University of San Francisco

From the Selected Works of Joel Oberstone

Spring 2011

Uncovering Europe's Best Goalscorers from the 2009-2010 Season

Joel Oberstone, *University of San Francisco*

Available at: https://works.bepress.com/joel_oberstone/3/

INTRODUCTION

This paper examines the contributions of the 20 leading goal scorers from each of the six most prestigious football leagues in Europe: the English Premier League, Spanish La Liga, Italian Serie A, German Bundesliga, French Ligue 1, and the Dutch Eredivisie. Since most of these leagues have 20 clubs and about 25 players on each roster, the leading 20 scorers in each represents the top 4 or 5 percent in each league—the crème de la crème. The goalscoring tables for each of these leagues are provided in Appendices A through Appendices F.

Although it is tempting to simply compare and rank these 120 players according to their goal production, it would ignore the significant disparity in the prevalence of goal scoring between leagues. Additionally, two of the six leagues have 34 games per season and the rest, 38. Because of this interleague incongruence, a ranking that acknowledges and takes into account these differences between leagues needs is devised before meaningful comparisons can be made.¹

METHODOLOGY

The interleague disparity of goalscoring is quick to see in the contrast between the leading scorer in Ligue 1, Mamadou Niang of Olympique de Marseille, who scored only 18 goals, with La Liga's Lionel Messi of Barcelona who banged in 34 league goals. The difference is not only among the top scorers but throughout the entire sample of 20 representing two leagues: the La Liga scoring average (15.75) is approximately 22% higher than their counterparts in Ligue 1 (12.65)—approximately 3 more goals per season.

One way to manage these interleague inequities is to create a *standardized Intraleague performance measure* (SIPM) for each player based on his within league performance using Z-scores converted to percentile ranks. This procedure facilitates between

¹ The standardized approach in this paper does not embrace the FIFA differential assessment of goals scored by downgrading the Eredivisie compared to the other five leagues, i.e., points earned by the Holland league receives 1.5 points per goal scored compared to the 2 points per goal for the other leagues.

league comparisons using the SIPM to create a common scale of measure.

The mean and standard deviation for goals scored for each league are shown in Table 1. An Illustration of the comparison procedure follows.

INTERLEAGUE COMPARISON OF TWO “EQUAL” GOALSCORERS

Both Diego Forlån of Athletico Madrid and Mamadou Niang of Olympique de Marseille have scored 18 league goals (Figure 1). However, the performance within each league is quite different. Here are the relative statistics of these two leagues applied to the same number of goals scored for each player in terms of the relative percentile rank:

Table 1. 2009-2010 Goal Scoring of “Top 20” Six European Leagues.

League	Mean	Std Dev
La Liga	15.75	6.48
EPL	15.55	6.10
Eredivisie	16.60	7.02
Serie A	14.60	4.48
Bundesliga	14.81	4.63
Ligue I	12.65	2.43

$$\text{Forlån: } Z_{Goals} = \left(\frac{X - \mu_{La\ Liga}}{\sigma_{La\ Liga}} \right) = \frac{(18 - 15.75)}{6.48} = 0.35 \rightarrow PR_{Z=0.35} = 63.58\%$$

$$\text{Niang: } Z_{Goals} = \left(\frac{X - \mu_{Bund}}{\sigma_{Bund}} \right) = \frac{(18 - 12.65)}{2.43} = 2.20 \rightarrow PR_{Z=2.43} = 98.60\%$$

These measures suggest that Niang “outperformed” Forlån when the comparison is tempered with the relative performance differences existing between the leagues. This should make sense since La Liga has a “Top 20” average number goals scored that is both higher than that of Ligue 1—and, using the coefficient of relative variation (CRV), displays approximately 300% greater variability.² In essence, this means that an elite striker in Ligue 1 is likely to accumulate considerably fewer goals than his counterpart in La Liga. Niang’s goals place him 2.20 standard deviations above the mean

² The CRV is the ratio of the standard deviation to mean, σ/μ and is a useful indication of the amount of spread in a set of data, i.e., the higher the value, the greater the sample variability.

and rank him near the 99th percentile even though the exact same number of goals scored by Forlán place him barely one-third of a standard deviations beyond the La Liga mean at the 64th percentile.

