

DISCUSSION PAPER SERIES

No. 7873

**COUNTRY-SPECIFIC GOAL-SCORING
IN THE "DYING-SECONDS" OF
INTERNATIONAL FOOTBALL
MATCHES**

Jan C. van Ours and Martin Van Tuijl

LABOUR ECONOMICS



Centre for Economic Policy Research

www.cepr.org

Available online at:

www.cepr.org/pubs/dps/DP7873.asp

COUNTRY-SPECIFIC GOAL-SCORING IN THE "DYING-SECONDS" OF INTERNATIONAL FOOTBALL MATCHES

**Jan C. van Ours, CentER, Tilburg University, University of Melbourne and
CEPR
Martin Van Tuijl, Tilburg University**

Discussion Paper No. 7873
June 2010

Centre for Economic Policy Research
53–56 Gt Sutton St, London EC1V 0DG, UK
Tel: (44 20) 7183 8801, Fax: (44 20) 7183 8820
Email: cepr@cepr.org, Website: www.cepr.org

This Discussion Paper is issued under the auspices of the Centre's research programme in **LABOUR ECONOMICS**. Any opinions expressed here are those of the author(s) and not those of the Centre for Economic Policy Research. Research disseminated by CEPR may include views on policy, but the Centre itself takes no institutional policy positions.

The Centre for Economic Policy Research was established in 1983 as an educational charity, to promote independent analysis and public discussion of open economies and the relations among them. It is pluralist and non-partisan, bringing economic research to bear on the analysis of medium- and long-run policy questions.

These Discussion Papers often represent preliminary or incomplete work, circulated to encourage discussion and comment. Citation and use of such a paper should take account of its provisional character.

Copyright: Jan C. van Ours and Martin Van Tuijl

June 2010

ABSTRACT

Country-specific goal-scoring in the "dying-seconds" of international football matches*

This paper investigates whether there are country-specific characteristics in goal-scoring in the final stage of important international football matches. We examine goal-scoring from 1960 onwards in full 'A' international matches of six national teams: Belgium, Brazil, England, Germany, Italy and the Netherlands. We analyze qualifying matches for the European Championship and World Cup and the matches at the final tournaments of these two events, the Copa America and the Confederations Cup. We find that the national teams of Germany, England and the Netherlands are more likely than the three other national teams to score in the last minute -- including stoppage time. However, for Germans this comes at a cost. Germany is more likely to concede a goal in the dying seconds of a match than other countries. During our period of analysis, the national teams of Brazil and Italy only conceded one goal in the last minute. As to winning penalty shootouts, Germany outperforms the other five countries.

JEL Classification: J44

Keywords: football, goal-scoring and national team matches

Jan C. van Ours
CentER
Tilburg University
Room K415
PO Box 90153
5000 Le Tilburg
THE NETHERLANDS
Email: vanours@uvt.nl

Martin Van Tuijl
Department of Economics
Tilburg University
NETHERLANDS

Email: m.a.vantuijl@uvt.nl

For further Discussion Papers by this author see:
www.cepr.org/pubs/new-dps/dplist.asp?authorid=121886

For further Discussion Papers by this author see:
www.cepr.org/pubs/new-dps/dplist.asp?authorid=172165

* The authors thank Willemijn van den Berg for helpful research assistance.

Submitted 25 May 2010

1 Introduction

There are clear analogies between sports economics and labor economics. As Kahn (2000) indicates professional sports offers a unique opportunity for labor market research, for example to establish the impact of incentives on behavior. According to Szymanski (2003) sports provide information about labor market behavior. Winning a sporting contest depends on relative, not on absolute performance. Talent will migrate to wherever it is most valued. This general rule may apply to club teams, but, apart from some naturalization it does not apply to national teams. National teams are different from club teams. Players are not bought and sold; their eligibility to play depends on their nationality. Once a player has represented a country by playing for the national ‘A’ team in a non-friendly match, the player is not allow to play in a different national team. Thus, national teams have more or less exogenously given resources as the labor market for players is restricted on the basis of nationality.

Playing for the national ‘A’ team is never the main job. However, there are clear incentives to participate in national teams because the market value, i.e. earnings capacity goes up once a player has been selected for a national team. Furthermore, it is usually considered such an “honor” to be chosen that hardly any player declines an invitation. So, one would expect that the performance of national teams is related to talent skills and not to incentives. The common element within a team is the team spirit since (most) players share the same “national identity” whatever this may be. In our paper we investigate country-specific goal-scoring in important international football matches. We focus on goal-scoring in the “dying seconds” because there the national identity becomes apparent. Italian teams are well-known for their defensive tactics, while Brazilian and Dutch teams are famous for their beautiful style of play while Germans have built a reputation of persistence and conviction never to give up before the “final whistle”.

The link between goal-scoring behavior of football players and behavior of individual workers is not straightforward. Whereas in the case of goal scoring in the last minute there is almost an immediate effect of effort on results for common workers this is less obvious. Workers putting in effort in their job will not immediately experience the results from this effort. Nevertheless, from our paper it will become clear that national identity influence the behavior of football players. When explaining cross-country differences in economic

performance this may be taken into account.

We investigate the goal-scoring in the last minute(s) of football matches by analyzing goal-scoring in more than 1500 important football matches which the national teams of Belgium, Brazil, England, Germany, Italy and the Netherlands played since 1960.¹ These matches included qualifiers for the European and World Cup, and matches at the final tournaments of either of these two events, the Copa America and the Confederations Cup.

Table 1 shows the importance of these countries in international football in the past five decades. Three are *big* football countries who won the World Cup several times – Brazil four times, Germany and Italy both twice. These countries also finished as runner-up at other occasions – Germany four times, Italy twice. The Netherlands have an *intermediate* status as they won the European Championship in 1988 and reached the final of the World Cup twice (in 1974 and 1978). The other two countries are *small* football countries, who only reached a final once in the past 50 years, England in 1966 winning the World Cup and Belgium in 1980 losing the European Championship final.

The set-up of our paper is as follows. In section 2 we provide anecdotal evidence of the importance of goal-scoring in the final minutes of important international football matches. Section 3 briefly discusses previous studies. Section 4 gives a description of our data and presents parameter estimates. As we show, our empirical analysis indicates that there is indeed evidence of German goal-scoring in the final stages of football matches not being just a myth. We also provide evidence of a home advantage. National teams that play at home are more likely to score goals and more likely to win their matches. Section 5 presents information from penalty shootouts. In Section 6 we explain our findings and conclude.

