	−2.993	A
Ukraine	UKR	2.1	−3.863	−3.158	D
Croatia	CRO	1.8	−4.009	−3.178	C
Poland	POL	1.6	−4.111	−3.332	A
Czech Republic	CZE	1.4	−4.263	−3.351	A
Sweden	SWE	1.3	−4.313	−3.266	D
Greece	GRE	1.3	−4.356	−3.375	A
Republic of Ireland	IRL	1.0	−4.582	−3.348	C
Denmark	DEN	1.0	−4.614	−3.325	B

Table 1: Bookmaker consensus rating for the EURO 2012, obtained from 23 online bookmakers. For each team, the consensus winning probability (in %), corresponding log-odds, simulated log-abilities, and group in tournament is provided.

see Henery 1999; Forrest, Goddard, and Simmons 2005). More precisely, the quoted odds are derived from the underlying "true" odds as: $\textit{quoted odds} = \textit{odds} \cdot \delta + 1$, where $+1$ is the stake (which is to be paid back to the bookmakers' customers in case they win) and $\delta < 1$ is the proportion of the bets that is actually paid out by the bookmakers. The remaining proportion $1 - \delta$ is the overround which is the main basis of the bookmakers' profits (for some illustrations see also Wikipedia 2012 and the links therein). Assuming that each bookmaker's δ is constant across the various teams in the tournament (see Leitner *et al.* 2010a, for all details), we obtain overrounds for all 23 bookmakers with a median value of 14.3%.

To aggregate the overround-adjusted odds across the 23 bookmakers, we transform them to the log-odds (also known as logit) scale where averaging (as in Leitner *et al.* 2010a) or

more generally linear modeling (as in Leitner, Zeileis, and Hornik 2011) is reasonable. The bookmaker consensus is then obtained by team-specific means on the log-odds scale (see column 4 in Table 1) and then transformed back to the associated winning probabilities (see column 3 in Table 1). The winning probabilities for all 16 participating teams are also depicted in the barchart in Figure 1.

According to the bookmaker consensus, Spain – the defending European and World champion – has the highest probability of 25.8% of winning the tournament. The expected runner-up is Germany with 22.2%. This situation gives the same final as expected and played in 2008.

The top two are followed by The Netherlands (with a winning probability of 11.3%), the runner-up of the World Cup final of 2010, and England (8%). While these teams are the "best of the rest", they are still clearly behind Spain and Germany. The teams with the lowest winning probability are the Republic of Ireland and Denmark, both with approximately 1%.

Although forecasting the winning probabilities for the EURO 2012 is the main concern in our investigation, there is also interest in the team abilities underlying the bookmakers' expectations. The tournament schedule was already known at the time the bookmakers odds were retrieved, and hence should be included in the expectations about the outcome of the tournament. To strip the "tournament effects" from this measure, we employ an "inverse" application of tournament simulations using team-specific abilities. The idea is:

1. If team abilities (or strengths) are available, pairwise winning probabilities can be derived for each possible match (see Section 2).

2. Given pairwise winning probabilities, the whole tournament can be easily simulated to see which team proceeds to which stage in the tournament and which team finally takes the victory.

3. Such a tournament simulation can then be run sufficiently often (here 100,000 times) to obtain relative frequencies for each team winning the tournament.

Here, we use an iterative approach to find team abilities so that the corresponding simulated winning probabilities (from 100,000 runs) closely match the bookmaker consensus probabilities. See Leitner *et al.* (2010a) for the details of this method. The resulting team abilities for the EURO 2012 are shown, for comparison reasons, as log-abilities (on the log-odds scale) in Table 1.

For the simulations, the whole tournament schedule is implemented: The 16 teams are drawn into four groups, labeled A, B, C, and D (see Table 1). Each group of four plays a round-robin (six matches within the group) and the top two teams in each group advance to the quarter-final, where the winner of group A plays against the second best team of group B (first quarter-final) and the winner of group B plays against the second best team of group A (second quarter-final). Analogously, the winner of group C plays against the second best team of group D (third quarter-final) and the winner of group D plays against the second best team of group C (fourth quarter-final). The four winners of the quarter-finals reach the semi-finals, where the winner of the first quarter-final plays against the winner of the third one and the winner of the second quarter-final plays against the winner of the fourth. The winners of the semi-finals then play the final and the winner of the final is the European football champion 2012.