A PROPOSAL TO EXPAND THE ROLE OF GOALSCORER BEYOND “GOALS SCORED”

The notion of “goalscorer” has traditionally been viewed in narrow, *personal* terms, i.e., goals scored. This paper explores a more inclusive perspective to embrace the overall influences on team success—the ability to *contribute* as well as create goals. This broader interpretation includes measures that may not directly lead to a player’s personal goalscoring tally yet leads to goalscoring for his teammates.

Contrary to the limited perspective offered by ESPN’s newly-coined soccer expert, polster-statistician Nate Silver of *FiveThirtyEight* fame—who suggested that there are relatively few measures available to evaluate football (soccer) performance—in reality there are dozens of such factors. The challenge, however, is how to select those that are most meaningful and whose inclusion is arguably, strongly compelling. These factors might include assists, key passes, and penalties awarded that might even be taken by teammates. Even the total game minutes a player can accumulate is an indication of durability—an essential factor of being able to contribute from game to game: being there.

Additionally, more subtle measures of effectiveness and efficiency that might view or per-unit time focus are also included to account for players that have not accumulated the pitch minutes to accumulate the kind of statistics that are obviously strong. Usually, these are the players that are not in the starting eleven or have been injured over a significant duration of the season. Regardless, all of these kinds of measures may also be meaningful indicators that provide a more expansive and, possibly, subtle perspective of how a player contributes to goal scoring.

Figure 1. Diego Forlan (l) and Mamadou Niang (r).

An example of why it is important to think outside the box (no pun intended) of the variety of considerations still make valuable contribution to goalscoring using Wayne Rooney's very different role played for Manchester United over the seasons of 2008-2009 and 2009-2010.

CASE IN POINT: WAYNE ROONEY AS RONALDO'S FOIL AND AS PRODIGIOUS GOALSCORER

During the 2007-2008 and 2008-2009 EPL seasons, Manchester United's Wayne Rooney accumulated a total of 24 goals and 17 assists. Although these tallies are decent numbers, they would not by themselves have catapulted Rooney into the elite class of goalscorers. However beyond his personal numbers, Rooney was instrumental in making huge contributions over this same time span to Cristiano Ronaldo's extremely successful campaigns in which the winger was selected as the runner up (2007-2008) and eventual winner (2008-2009) of the prestigious Ballon d'Or Award.³ There is little doubt that much of Ronaldo's accomplishments were directly attributable to Wayne Rooney's ability to control and hold the ball and to create open space by drawing defenders to himself in the left flank as well as the key passes he provided into the area. Rooney clearly sacrificed individual goalscoring opportunities for massive contributions to overall team effectiveness—especially to Ronaldo.

Following Ronaldo's departure to Real Madrid in the summer transfer window following 2009-2010 season, Man U's attack philosophy changed. With Ronaldo gone, Rooney became the center of attention and often played alone on top as the central striker in Man U's 4-5-1 formation scoring 26 league goals—more than the past two seasons combined—and 34 in all competitions, before being injured over the last six games.⁴ Rooney illustrated that a player

³ The Ballon d'Or award (now called the FIFA Ballon d'Or) is given to the footballer that is considered to have delivered the year's best performance. This award is, arguably, worth millions in terms of the player's market value and, possibly, the commanding position it puts the player in at the next contract negotiation with his club.

⁴ His assist total dropped from 17 over the two seasons prior to 2009-2010 to only 3 illustrating the shift in his role from support and attack to the primary goalscorer for Manchester United.

can contribute distinctly different, yet impressive, performance numbers from either an individual or supporting role during these three consecutive seasons. At the end of the day, a strong case can be argued that the *overall* contribution made to the team goal count is what matters the most.

Performance factors that include both individual as well as team contributions are suggested next in an effort to more fully uncover those performance qualities that create the robust makeup of a valuable goalscorer.

CUMULATIVE AND TIME-SENSITIVE GOALSCORING ATTRIBUTES

This paper presents an that a great goalscorer not only scores goals but also creates goals beyond personal or immediately direct measures. The most common measures that represent goalscoring are comparatively few (Figure 2). However, these are cumulative measures and will tend to overlook players who don't have the opportunity of playing regularly. With limited game minutes, it is possible to overlook talented goalscorers who have missed game time during the season due to injury or because they were not selected in the club's starting eleven. An expanded, more comprehensive array of goalscoring measures that include performance that reflects efficiency, productivity, effectiveness, and resilience not so closely tied to minutes on the pitch is shown in Figure 3.

Figure 2. Basic Goalscoring Factors.

Figure 3. Comprehensive Goal Contribution Factors.