2 Anecdotal evidence

Other than one might think, the ability to score goals in the last minutes is not randomly distributed across countries. There is abundant anecdotal evidence on this, especially regarding the impressive performance of the German national team. As Gary Lineker has

¹The four continental European countries are praised for their contribution to the development of football tactics (Kuper and Szymanski, 2009). England is the country where professional football started. Brazil plays football beyond comprehension.

stated: “Football is a simple game; 22 men chase a ball for 90 minutes and at the end, the Germans win.”² Michel Platini, the current chairman of the UEFA (Union of European Football Associations) once said: “When the Germans play well they become world champion; if they play poor they reach the final.”³ The German success is partly owing to their ability to score goals in the final minutes, which provoked the Dutch comedian Youp van ’t Hek to the statement that “Germans are only defeated when the bus has taken them out of town.” Vergouw (2006) presents an analysis of the myths surrounding the (West-)German national team. One of these myths is that, in crucial matches, the Germans often score in the final minute.

The first occasion on which the (West-)German national football team decided an important match in the final stages was the 1954 World Cup final in Bern (Switzerland). Attacker Helmut Rahn scored the winning goal (3-2) against Hungary in the eighty-fifth minute. After only eight minutes, the “Mighty Magyars” had been ahead 2-0. Even this early Hungarian lead did not prevent West-Germany from winning their first World Cup. Some commentators even consider this event as the true beginning of the new Federal Republic of Germany after the second World War. The general feeling that the Federal Republic of Germany was to be taken serious again boosted confidence and was a stimulus to the miraculous post-war economic development, the so called “Wirtschaftswunder”

²Gary Lineker (1960) played as a striker for Leicester City FC, Everton FC, FC Barcelona, Tottenham Hotspur FC and Nagoya Grampus Eight. He scored 282 goals in 567 official club matches, as well as 48 goals in 80 appearances for England. Lineker has won the European Cup Winners’ Cup with FC Barcelona (1989). With the English national team, he reached the semi-finals of the 1990 World Cup, in which they were beaten by West-Germany, after a penalty shoot-out. On this occasion, he is supposed to have made the cited statement. Nowadays, Lineker is the anchor man of the BBC program *Match of the Day*, which broadcasts highlights of Premier League matches.

³Michel Platini (1955) played for AS Nancy-Lorraine, AS Saint-Etienne and Juventus FC. Platini has won the European Cup (1985) and the European Cup Winners Cup with Juventus (1984). With the French national team, he won the European Championship in 1984, while reaching the semi-finals of the World Cup in 1982 and 1986. On both occasions, West-Germany dashed the French World Cup dreams, in 1982, via a penalty shoot-out, in 1986, by a victory in regular time. Platini was voted European Footballer of the Year a record three times (shared with Johan Crujff and Marco van Basten). He managed France during a successful qualification campaign for Euro 1992. Disappointing results in the final tournament induced him to resign. Since January 2007, he has been the president of the UEFA, the Union of European Football Associations.

(Heinrich, 2003).

Thirty-six years later, West-Germany won their third World Cup by beating Argentina, captained by Maradona, in the final in Rome. Defender Brehme scored the decisive goal from the penalty spot, again in the eighty-fifth minute. Only the second World Cup win, in 1974 in Munich against the Netherlands, did not require a late decision. However, striker Gerd Müller scored the winning goal just two minutes prior to the end of the first half. Once more, the Germans had caught their opponents by surprise when the latter thought that the match was almost over.

In the course of history, (West-)Germany also lost four World Cup finals, viz. in 1966, 1982, 1986 and 2002. The 1966 World Cup final is, of course, most of all famous for the dubious third England goal, in Germany still indicated as the *Wembley Tor*. However, the Germans scored a crucial goal in the last minute of a match. Home-country England were leading by 2-1 and were close to victory in the World Cup, when defender Wolfgang Weber scored the equalizer. Nevertheless, England won the World Cup, with striker Geoff Hurst scoring two goals in extra time. In 1986, Argentina were still trailing West-Germany 2-0 after three fourths of the match, but attacker Karl-Heinz Rummenigge and striker Völler restored German hopes. However, now the German national team lost a World Cup final in the eighty-fifth minute, as Burruchaga did not let the great chance provided by Maradona slip away.

During the preliminary matches for the 1970 World Cup, West-Germany were about to lose a costly point away in Cyprus, on November 23, 1968. However, striker Gerd Müller scored the winning goal in the final minute, thus preventing a major German failure. Italy were trailing West-Germany 1-0 one minute from the end of the match in the semi-final of the 1970 World Cup in Mexico. The Italians already thought they had reached the World Cup final, when defender Schnellinger equalized. Two things are remarkable about this goal. First, this (West-)German player had earned his income in the Italian serie A during the preceding seven years, playing for Mantova, AS Roma and AC Milan. Second, this was the first and, as it turned out later, only international goal of the solid defender. Yet, the Italians still reached the final, beating West-Germany 4-3 after extra time.

In the European Championship final in 1976 in Belgrade, Czechoslovakia were trailing (West-)Germany 2-0 after twenty-five minutes. Via Dieter Müller, Germany soon scored

the catching-up goal, but attacker Hölzenbein only equalized in the very last minute of the match. No goals were scored in extra time. Czechoslovakia beat West-Germany in the penalty series (5-3), the only time the Germans ever lost in a penalty shootout during a major tournament.

A decade later, France were caught by surprise, viz. by an early goal from defender Brehme in the semi-final of the World Cup in Mexico in 1986. However, the decision in this match came from a goal by striker Völler in the last minute. Just like in 1982, the (West-)Germans had blocked the French entry into the final.

As a re-unified country Germany entered Euro 1992 in Sweden as world champions and favorites for the title. Yet, in the first match they were 0-1 behind against the Commonwealth of Independent States, the first successor to the Soviet-Union. Midfielder Hässler prevented the upset defeat by a last-minute goal from a free-kick. In the fall of 1997, the Germans played some nerve-breaking preliminary matches for the 1998 World Cup. For example, underdogs Albania were only beaten 4-3 by a last minute goal by striker Bierhoff.

At the end of the 2002–003 season, Germany had to travel to the Faærøer Islands for a preliminary match for the European championship 2004. After 88 minutes, the score was still 0-0 and one of the greatest upsets in football history was about to take place. The strikers Klose (89th minute) and Bobic (in injury time) led the Germans to a narrow escape. Striker Neuville had already scored to eliminate Paraguay in the 2002 World Cup in Japan and South-Korea two minutes before time. He again scored the winner, now really in the final minute, in the second group match against Poland in the 2002 World Cup at home.