2. Pairwise comparisons

A classical approach to the modeling of winning probabilities in pairwise comparisons (i.e., matches between teams/players) is that of Bradley and Terry (1952). It is also similar to the ideas of the Elo rating (Elo 2008) which is popular in sports. The Bradley and Terry (1952) approach models the probabilitiy that a Team A beats a Team B by their associated abilities (or strengths) as

$$\Pr(A \text{ beats } B) = \frac{ability_A}{ability_A + ability_B}.$$

As explained in Section 1, the abilities for the teams in the EURO 2012 have been chosen such that when simulating the whole tournament with these pairwise winning probabilities

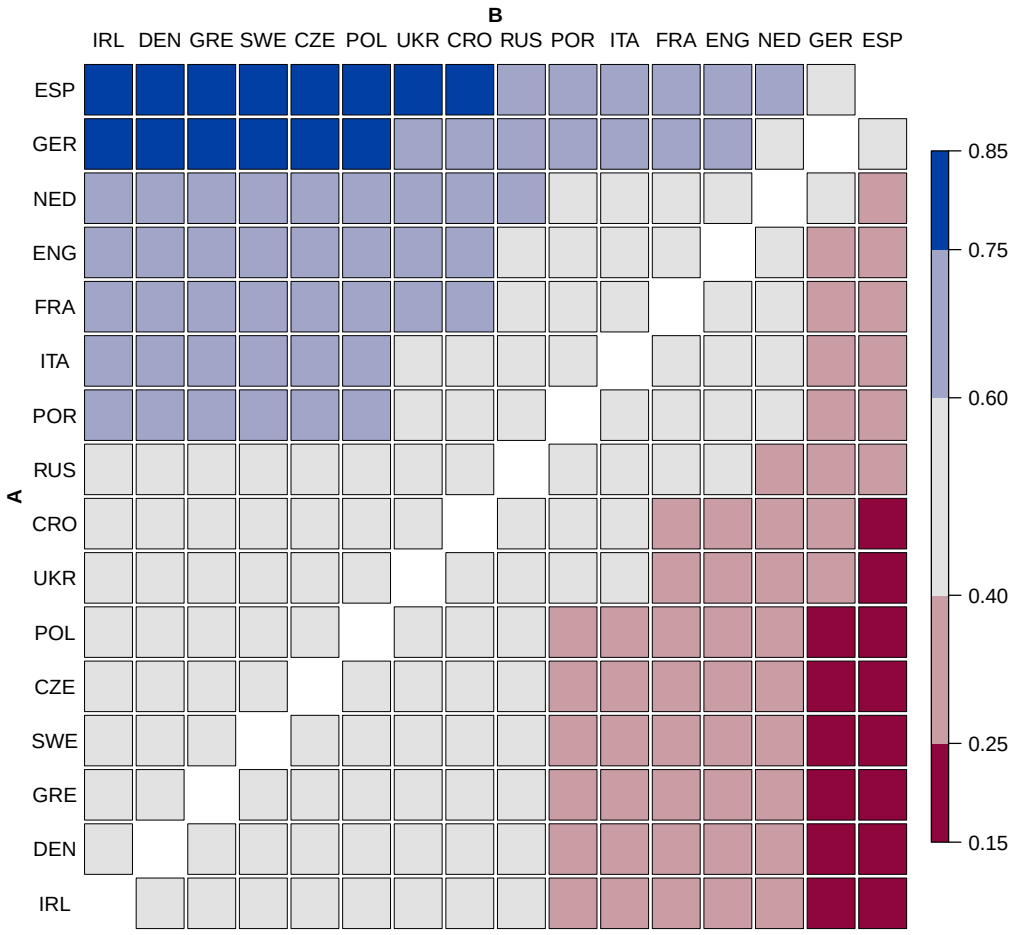

Figure 2: Winning probabilities in pairwise comparisons of all EURO 2012 teams. Light gray signals that either team is almost equally likely to win a match between Teams A and B (probability between 40% and 60%). Light and dark blue, respectively, correspond to a moderate (60% to 75%) or clear (75% to 85%) winning probability in favor of Team A. Vice versa, light and dark red correspond to moderate and clear advantages for Team B, respectively.

$\Pr(A \text{ beats } B)$, the resulting winning probabilities for the whole tournament are close to the bookmaker consensus winning probabilities (see Table 1).