A variety of different of goalscoring measures will be examined to illustrate how an analyst might use a diverse collection of factors to uncover footballers that, to the casual observer, may be flying “under the radar.”

CLUSTER 1—CUMULATIVE GOALSCORING MEASURES

Goals scored. The scoring in Table 2 includes not only the in-play goals struck but also goals scored from penalties made and scores from set pieces (corners and direct, free kicks). In the case of penalties, *a distinction must be made concerning the player awarded the penalty and the player taking the penalty and if it the same player.* Frank Lampard of Chelsea is an excellent example of being, with rare exception, Chelsea’s default penalty taker. As a result, the 22 goals that Lampard scored were inflated by 11 penalty conversions—the majority of which he did not create. By contrast, Didier Drogba’s 29 league-leading goals were only supplemented by a single penalty kick—a direct result of his being fouled and awarded the penalty. The primary problem with receiving “full credit” for a PK conversion is that the chance for creating a goal from play is about 15 to 20 percent while the likelihood of successfully scoring

from a PK is close to 80 percent—you might even call it the easy way of accumulating a goal count. And it is.

Table 2 lists the top 25 goal scorers from all six leagues for the 2009-2010 season and reveals some interesting findings that include:

- Both Antonio Di Natale, (1st, Udinese, Serie A, 29 goals) and Luis Suarez (2nd, Ajax, Eredivisie, 35 goals) place above, arguably, the most highly prized goalscorers in football that include Lionel Messi (3rd, Barcelona, La Liga, 34 goals), Didier Drogba (5th, Chelsea, EPL, 20 goals), Wayne Rooney (10th, Manchester United, EPL, 26 goals), Diego Milito (11th, Inter, Serie A, 22 goals), and Cristiano Ronaldo (12th, Real Madrid, La Liga, 26 goals).
- Another cluster of the goalscoring elite that finished further down (and some beyond) this prestigious ladder includes Carlos Tevez (17th, Manchester City, EPL, 23 goals), David Villa (25th, Valencia, Barcelona EPL, 21 goals), Arjen Robben (27th, Bayern Munich, Bundesliga, 16 goals), Fernando Torres (31st, Liverpool, EPL, 18 goals), Diego Forlân (32nd, Athleticco Madrid, La Liga, 18 goals), and Zlatan Ibrahimovic (34th, Barcelona, La Liga, 16 goals).
- Although the list does not include any that might be considered non-entities, quite a few lesser-known players that were highly ranked and include: Edin Dzeko (4th, Wolfsburg, Bundesliga, 23 goals), Mamadou Niang (6th, Marseille, Ligue 1, 18 goals), Stefan

Table 2. Standardized List Top 25 Goal Scorers for 2009-2010 Season.

Rank	Player	Team	League	Goals	PR (Goals)
1	Antonio Di Natale	Udinese	Serie A	29	99.94%
2	Luis Suárez	Ajax	Eredivisie	35	99.93%
3	Lionel Andrés Messi	Barcelona	La Liga	34	99.76%
4	Edin Dzeko	VfL Wolfsburg	Bundesliga	23	99.07%
5	Didier Drogba	Chelsea	EPL	29	98.63%
6	Mamadou Niang	Olympique de Marseille	Ligue 1	18	98.60%
7	Stefan Kiessling	Bayer Leverkusen	Bundesliga	21	96.94%
8	Kevin Gameiro	FC Lorient	Ligue 1	17	96.31%
9	Gonzalo Gerardo Higuain	Real Madrid	La Liga	27	95.87%
10	Wayne Rooney	Manchester United	EPL	26	95.67%
11	Diego Alberto Milito	Inter Milan	Serie A	22	95.08%
12	Ronaldo	Real Madrid	La Liga	26	94.32%
13	Ruiz	Twente Enschede	Eredivisie	24	92.73%
14	Lucas Ramón Barrios	Borussia Dortmund	Bundesliga	19	91.75%
15	Darren Bent	Sunderland	EPL	24	91.70%
16	Mads Junker	Roda JC	Eredivisie	23	90.26%
17	Carlos Tevez	Manchester City	EPL	23	88.90%
18	Kevin Kuranyi	Schalke 04	Bundesliga	18	87.43%
19	Frank Lampard	Chelsea	EPL	22	85.48%
20	Fabrizio Miccoli	Palermo	Serie A	19	83.72%
21	Giampaolo Pazzini	Sampdoria	Serie A	19	83.72%
22	Mevlüt Erding	Paris Saint-Germain	Ligue 1	15	83.29%
23	Lisandro López	Olympique Lyonnais	Ligue 1	15	83.29%
24	Mounir El Hamdaoui	AZ Alkmaar	Eredivisie	20	79.37%
25	David Villa	Valencia	La Liga	21	79.11%

Kiessling (7th, Bayern Leverkusen, Bundesliga, 21 goals), Kevin Gameiro (8th, FC Loreint, Ligue 1, 17 goals), and Mads Junker (16th, Roda JC, Eredivisie, 23 goals).