The semi-final between Germany and Turkey during Euro 2008 was a hectic match. Turkey took the lead, then Germany equalized, Germany seemed to have decided the match eleven minutes before the end, but then Turkey equalized in the eighty-sixth minute. However, right-footed left-back Lahm opened the door to the final for Germany in the last minute.

The successes of the German national team are sometimes attributed to German attitude and planning: “The German national team plays the way its general staff prepared for the war; games are meticulously planned, each player skilled in both attack and de-

fense. Intricate pass patterns evolve, starting right in front of the German goal. Anything achievable by human foresight, careful preparation and hard work is accounted for. (...) At the same time, the German national team suffers from the same disability as the famous Schlieffen plan for German strategy in World War I. There is a limit to human foresight; psychological stress on those charged with executing excessively complex maneuvers cannot be calculated in advance. If the German team falls behind, or if its intricate approach yields no results, its game is shadowed by the underlying national premonition that in the end even the most dedicated effort will go unrewarded, by the nightmare that ultimately fate is cruel - a nightmare reinforced by the knowledge that the German media are unmerciful when high expectations go unfulfilled. The impression is unavoidable that an outstanding national soccer team has not brought a proportionate amount of joy to a people that may not in its heart of hearts believe joy is the ultimate national destiny” (Kissinger, 1986).

While the first citation may make sense, the second quote may be stretching the evidence too much. No team seems to have come back from a desperate position to get victory or at least a shot at survival as frequently as the Germans. One should remember the 1954 World Cup final against Hungary, the 1966 World Cup final against England, the World Cup quarter final against the same opponent in 1970, the semi-final of the European Championship against Yugoslavia in 1976, the final of the same tournament against Czechoslovakia, the semi-final against France in 1982 World Cup, the final against Argentina in the 1986 World Cup, as well as the group match against Yugoslavia in the 1998 World Cup. All opponents were trailing by two goals, but the Germans gave them at least a very hard time to secure victory.

3 Previous studies

Houston and Wilson (2002) study international football achievement of national teams using the FIFA world ranking of June 1999 as indicator. Using data from 179 countries, they find that per capita GDP has a positive but diminishing effect achievement. Furthermore, population size and World Cup appearance have positive effects on football achievement. The positive effect of population is related to the increased probability of having high skilled football players in larger populations. The number of World Cup appearances is

an indicator of a “learning curve”.

Hoffmann *et al.* (2002) examine the determinants of international football performance using FIFA ranking for 76 countries. This ranking is calculated on a monthly basis using the performance of a given country in all international matches, including friendly matches, over the previous eight years. Points are awarded on the basis of the games’ results, goals scored, strength of the opponents, importance and venues of the matches (home or away). They find a positive but diminishing effect of per capita GDP.

Macmillan and Smith (2007) replicate Hoffmann *et al.* (2002) using a larger sample confirming earlier results of per capita GDP, size of population and experience in international matches to be important. As an alternative to the FIFA ranking they use the so called “Elephant ranking”, which excludes friendly games and is based on results in the World Cup and Continental Championships including qualifiers. The effect of the main explanatory variables is quite identical.

Since July 2006 the FIFA ranking is the sum of the current year performance and a three-year weighted average of previous annual performances. Annual performance is measured by average points per game, which are determined by the outcome and the importance of the match, the strength of the opponent and the strength of regional confederation. Leeds and Leeds (2009) use the new ranking to investigate how it is affected by country-specific differences, finding similar results as before; it helps to be big in terms of population and rich in terms of per capita GDP.

Kuper and Szymanski (2009) explain why the Dutch national team have a better performance than the English national team. Both national teams are not terribly successful but “whereas the Netherlands die in beauty, England just dies”. They perform an analysis of (net) goal-scoring based on the effect of population size, per capita income and football experience on football performance using data from 189 countries. Then they calculate how England and the Netherlands real scores compare to the predicted scores from their cross-country analysis. They find that England does better than expected but not as much better as the Netherlands does. Only Brazil does even better than the Netherlands. Kuper and Szymanski conclude that England does better than one would expect conditional on the size of their population and per capita GDP. Conditional on its small population, compared to for example Germany, Italy or Brazil, England does not underperform, it

simply could not have done much better.

There is also research on the home advantage of football teams. Pollard and Pollard (2005) providing a review of studies conclude that although there is clear evidence of a home advantage in football, the causes of this advantage is not clear. It could be crowd support although it not exactly clear how this works. A possible explanation is that the noise of a home crowd is a cause of referee bias. However, in football matches between national teams top-referees are selected which are probably less vulnerable to this. It could simply be that the home advantage is psychological although this is hard to establish.

4 Data and empirical analysis

4.1 Data

Table 2 gives an overview of our information from 1564 country matches.⁴ Clearly the number of matches increases over time. Whereas in the 1960s there were 180 matches in the 1990s there were 346 matches. The increase in matches is partly related to a change in set-up of the World Championship and the European Championship causing teams to play more games. For example initially the World Championship had 16 teams participating, from 1982 onwards this was 24 and from 1998 onwards 32 teams compete at the tournament. Similarly, the number of nations competing in the final tournament of the European Championship was increased from 4 to 8 in 1980 and to 16 in 1996. Furthermore, with the collapse of the former communist regimes in Eastern Europe the number of countries has expanded a lot. The lowest number of matches is available for Belgium (228) and Brazil (240). Germany provides the highest number of matches (344), which has to do with the fact that until 1990 Germany consisted of two countries with their own national team. Approximately 1 in 3 matches is a home match.

Table 3 shows the importance of scoring in the last minute or in the last five minutes. On average in 4.0 percent of the 1564 available matches a goal is scored in the last minute (13.9 percent in the last five minutes), while in 1.9 percent of the matches the countries got a goal against (6.8 percent in the last five minutes). Clearly the countries in our sample

⁴The data on the various matches in our sample are from various web-sites: Belgium: www.footbel.com; Brazil: br.sambafoot.com; England: www.thefa.com; Germany: www.dfb.de; Italy: www.figc.it; Netherlands: www.voetbalstats.nl.

predominantly have strong football teams as in the last time periods the number of goals scored always exceed the number of goals incurred. The exception is Belgium who in 228 matches only have scored six goals in the last minute but also conceded half a dozen goals in the last minute. From table 3 some confirmation about the validity of the German goal-scoring myth may be derived. Whereas in 4.0 percent of all matches a goal is scored in the last minute, German teams succeed to do this in 5.5 percent of their matches. Note, however, that the Netherlands have even scored in the last minute in 5.9 percent of their matches.