Table 1 provides the log-abilities for all teams and the implied pairwise winning probabilities are visualized in Figure 2. This shows that Spain would have very high winning probabilities (between 75% and 85%) in matches against the eight weaker teams in the tournament, and still moderately large winning probabilities (between 60% and 75%) in matches against the next six stronger teams. Spain's strength is only roughly matched by Germany with an associated winning probability of 52.9%. Furthermore, Germany's team is also rather strong with very high winning probabilities against six teams, moderately high probabilities against seven teams, and comparable in strength only to Spain and The Netherlands. The latter, however, could be important because The Netherlands are playing in the same group (B) as Germany. Finally, it is worth pointing out that among the weaker nine teams (from Russia to Ireland), there are no clear favorites: all teams have roughly comparable abilities resulting in winning probabilites between 40% and 60% for all possible matches.

3. Performance throughout the tournament

As pointed out above, using the pairwise comparison approach from Section 2 and the abilities implied by the bookmaker consensus rating (see Table 1), the whole tournament can be simulated. From 100,000 tournament runs we can obtain estimates for the expected performance of each team throughout the tournament. More specifically, we obtain probabilities for each team to "survive" over the tournament, i.e., proceed from the group-phase to the quarter-finals, semi-finals, the final and to win the tournament. The latter simulated winning probabilities for the tournament then match the bookmaker consensus winning probabilities.

Figure 3 depicts these "survival" curves for all 16 teams within the groups they were drawn in. One can see that whereas the groups B, C and D have more or less clear favorites for surviving the group-phase, group A has no clear favorites. Also, for the teams from group A the probability to proceed to the semifinals is extremely low because they have to face teams from the strong group B in the quarter-finals. Conversely, the survival curves of Germany and The Netherlands are rather flat for proceeding from quarter- to semi-finals as they will face a relatively weak oppenent. Furthermore, the situation in group D is particularly exciting because the group's favorites (England and France) are extremely close and it will be very interesting to see which team can avoid facing the expected group C winner Spain in the quarter-finals already.

From these considerations it is rather clear that the teams' abilities are not evenly distributed across the four groups. In particular, there was some debate in the media about Germany having to play a much stronger group than Spain. To provide some further insights into these group effects resulting from the tournament draw, Figure 4 shows the average log-ability of the teams in each group, excluding the group favorite (and centered by the median log-ability). Thus, team Germany has to play against much stronger opponents than Spain or England while Russia is the favorite in the weakest group (as judged by the bookmakers). Clearly, Germany has to face the strongest group but will play against a team from the weakest group in the quarter-finals (provided they proceed to that stage). Hence, it is not much harder for Germany to proceed to the final than for Spain.