The apparent disconnect between the relative goalscoring performance illustrated in Table 2 and the cluster commonly believed to be the “best goalscorers in football” suggests that there must be more to the implied *value* of a goal scorer than simply scoring goals. If not, Antonio Di Natale, Luis Suarez, Edin Dzeko, and Mamadou Niang, also ranked highly in relative goal scoring, would be viewed as on par with members of the more illustrious array, and yet they are not. Additionally, it interesting to note that none of these four were involved in the summer 2010 transfer market even though there were numerous rumblings that Dzeko was being considered for transfer to AC Milan and both Manchester football clubs. Similar rumors occurred for Suarez. This conundrum begs the question, “Is there more to the *value* of being a top-notch goalscorer than simply the scoring of goals?”

Assists. Any direct pass to another player that results in a goal acknowledges and correctly rewards the contributing, yet non-scoring player. Although most assists are primarily associated with central or holding midfielders, there are exceptions. This skill is particularly important since most assists occur in the final third of the pitch—occupied by a significantly larger number of defenders reside. Moving the ball in this location is particularly challenging and often not given the credit deserved. As a result, some outside backs (wing backs) and attacking midfielders and even, to a lesser degree, forwards, are often significant contributors. The findings, shown in Table 3, generally support the contention that the primary assist leaders are midfielders, although not entirely.

- Midfielders Zvezdan Misimovic (1st, VfL Wolfsburg, Bundesliga, 13 assists), Balazs Dzsudzsak (4th, PSV Eindhoven, Eredivisie, 15 assists), Frank Lampard (5th, Chelsea, EPL, 14 assists), Cesc Fabregas (6th, Arsenal, EPL, 14 assists), and Yohan Cabaye (7th, Lille, Ligue 1, 8 assists).

- The handful of forwards and attacking midfielders that are among the most successful at creating goals for their teammates include Ronaldinho (2nd, AC Milan, Serie A, 14 assists),⁵ Luis Suarez (3rd, Ajax, Eredivisie, 17 assists), Lionel Messi (8th, Barcelona, La Liga, 9 assists), Ronaldo (10th, Real Madrid, La Liga, 8 assists), Zlatan Ibrahimovic (11th, Barcelona, La Liga, 8 assists), Diego Forlán (12th, Atletico Madrid, La Liga, 7 assists), and Didier Drogba (13th, Chelsea, EPL, 7 assists), and Mamadou Niang (14th, Marseille, Ligue 6 assists).

Table 3. Top 25 Assists for 2009-2010 Season.

Rank	Player	Team	League	Asst	PR (Assists)
1	Misimovic	VfL Wolfsburg	Bundesliga	13	99.90%
2	Ronaldinho	AC Milan	Serie A	14	99.80%
3	Luis Suárez	Ajax	Eredivisie	17	99.72%
4	Balazs Dzsudzsak	PSV Eindhoven	Eredivisie	15	98.91%
5	Frank Lampard	Chelsea	EPL	14	98.66%
6	Francesc Fabregas	Arsenal	EPL	14	98.66%
7	Yohan Cabaye	LOSC Lille Metropole	Ligue 1	8	98.12%
8	Lionel Messi	Barcelona	La Liga	9	97.44%
9	Kevin Gameiro	FC Lorient	Ligue 2	7	94.71%
10	Ronaldo	Real Madrid	La Liga	8	94.19%
11	Zlatan Ibrahimovic	Barcelona	La Liga	8	94.19%
12	Diego Forlán	Atletico Madrid	La Liga	7	88.35%
13	Didier Drogba	Chelsea	EPL	10	88.18%
14	Mamadou Niang	Olympique de Marseille	Ligue 3	6	87.60%
15	Geraldo Wendel	FC Girondins de Bordeaux	Ligue 4	6	87.60%
16	Fabrizio Miccoli	Palermo	Serie A	8	86.13%
17	Mirko Vucinic	AS Roma	Serie A	8	86.13%
18	Florent Malouda	Chelsea	EPL	9	82.29%
19	Edin Dzeko	VfL Wolfsburg	Bundesliga	7	81.58%
20	Kevin Kuranyi	Schalke 04	Bundesliga	7	81.58%
21	Marko Pantelic	Ajax	Eredivisie	9	80.71%
22	Francesco Totti	AS Roma	Serie A	7	78.48%
23	Bafetimbi Gomis	Olympique Lyonnais	Ligue 5	5	75.59%
24	Sylvain Marceaux	Stade Rennais FC	Ligue 6	5	75.59%
25	Craig Bellamy	Manchester City	EPL	8	74.83%