Dobson and Goddard (2001) argue that scoring rates tend to increase with the duration of the match elapsed. A possible explanation is that players tend to get tired as matches progress, increasing the likelihood of mistakes and therefore goals. An alternative explanation is that the scoring rate increases because of the rise in the probability of the scores being unequal. Table 4 shows the intensities by which goals are scored and conceded over the evolution of 90 minutes matches. In the first quarter goals are scored with an intensity of 1.7 percent per minute, while they are conceded with 0.7 percent per minute. These frequencies go up in the second quarter of the matches. However, the average goal-scoring intensity in the second quarter of the matches is as high as the goal-scoring intensity between the 76th and the 85th minute of the match, 2.1 percent per minute. The goal-conceding intensity increases gradually from 0.8 percent per minute in the second quarter to 1.2 percent per minute between the 76th and the 85th minute of the match. In other words, we hardly find an increase in the scoring rates as the matches evolve. It is possible that the quality of the players in the national teams is so high that they do not get as tired towards the end of the game as is the case in domestic league games where the average quality of the players is substantially lower. Nevertheless, the goal-scoring and goal-conceding intensities are somewhat higher in the 86th to the 89th minute and substantially higher in the last minute of the matches, an intensity of 3.9 percent for goals scored and 1.8 percent for goal conceded.⁵

Figure 1 shows the evolution of goal-scoring over the duration of the match for the separate countries. Clearly, all countries score more goals than they concede, although

⁵Of course, this has to do with the fact that hardly any game lasts exactly ninety minutes, as usually extra time is added. However, the same happens and the end of the first half, which rarely lasts exactly forty-five minutes. The higher goal-scoring and goal-conceding rates are typical end-of-match phenomena.

for Belgium the differences between goal-scoring and goal-conceding are small. As shown, for every country except Brazil and Italy, the goal-scoring intensity is higher in the last minute than it is in the four minutes before that. Also, for every country except for Italy and Brazil, the goal-conceding intensity in the last minute is lower than in the four minutes before that. The increase in the goal-scoring intensity in the last minute is very large in the England, Germany and the Netherlands. For Germany, there is a parallel increase in the goal-scoring rate and the goal-conceding rate in the last minute. We will analyze the goal-scoring and goal-conceding intensities in more detail below.

4.2 Parameter estimates exploratory analysis

We present simple and straightforward linear models to explain the probability to score in the last minute (last five minutes) of a game or conceding a goal in the last minute (last five minutes). Panel *a* of Table 5 shows the parameter estimates of a simple linear probability model in which Brazil is the reference country and data from 1960 onwards are used.⁶ As shown in the first column there is no home advantage for scoring goals in the last minute. Furthermore, England, Germany and the Netherlands are about 3.5–4.5 percent more likely to score goals in the last minute than Brazil is. Belgium and Italy also have a higher last minute goal-scoring probability than Brazil, but the parameter estimates are not different from zero at conventional levels of significance. The second column shows that there is no home effect in conceding goals in the last minute either. Furthermore, Belgium and Germany have a significant higher probability than Brazil to concede a goal. Germany is 4.5 percent more likely than Brazil to score a goal in the last minute, but also 4.3 percent more likely to concede a goal in the last minute. The third and fourth column of panel *a* of Table 5 show that in the last five minutes of a match there seems to be a home advantage. Teams playing at home have a 4.2 percent higher probability to score at home and a 2.3 percent lower probability to concede a goal at home. Furthermore, the Netherlands have the highest probability to score a goal in the last five minutes while Germany has the highest probability to concede a goal in the last five minutes of a match.

Clearly Germany is an “outlier” in terms of goal-scoring, as it is most likely to score

⁶Modeling football match results is sometimes done using an ordered probit specification (Dobson and Goddard, 2001), but using this alternative specification does not change the main outcomes of our analysis.

in the last minutes and also most likely to concede a goal in the last minutes. So far, we ignored the fact that for a long period of time Germany had two national teams representing East-Germany and West-Germany. Therefore, panel *b* of Table 5 shows the parameter estimates when we limit the time period to 1990-2009. Basically, the pattern of goal-scoring in the last minute is not much different, confirming the results presented in panel *a* that Germany is more likely to score a goal and more likely to concede a goal in the last minute than Brazil is.⁷ Also England and the Netherlands are more likely to score a goal in the last minute.

4.3 Parameter estimates rates of scoring and conceding goals

To investigate the goal-scoring rates over the evolution of matches in more detail we use a hazard model, in which the rate by which goals are scored is dependent on the elapsed duration of the match t and some observed characteristics x , i.e. the country and the calendar time period:

$$\theta(t|x) = \exp(\beta x + \sum_k \lambda_k I_k(t)) \quad (1)$$

where k ($= 1, \dots, 5$) is a subscript for duration interval and $I_k(t)$ are time-varying dummy variables that are one in subsequent duration intervals. We distinguish duration intervals (in minutes): 1-15, 16-30, 31-45, 46-60, 61-75, 76-85, 86-89, 90. Because we also estimate a constant term, we normalize $\lambda_1 = 0$. Furthermore, β represents a vector of parameters and the λ 's are the main parameters of interest. The conditional density functions of the durations until a goal is scored can be written as

$$f(t | x) = \theta(t | x) \exp(- \int_0^t \theta(s | x) ds) \quad (2)$$

Assuming that conditional on the observed characteristics and the elapsed duration of the match, the goal-scoring events are independent we can specify the log-likelihood function as follows:

$$\sum_k (n_k \log(\theta_k) - \theta_k d_k) \quad (3)$$

⁷Note that the home advantage for goal-scoring and goal-conceding in the last five minutes is no longer significantly different from zero.

where n_k represents the number of goals scored in interval k and d_k is the duration of interval k in minutes. We estimate the parameters of the model using Maximum Likelihood. The goal-conceding rate is estimated similarly.