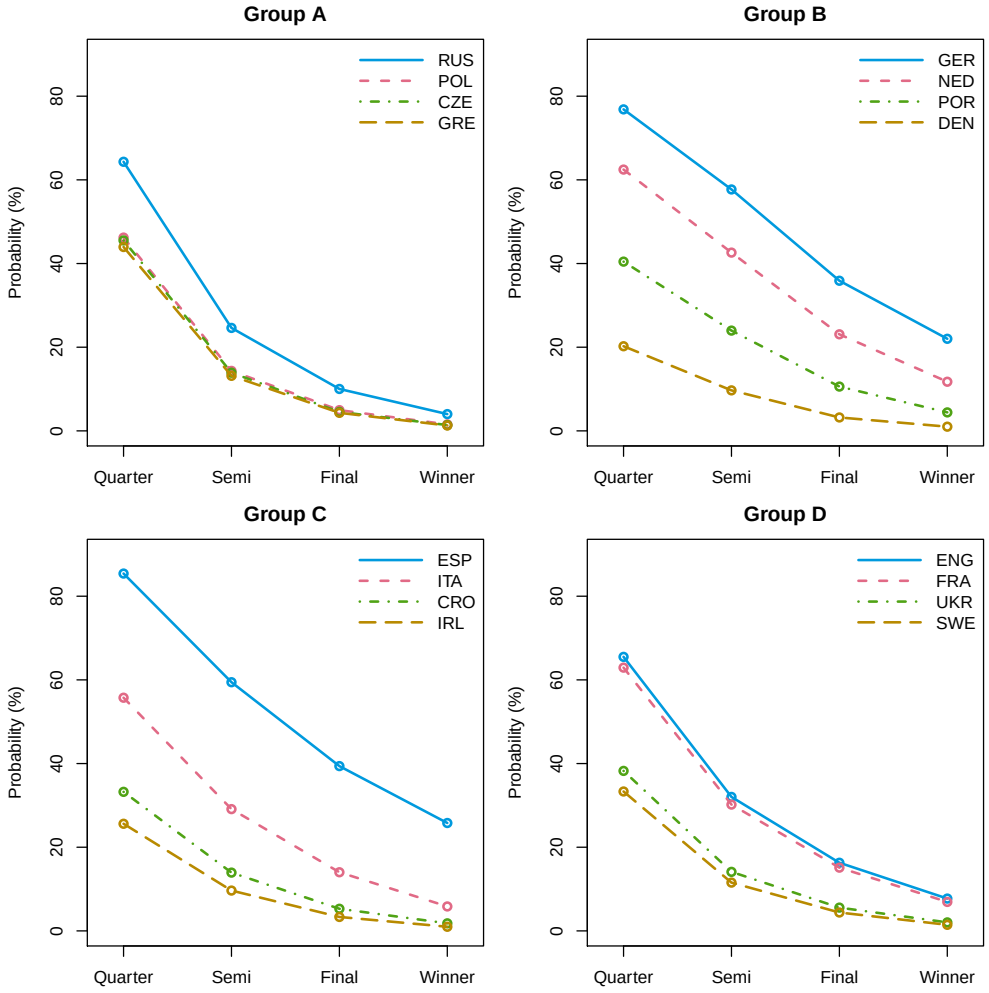

Figure 3: Probability for each team to "survive" in the EURO 2012, i.e., proceed from the group-phase to the quarter finals, semi-finals, the final and to win the tournament.

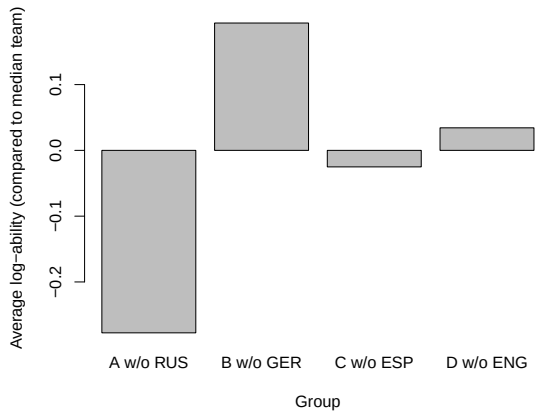

Figure 4: Group strengths. Average log-ability within each group, excluding the group favorite and centered by median log-ability across all teams.

4. Conclusions

Bookmakers can be regarded as experts in assessing the outcomes of sports tournaments. They have to judge all possible outcomes and assign odds to them – doing a poor job (i.e., assigning too high or too low odds) will cost them money. Hence, we base our forecasts for the EURO 2012 tournament on the expectations of 23 such experts. We (1) adjust the quoted odds by removing the bookmakers' overrounds, (2) derive a consensus rating by averaging on a suitable scale and then transforming to probabilities, (3) infer the corresponding tournament-draw-adjusted team abilities using a classical pairwise-comparison model. This bookmaker consensus model allows for a variety of probability forecasts for various events of interest in the EURO 2012 tournament.

Not surprisingly, these forecasts are related to other rankings of the teams in the EURO 2012, notably the FIFA and Elo ratings. However, while being correlated to both (Spearman rank correlation of 0.65 with the FIFA and 0.815 with the Elo rating), the bookmaker consensus model provides offers two advantages: It provides winning and "survival" probabilities for the tournament and performed very well at the EURO 2008 (Leitner *et al.* 2010a).

Needless to say, of course, that all predictions are in probabilities that are far from being certain (i.e., much lower than 100%). While Spain beating Germany is the most likely event in the bookmakers' expert opinions, many other outcomes are not unlikely as well which will hopefully make the EURO 2012 the exciting event that football fans worldwide are looking forward to.