Key passes. A pass that leads to a goal scoring opportunity that may or may not result in a score directly reflects a player's passing skills and, moreover, an indication of unselfishness. These important indicators are typically passes into the area or through balls that the potential goalscorer "runs onto" in space—often beyond the defender. This measure is rarely published in the public domain and is typically only accessible from game analysis sources such as Opta Sports (Opta Index), STAT LLC, Catrol (Castrol Index) and PA Sport (Actim Index).

Game minutes. The total minutes accumulated during the season serves as testimony to a player's durability. These are the "iron

⁵ Ronaldinho primarily plays as a winger or attacking midfielder a bit deeper than the center forward although he is sometimes listed as a forward as well.

men” that play game in and game out and suggests player’s ability to shake off niggling injuries if and when they occur. Additionally, the effective salary of the player creates an artificial inflation for his club as well, e.g., if the player is paid £25,000 per week and yet plays an average of only 45 minutes a game, his effective salary is costing the club closer to £50,000 per week.

The top 25 rated players, as measured by the standardized amount of game minutes accumulated during the season, is shown in Table 4. A quick scan of names reveals few of these hard working footballers were among the top rated goalscorers listed in Table 2, with the exception of Edin Dzeko (9th, Wolfsburg, Bundesliga, 3001 minutes). It is necessary to look past the first 16 places in the table before you see the other highly recognizable names of Di Natale, Suárez and Messi.

Table 4. Game Minutes Played Per Season

Rank	Player	Team	League	Min Played	PR (% MinP)
1	Nino	Tenerife	La Liga	3359	98.55%
2	Darren Bent	Sunderland	EPL	3387	96.62%
3	Massimo Maccarone	Siena	Serie A	3253	96.62%
4	Hugo Rodallega	Wigan Athletic	EPL	3323	95.41%
5	Marek Hamsik	Napoli	Serie A	3247	95.41%
6	Frank Lampard	Chelsea	EPL	3220	92.76%
7	Giampaolo Pazzini	Sampdoria	Serie A	3237	92.76%
8	Alexander Meier	Eintracht Frankfurt	Bundesliga	3014	92.24%
9	Edin Dzeko	VfL Wolfsburg	Bundesliga	3001	91.81%
10	Bas Dost	Heracles Almelo	Eredivisie	3138	90.93%
11	Victor Hugo Montano	Montpellier	Ligue 1	3035	90.39%
12	Mads Junker	Roda JC	Eredivisie	3119	90.36%
13	Anderson Luiz Nené	AS Monaco FC	Ligue 1	2995	88.83%
14	Stefan Kiessling	Bayer Leverkusen	Bundesliga	2921	88.77%
15	Kevin Gameiro	FC Lorient	Ligue 1	2991	88.67%
16	Gabriel Agbonlahor	Aston Villa	EPL	3082	87.56%
17	Antonio Di Natale	Udinese	Serie A	3012	87.56%
18	Ruiz	Twente Enschede	Eredivisie	3009	86.51%
19	Mario Bermejo	Xerez	La Liga	2889	85.69%
20	Luis Suárez	Ajax	Eredivisie	2970	84.92%
21	Fernando Llorente	Athletic Bilbao	La Liga	2866	84.42%
22	Marouane Chamakh	FC Girondins de Bordeaux	Ligue 1	2875	83.12%
23	Loïc Remy	OGC Nice	Ligue 1	2873	83.01%
24	Lionel Messi	Barcelona	La Liga	2840	82.90%
25	Kevin Kuranyi	Schalke 04	Bundesliga	2800	82.77%

CLUSTER 2—TIME-SENSITIVE GOALSCORING MEASURES

It can also be argued that considerations for footballers who have played only a fraction of the total minutes possible because of either (1) injury or (2) they have not broken into the starting eleven, are also very important to include. Cumulative measures such as total goals scored and assists will typically penalize these “part-time” players since they will usually not be among the leaders simply due to lack of minutes.