Table 6 shows the parameter estimates for the rates by which teams score and concede goals. There is a clear home advantage. Teams playing at home score more goals and concede fewer goals. The first column gives the parameter estimates if we interact country and goal-scoring intensity in the last minute – including stoppage time. As shown, goal-scoring intensity is highest for Brazil and lowest for Belgium (the reference country). From the second quarter to the 85th minute the goal-scoring intensity is higher than in the first quarter, but there is no obvious increase in goal-scoring intensity. From the 86th to the 89th minute the goal-scoring intensity and goal-conceding intensity increases. In the last minute there is a difference between on the one hand Belgium, Brazil and Italy for whom the goal-scoring intensity does not increase significantly and on the other hand England, Germany and the Netherlands for whom the goal-scoring intensity is significantly higher than before.

The second column shows the parameter estimates if we restrict some of the interaction terms between country and goals in the last minute. Those that were insignificant in the first estimate are restricted to zero. The interaction effects in the 90th minute for England, Germany and the Netherlands are imposed to be the same. From a Likelihood-Ratio test it appears that we cannot reject the statistical validity of these restrictions. In the third column we restrict all interactions between country and duration intervals to be equal to zero. A Likelihood Ratio test shows that in this case the value of the loglikelihood drops significantly, i.e. we cannot reject the hypothesis that these interaction terms are significantly different from zero. From this, we conclude that for the six countries in our sample there is at most a mild increase in the goal-scoring intensity over the duration of the match. The Netherlands, England and Germany exhibit a significant higher scoring intensity in the last minute.

The fourth to six columns of Table 6 show a similar analysis of the goal-conceding rates. The goal-conceding rate was higher in the 1960s than in the following decades, but over time the goal-conceding intensity did not change since the 1970s. Belgium has the highest goal-conceding intensity, while Germany has the lowest. The other countries are

not very different from each other. Over the duration of the match, the goal-conceding intensity increases to remain approximately constant in the last 30 minutes of the match. Above all, Germany has a substantially higher goal-conceding intensity in the 90th minute than the other five countries.⁸

4.4 Winning and losing in the “dying seconds”

Does it matter, whether teams play at home? It does matter, as shown in Table 7, where we show the parameter estimates for the probability to win or lose a match. Teams are about 20 percent more likely to win if they play at home and 12 to 16 percent less likely to lose if they play at home. Does it matter whether a goal is scored in the last minute in a game? It does, in fact it is very important. If a team scores in the last minute, it is 21 to 26 percent more likely to win and 12 to 14 percent less likely to lose the match. Table 7 also shows that all countries are more likely to win and less likely to lose than Belgium. Over the period 1960–2009, Brazil has the highest probability to win a match. However, over the period 1990–2009 Brazil does not do better than Germany, Italy or the Netherlands. Except for Belgium, the probability to lose is not so much different for the other countries. Brazil and Italy have the smallest probability to lose in the period 1960–2009. Over the more recent time period the differences are minor.

5 Penalty shootouts

Sometimes goals in international tournaments are scored in penalty shootouts. When two teams are tied in an elimination game, and extra time cannot provide a resolution, a decision has to be reached differently. Initially, a replay was the solution but from 1976 onwards in the European Championship and from 1982 onwards in the World Cup penalty kicks were used to decide the game. The procedure is as follows. Five players from each team take one kick each. If the score is still equal after these 10 kicks, one player from each team takes a kick until one team has scored a goal more than the other from the same number of kicks. Jordet *et al.* (2007) perform a statistical analysis to establish the relationship between results of individual penalty kicks during a penalty shootout

⁸Note that we could not estimate a separate interaction parameter for Italy in the 90th minute because the Italians never conceded a goal in the last minute – or in stoppage time.

and potential determinants such as stress, skill and fatigue. Analyzing the outcome of penalty kicks in all 41 penalty shootouts and 409 kicks taken in the World Cup, European Championships, and Copa America between 1976 and 2004 they find that the importance of the kicks – indicative of stress – was negatively related to the outcomes of the kicks, whereas skill and fatigue were less, or not, related to outcome.

Table 8 gives an overview of penalty shootouts in the World Cup and Continental Championships. Belgium participated only once in a penalty shootout during the 1986 World Cup and won (against Spain). The other national teams participated many times in penalty shootouts with striking differences. Whereas England, Italy and the Netherlands have a poor performance, Brazil has a much better performance, and Germany has an excellent performance with five wins (against France, Mexico, Argentina and England (twice)) and only one loss (West-Germany against Czechoslovakia in the final of the 1976 European Championship). With the exception of the Belgium national team which participated in penalty shootouts only once, the German national team has the highest percentage of goals scored from penalty kicks in penalty shootouts – 94 percent in the World Cup and 90 percent in the European Championship.

6 Conclusions

Scoring goals is a team effort, although it helps to have a good striker who makes it easier to transfer team effort into results. Scoring goals is also determined by the support of the crowd watching the game. We find that national teams have a clear home advantage when playing important matches. On average they are more likely to score goals and less likely to concede goals. On average, the probability to win a match is almost 20% higher if played at home while the probability to lose a match is about 15% lower if played at home. The probability to win a match is also determined by the quality of the team. Although the differences between the best national teams tend to get smaller. Overall in the period 1960-2009 Brazil had a much better track record of winning games than for example Italy, Germany, England and the Netherlands. However, this is determined by the performance in the early years as over the period 1990-2009 the differences are much smaller. Differences between national teams not only occur in terms of overall goal scoring and goal conceding or in the probabilities to win or lose but also in the evolution of goal

scoring over the course of the match. Apparently not only skills but also national identity seems to matter.

We tried to relate our findings to work on national identity to Hofstede's work on culture. Hofstede (1980) demonstrated that there are national cultural groupings that affect the behavior of organizations, distinguishing several dimensions. We find support for the idea that there are differences in national identity which affect goal scoring behavior of national teams. However, the differences in behavior between national teams cannot be related on any of these dimensions.⁹

Sugden and Tomlinson (1998) note that football is used as a vehicle for the expression of nationalism and for the promotion of individual nations' power and status internationally. As discussed before, in the decades after World War II Germany football contributed to the process of nation building. According to Foer (2004) with increasing globalization one would expect football games local cultures to disappear. However, this does not seem to be the case. National teams reflect the particular social and political climate of countries. The behavior of national teams seems to be related to country-specific cultural characteristics.¹⁰

According Kuper and Szymanski (2009) football "culture" is becoming less important. Football coaches from Spain, Italy and France are working in the English Premier League; Dutch coaches are working all over the world. Thus, technical differences between teams in terms of tactics and strategy are disappearing. International competitive forces induce

⁹In particular the goal scoring behavior of the German national team is difficult to explain using Hofstede's dimensions of national identity. For example, there are high scores for Italians on "masculinity", for English on "individualism" and Belgians on "uncertainty avoidance" and low scores for Dutch on "masculinity, Brazilians on "individualism" and English on "uncertainty avoidance". The German goal scoring behavior is an outlier while in terms of Hofstede's dimensions the German are "middle of the road".