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	ESP	GER	NED	ENG	FRA	ITA	POR	RUS
bwin	3.75	3.75	8.0	13.0	12.0	13.0	17	23
X10Bet	3.25	3.70	8.0	9.7	12.5	15.0	20	20
X888sport	3.50	4.00	8.0	11.0	13.0	15.0	21	19
bet365	3.50	4.00	8.5	10.0	13.0	15.0	21	21
BETFRED	3.50	4.00	7.5	11.0	13.0	15.0	21	21
betinternet	3.25	4.00	7.5	9.0	13.0	15.0	19	21
BETVICTOR	3.50	3.75	7.5	10.0	13.0	15.0	21	23
BLUESQ	3.50	4.00	8.0	11.0	13.0	15.0	21	19
bodog	3.60	4.33	8.0	11.0	13.0	15.0	21	23
Boylesports	3.50	4.33	8.5	12.0	13.0	15.0	19	21
corbettsports	3.25	4.00	8.0	11.0	13.0	15.0	21	21
Ladbrokers	3.50	4.00	8.0	10.0	12.0	13.0	21	21
PaddyPower	3.50	4.50	8.0	11.0	13.0	15.0	19	21
Panbet	3.50	4.33	7.0	11.0	15.0	15.0	21	18
SkyBET	3.50	4.00	7.5	11.0	12.0	15.0	21	21
sportingbet	3.50	4.00	7.5	11.0	12.0	13.0	19	21
SPREADEX	3.25	4.00	7.0	11.0	9.5	16.0	19	26
StanJames	3.50	4.00	7.5	11.0	13.0	15.0	21	21
totesport	3.50	4.00	7.5	11.0	13.0	15.0	21	21
UNIBET	3.70	3.75	8.0	12.5	11.0	16.0	20	25
WilliamHILL	3.25	4.00	8.0	9.0	13.0	15.0	21	21
BETDAQ	3.70	4.40	8.2	13.0	14.0	15.5	22	27
betfair	3.80	4.30	8.4	13.0	14.0	16.0	22	26
	UKR	CRO	POL	CZE	SWE	GRE	IRL	DEN
bwin	41	41	41	67	51	67	81	81
X10Bet	43	41	53	53	70	66	76	81
X888sport	41	51	67	67	81	67	101	101
bet365	41	41	51	51	51	67	81	81
BETFRED	41	51	67	51	67	67	81	81
betinternet	34	41	51	51	67	67	67	81
BETVICTOR	41	51	67	67	51	81	101	101
BLUESQ	41	51	67	67	81	67	101	101
bodog	41	51	51	67	67	81	101	81
Boylesports	41	51	51	67	67	67	81	81
corbettsports	41	51	51	67	67	67	101	101
Ladbrokers	41	51	51	67	67	51	101	101
PaddyPower	41	41	51	51	67	81	81	101
Panbet	34	41	51	51	67	67	67	81
SkyBET	41	41	51	51	67	67	67	81
sportingbet	41	51	51	67	67	81	101	101
SPREADEX	41	51	34	81	51	41	101	67
StanJames	51	51	51	51	67	51	51	67
totesport	41	51	67	51	67	67	81	81
UNIBET	50	50	50	75	65	80	100	80
WilliamHILL	41	51	51	51	67	67	81	101
BETDAQ	56	66	66	100	72	90	90	112
betfair	55	65	65	100	80	95	110	110

Table 2: Quoted odds from 23 online bookmakers for all teams in the EURO 2012. Obtained on 2012-05-09 from http://www.oddscomparisons.com/football/european-championship/ and http://www.bwin.com/, respectively.

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Abstract
Four years after the last European football championship(EURO) in Austria and Switzerland, the two finalists of the EURO 2008 - Spain and Germany - are again the clear favorites for the EURO 2012 in Poland and the Ukraine. Using a bookmaker consensus rating - obtained by aggregating winning odds from 23 online bookmakers - the forecast winning probability for Spain is 25.8% followed by Germany with 22.2%, while all other competitors have much lower winning probabilities (The Netherlands are in third place with a predicted 11.3%). Furthermore, by complementing the bookmaker consensus results with simulations of the whole tournament, we can infer that the probability for a rematch between Spain and Germany in the final is 8.9% with the odds just slightly in favor of Spain for prevailing again in such a final (with a winning probability of 52.9%). Thus, one can conclude that - based on bookmakers'expectations - it seems most likely that history repeats itself and Spain defends its European championship title against Germany. However, this outcome is by no means certain and many other courses of the tournament are not unlikely as will be presented here.
All forecasts are the result of an aggregation of quoted winning odds for each team in the EURO 2012: These are first adjusted for profit margins (överrounds"), averaged on the log-odds scale, and then transformed back to winning probabilities. Moreover, team abilities (or strengths) are approximated by an ïnverse"procedure of tournament simulations, yielding estimates of all pairwise probabilities (for matches between each pair of teams) as well as probabilities to proceed to the various stages of the tournament. This technique correctly predicted the EURO 2008 final (Leitner, Zeileis, Hornik 2008), with better results than other rating/forecast methods (Leitner, Zeileis, Hornik 2010a), and correctly predicted Spain as the 2010 FIFA World Champion (Leitner, Zeileis, Hornik 2010b). Compared to the EURO 2008 forecasts, there are many parallels but two notable differences: First, the gap between Spain/Germany and all remaining teams is much larger. Second, the odds for the predicted final were slightly in favor of Germany in 2008 whereas this year the situation is reversed.

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