¹⁰Miguel *et al.* (2008) present an analysis of the relationship between national cultural norms and violence in football games. They focus on the civil war history in a player's country and his level of violence in football matches. Violence is measured by the number of yellow cards – cautioning the player after a foul – and red cards – sending the player off. Their analysis is based on information about players from seventy nationalities in matches in the football seasons 2004/05 and 2005/06 in five national leagues (England, France, Germany, Italy, Spain) and the UEFA Champions League. The authors conclude that the player's home country's history of civil conflict is strongly associated with violent behavior during soccer matches, which they consider to be support for the idea that national cultures of violence accompany the football players as they move to Europe (see also Kuper, 2006).

the best players to move to competitions where the highest salaries are paid: England (Premier League), Spain (La Liga) and Italy (Serie A). Also at the level of national teams differences are becoming smaller since players play all over Europe in various clubs. Still, there may be cultural differences that remain at the level of national teams, maybe not in tactics or in strategy but in fighting spirit. This is what we find in our empirical analysis.

A popular myth in football is that the German national team is never defeated until the last whistle is blown. This is confirmed in matches that were decided through penalty shootouts. The German national team outperforms the other five countries, both during World Cup matches and the European championships. Furthermore, the German national team is more likely to score in the “dying seconds” of a match than other national teams are. We expose this myth to an empirical test by investigating goal-scoring in the last minutes of important international matches. We find that indeed Germans are more likely to score in the last minute of important games than other countries are. However, also England and the Netherlands are more likely to score a goal in the last minute whereas Germany is also more likely to concede a goal in the last minute.

So, whereas in goal-scoring there is a random element which makes football matches all the more exciting to watch, there is also persistence in performance of national teams with Brazil and Germany almost always performing well. Surprisingly, there is also a country-specific element in goal-scoring in the last minutes of football matches. Whereas general performance has to do with talent, goal-scoring in the last minutes seems to be related to attitude. Whereas the national team from Brazil and Italy do not like to lose and reduce their effort to score a goal in the last minutes for to avoid conceding a goal England, Germany and the Netherlands are risk seeking, increasing their effort to score a goal at the risk of conceding one. Only for Germany we find that the risk of conceding a goal increases significant. Apparently, Germany wants to win whatever the costs may be.

Comparative to the home advantage, the effect of goal scoring in the last minute on the probability to win a match is quite large. Nevertheless, goal scoring in the last minute does not happen very often. Therefore, the effects of the German attitude on winning a match, though significant, is small.

7 References

- Boscá, J.E., V. Liern, A. Martnez and R. Sala (2009) Increasing offensive or defensive efficiency? An analysis of Italian and Spanish football, *Omega*, 37, 63-78.
- Dobson, S. and J. Goddard (2001) *The Economics of Football*, Cambridge University Press, Cambridge.
- Foer, F. (2004) *How Soccer Explains the World*, Harper Perennial, New York.
- Foer, F. (2006) How governments nurture soccer, *New Republic On-Line*, <http://www.tnr.com/article/how-governments-nurture-soccer>
- Heinrich, A. (2003) The 1954 soccer world cup and the Federal Republic of Germany's self-discover, *American Behavioral Scientist*, 46, 1491–1505.
- Hoffmann, R., C.G. Lee and B. Ramasamy (2002) The socio-economic determinants in international soccer performance, *Journal of Applied Economics*, 5, 253–272.
- Hofstede, G. (1980) *Culture's Consequences: International Differences in Work Related Values*, Beverly Hills, Sage Publications.
- Houston, R., D.P. Wilson (2002) Income, leisure and proficiency: an economic study of football performance, *Applied Economics Letters*, 9, 939–943.
- Jordet, G., E. Harman, C. Visscher, K.A.P.M. Lemmink (2007) Kicks from the penalty mark in soccer: The roles of stress, skill, and fatigue for kick outcomes, *Journal of Sports Sciences*, 25, 121-129.
- Kahn, L.M. (2000) The sports business as a labor market laboratory, *Journal of Economic Perspectives*, 14, 75–94.
- Kissinger, H. (1986) The World Cup according to character, *Los Angeles Times*, Sunday, June 29.
- Kuper, S. (2006) *Soccer against the enemy*, New York, Nation Books.
- Kuper, S. and S. Szymanski (2009) *Soccernomics*, Nation Books, New York.

- Leeds, M.A. and E.M. Leeds (2009) International Soccer Success and National Institutions, *Journal of Sports Economics*, 10, 369–390.
- Macmillan, P. and I. Smith (2007) Explaining international soccer rankings, *Journal of Sports Economics*, 8, 202–213.
- Miguel, E., S.M. Saiegh, and S.Satyanath (2008) National cultural norms and soccer violence, *mimeo*.
- Pollard, R. and G. Pollard (2005) Home advantage in soccer: a review of its existence and causes, *International Journal of Soccer and Science Journal*, 3, 28–38.
- Szymanski, S. (2003) The assessment: the economics of sport, *Oxford Review of Economic Policy*, 19, 467–477.
- Sugden, J. and A. Tomlinson (1998) *FIFA and the Contest for World Football*, Cambridge, Polity Press.
- Van Calster, B., T. Smits, and S. van Huffel (2008) The curse of scoreless draws in soccer: the relationship with a team’s offensive, defensive, and overall performance, *Journal of Quantitative Analysis in Sports*, 4, 1–22.
- Vergouw, G. (2006) De laatste minuut: de 7 mythen van het Duitse voetbal (“The Last Minute: the 7 myths of German football”), *Bzztoh*, Amsterdam.

Table 1: Participation and finalists in Continental and World Championships, 1960–2008

a. Continental Championship			
Country	Participation	Winner	Runner-up
Belgium	4	–	1980
Brazil	13*	1989, 1997, 1999, 2004, 2007	1983, 1991, 1995
England	7	–	–
Germany	12	1972, 1980, 1996	1976, 1992, 2008
Italy	7	1968	2000
Netherlands	8	1988	–

b. World Championship			
Country	Participation	Winner	Runner-up
Belgium	7	–	–
Brazil	12*	1962, 1970, 1994, 2002	1998
England	9	1966	–
Germany	12*	1974, 1990	1966, 1982, 1986, 2002
Italy	12*	1982, 2006	1970, 1994
Netherlands	6	–	1974, 1978

Note: Participation refers to the number of times a national team participated in a tournament. A * indicates that a national team was present in every tournament.

Table 2: Number of matches by time period

Country	1960s	1970s	1980s	1990s	2000s	Total	Home
Belgium	23	41	57	47	60	228	98
Brazil	21	38	39	55	87	240	59
England	26	35	53	53	65	232	94
Germany	49	81	90	61	63	344	132
Italy	36	42	43	69	77	267	100
Netherlands	25	50	47	61	70	253	104
Total	180	287	329	346	422	1564	587

Table 3: **Number of matches with last minutes goal-scoring**

Country	Last minute		Last five minutes		Total matches
	For	Against	For	Against	
Belgium	6	6	24	21	228
Brazil	5	1	30	15	240
England	12	2	32	9	232
Germany	19	15	49	34	344
Italy	6	1	31	16	267
Netherlands	15	4	51	11	253
Total	63	29	217	106	1564
Total (%)	4.0	1.9	13.9	6.8	100.0

Table 4: **Goal-scoring intensity (percentage per minute)**

Minutes	For	Against	Difference
1–15	1.7	0.7	1.0
16–30	2.1	0.8	1.3
31–45	2.0	0.8	1.2
46–60	2.0	0.9	1.1
61–75	2.1	1.0	1.1
76–85	2.1	1.0	1.1
86–89	2.4	1.2	1.2
90	3.9	1.8	2.1

Note: Based on 1531 matches without extra time; also note that the 90th minute includes extra time.

Table 5: **Parameter estimates goal-scoring and goal-conceding in the final stage of a football match**

Country	Last minute		Last five minutes	
	For	Against	For	Against
a. 1960–2009				
Home	0.010 (1.0)	-0.004 (0.5)	0.042 (2.3)**	-0.023 (1.9)*
Belgium	0.009 (0.6)	0.025 (2.2)**	-0.024 (0.8)	0.034 (1.4)
England	0.034 (1.9)*	0.006 (0.8)	0.008 (0.3)	-0.020 (1.0)
Germany	0.043 (2.7)**	0.044 (3.6)**	0.018 (0.6)	0.040 (1.8)*
Italy	0.003 (0.2)	0.001 (0.2)	-0.013 (0.5)	-0.003 (0.2)
Netherlands	0.041 (2.3)**	0.014 (1.5)	0.072 (2.2)**	-0.014 (0.7)
b. 1990–2009				
Home	0.014 (0.7)	0.001 (0.1)	0.017 (0.6)	-0.024 (1.4)
Belgium	0.024 (1.0)	0.030 (1.7)	-0.003 (0.1)	0.055 (1.5)
England	0.054 (2.0)**	0.010 (0.7)	0.046 (1.1)	-0.007 (0.3)
Germany	0.061 (2.2)**	0.042 (2.0)**	0.023 (0.6)	0.022 (0.7)
Italy	0.013 (0.6)	0.000 (0.0)	0.015 (0.4)	-0.017 (0.6)
Netherlands	0.070 (2.5)**	0.024 (1.4)	0.137 (2.9)**	-0.004 (0.2)

Note: Number of matches: 1960-2009: 1564; 1990-2009: 768; Brazil = reference country; note that the 90th minute includes extra time; parameters of linear probability models; in parentheses absolute t statistics based on robust standard errors; all estimates contain calendar period fixed effects.

Table 6: **Parameter estimates goal-scoring and goal-conceding rates; 90 minutes matches**

	goal-scoring rates			goal-conceding rates		
	(1)	(2)	(3)	(1)	(2)	(3)
Home	0.37 (10.0)**	0.37 (10.0)**	0.37 (10.1)**	-0.42 (6.8)**	-0.42 (6.9)**	-0.42 (6.9)**
Countries						
Brazil	0.35 (5.1)**	0.35 (5.1)**	0.35 (5.1)**	-0.45 (4.8)**	-0.47 (5.0)**	-0.47 (5.0)**
England	0.20 (2.9)**	0.19 (2.8)**	0.21 (3.0)**	-0.54 (5.2)**	-0.55 (5.7)**	-0.55 (5.7)**
Germany	0.24 (3.8)**	0.24 (3.7)**	0.25 (4.0)**	-0.29 (3.5)**	-0.30 (3.6)**	-0.27 (3.3)**
Italy	0.09 (1.2)	0.08 (1.1)	0.08 (1.1)	-0.55 (5.8)**	-0.56 (5.8)**	-0.58 (6.0)**
Netherlands	0.28 (4.2)**	0.28 (4.2)**	0.29 (4.4)**	-0.42 (4.5)**	-0.43 (4.6)**	-0.43 (4.6)**
Duration (minutes)						
16-30	0.20 (2.8)**	0.20 (2.9)**	0.20 (2.9)**	0.16 (1.5)	0.16 (1.5)	0.16 (1.5)
31-45	0.15 (2.1)**	0.15 (2.2)**	0.15 (2.2)**	0.09 (0.8)	0.09 (0.8)	0.09 (0.8)
46-60	0.18 (2.4)**	0.18 (2.4)**	0.18 (2.4)**	0.23 (2.1)**	0.23 (2.1)**	0.23 (2.1)**
60-75	0.22 (3.0)**	0.22 (3.1)**	0.22 (3.1)**	0.36 (3.4)**	0.36 (3.4)**	0.36 (3.4)**
76-85	0.20 (2.5)**	0.20 (2.6)**	0.20 (2.6)**	0.31 (2.7)**	0.31 (2.7)**	0.31 (2.7)**
86-89	0.36 (3.5)**	0.36 (3.5)**	0.36 (3.6)**	0.55 (3.8)**	0.55 (3.8)**	0.55 (3.8)**
90	0 (-)	0.39 (1.5)	0.82 (5.8)**	0 (-)	0.73 (2.7)**	0.95 (4.7)**
Belgium	0.28 (0.7)	0 (-)	0 (-)	0.44 (1.0)	0 (-)	0 (-)
Brazil	-0.22 (0.5)	0 (-)	0 (-)	-1.01 (1.0)	0 (-)	0 (-)
England	0.59 (1.8)*	0.67 (2.3)**	0 (-)	0.27 (0.6)	0 (-)	0 (-)
Germany	0.75 (2.9)**	0.67 (2.3)**	0 (-)	1.15 (3.8)**	0.96 (2.6)**	0 (-)
Italy	0.08 (0.2)	0 (-)	0 (-)	$-\infty$	$-\infty$	0 (-)
Netherlands	0.75 (2.7)**	0.67 (2.3)**	0 (-)	0.57 (1.1)	0 (-)	0 (-)
-Loglikelihood	13,582.0	13,582.4	13,585.3	6,887.1	6,888.5	6,895.7
LR-test statistics						
(1)-(2)	0.8			2.8		
(2)-(3)	5.8 **			14.4 **		

Note: Based on 1531 90-minutes matches; note that the 90th minute includes extra time; note that for Italy for goal-conceding in the last minute no parameter could be estimated since Italy never conceded a goal in the last minute of a 90 minute match; calendar period dummies are included; in parentheses absolute t statistics based on robust standard errors.

Table 7: **Probability to win or to lose a football match**

	Probability to win		Probability to lose	
	1960-2009	1990-2009	1960-2009	1990-2009
Home	0.19 (7.6)**	0.18 (5.0)**	-0.16 (9.0)**	-0.12 (5.0)**
Scoring last minute	0.26 (5.6)**	0.21 (3.5)**	-0.14 (3.8)**	-0.12 (3.7)**
Conceding last minute	-0.15 (1.8)*	-0.16 (1.4)	0.07 (0.8)	0.10 (0.9)
Brazil	0.20 (4.5)**	0.21 (3.4)**	-0.20 (5.3)**	-0.22 (4.0)**
England	0.11 (2.4)*	0.11 (1.7)	-0.14 (3.8)**	-0.18 (3.3)**
Germany	0.13 (3.1)**	0.19 (3.0)**	-0.16 (4.3)**	-0.22 (4.1)**
Italy	0.12 (2.9)**	0.18 (2.3)**	-0.18 (5.0)**	-0.24 (4.6)**
Netherlands	0.13 (3.0)**	0.16 (2.6)**	-0.12 (3.1)**	-0.18 (3.3)**
R^2	0.106	0.101	0.108	0.104

Note: Based on 1564 (1960-2009) and 768 (1990-2009) matches; in panel a. Belgium = reference country; parameters of linear probability models; in parentheses absolute t statistics based on robust standard errors.

Table 8: **Penalty shootouts**

a. World Cup

	Won	Lost	Total	Years	Scored (%)
Belgium	1	0	1	1986	100
Brazil	2	1	3	1986, 1994, 1998	77
England	0	3	3	1990, 1998, 2006	50
Germany	4	0	4	1982, 1986, 1990, 2006	94
Italy	1	3	4	1990, 1994, 1998, 2006	65
Netherlands	0	1	1	1998	50

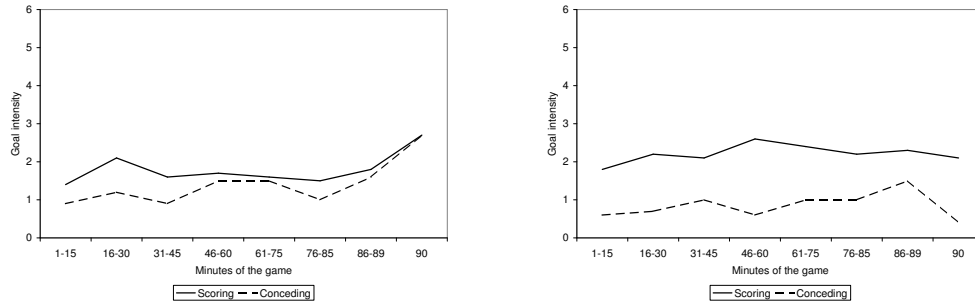
b. Continental Championship

Belgium	0	0	0	–	–
Brazil	4	2	6	1993, 1995 (2), 2004 (2), 2007	84
England	1	2	3	1996 (2), 2004	82
Germany	1	1	2	1976, 1996	90
Italy	1	2	3	1980, 2000, 2008	76
Netherlands	1	3	4	1992, 1996, 2000, 2004	70

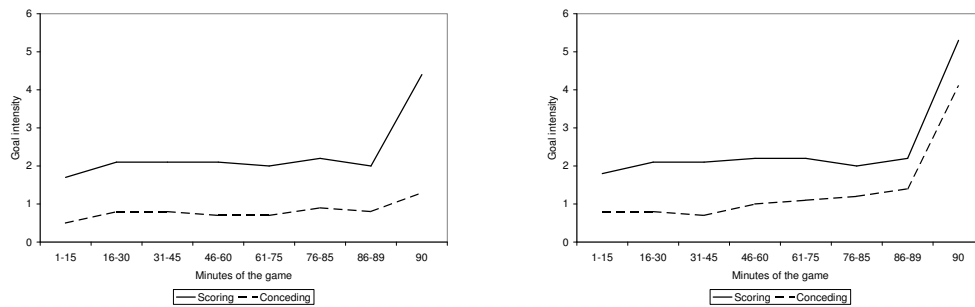
Source: <http://www.penaltyshootouts.co.uk/tournaments.html>

Figure 1: Intensity of goal-scoring and goal-conceding (Percentage per minute)

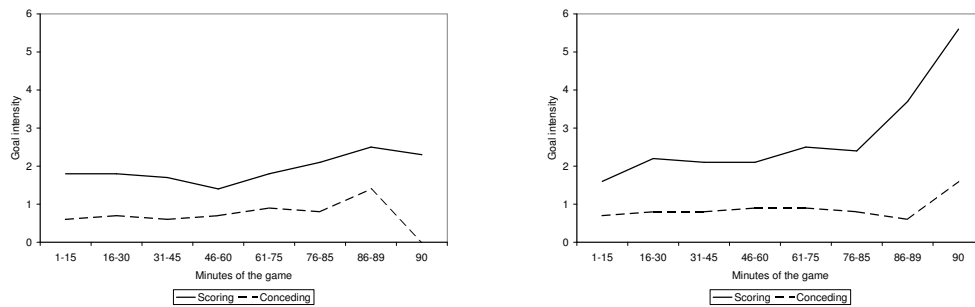
a. Belgium (left) and Brazil (right)



b. England (left) and Germany (right)



c. Italy (left) and Netherlands (right)



Note that the 90th minute includes extra time.