Factors such as minutes between goals (MBG) as well as percent of shots-to-goals ratio provide a chance to uncover players whose cumulative numbers cannot shine but, when examined in

conjunction with the how they use the available minutes they have played, can be identified as hidden gems. A simple regression analysis reveals that neither of these time-sensitive factors provides a useful relationship with season goals scored emphasizing the importance of employing such measures.⁶

Minutes between goals. Although Table 3 and Table 4 include many of the same players, Table 5 is more forgiving of players that have limited playing minutes.

- The new group of high performance players includes Toifilou Maoulida (1st, Lens, Ligue 1, 105.8 minutes per goal) who tops the MBG list with a percentile rank of over 97%. Who's he? Maoulida's performance would normally be difficult to uncover because he started only 12 games and played less than 31% of the time during the Lens season and yet scored 10 goals in his abbreviated game time.
- Luis Suarez (2nd, Ajax, Eredivisie, 84.9 minutes per goal), Lionel Messi (3rd, Barcelona, La Liga, 83.5 minutes per goal), Antonio

Table 5. Comparison of Top 25 Standardized Interleague Goalscoring Efficiency: Minutes Between Goals

Rank	Player	Team	League	MBG	PR (MBG)
1	Toifilou Maoulida	Lens	Ligue 1	105.8	97.25%
2	Luis Suárez	Ajax	Eredivisie	84.9	95.42%
3	Lionel Andrés Messi	Barcelona	La Liga	83.5	94.07%
4	Antonio Di Natale	Udinese	Serie A	103.9	93.92%
5	Gonzalo Gerardo Higuaín	Real Madrid	La Liga	88.9	92.86%
6	Arjen Robben	Bayern Munich	Bundesliga	111.1	92.55%
7	Fernando Torres	Liverpool	EPL	95.3	92.29%
8	Didier Drogba	Chelsea	EPL	95.7	92.20%
9	Ronaldo	Real Madrid	La Liga	95.1	91.27%
10	Sergio Floccari	Lazio	Serie A	116.8	89.88%
11	Wayne Rooney	Manchester United	EPL	104.7	89.82%
12	Mamadou Niang	Olympique de Marseille	Ligue 1	137.7	89.33%
13	Marko Pantelic	Ajax	Eredivisie	109.2	89.10%
14	Danny Koevermans	PSV Eindhoven	Eredivisie	112.8	87.78%
15	Luis Fabiano	Sevilla	La Liga	109.7	86.46%
16	Mounir El Hamdaoui	AZ Alkmaar	Eredivisie	116.6	86.31%
17	Edin Dzeko	VfL Wolfsburg	Bundesliga	130.5	86.27%
18	Claudio Pizarro	Werder Bremen	Bundesliga	133.1	85.19%
19	López	Catania	Serie A	128.1	85.02%
20	Francesco Totti	AS Roma	Serie A	128.4	84.86%
21	Diego Alberto Milito	Inter Milan	Serie A	131.1	83.48%
22	Carlos Tevez	Manchester City	EPL	124.7	82.81%
23	Ruiz	Twente Enschede	Eredivisie	125.4	82.36%

⁶ Although the Pearson test statistic is significant, an extremely low coefficient of determination and large residual error makes the relationship of no practical use: although $p < 0.01$, $r^2 = 0.228$. So, the MBG parameter only accounts for 23% of the association with goal scoring.

DiNatale (4th, Udinese, Serie A, 103.9 minutes per goal). And Gonzalo Higuain (5th, Real Madrid, La Liga, 88.9 minutes per goal)—far more recognizable names than Maoulida—have done well with goals scored *and* continue to deliver quality performance even when examined with the MBG factor. However, Arjen Robben (6th, Bayern Munich, Bundesliga, 111.1 minutes per goal), and Fernando Torres (7th, Liverpool, EPL, 95.3 minutes per goal) are two more players that, due to injury, missed a significant portion of their season and, as a result, did not accumulate performance numbers near the top of goal scoring list and greatly benefited from the MGB measure.

- A few of the elite goalscorers such as Edin Dzeko (17th, Wolfsburg, Bundesliga, 130.5 minutes per goal), Diego Milito (21st, Inter Milan, Serie A, 121.1 minutes per goal), Carlos Tevez (22nd, Manchester City, EPL, 124.7 minutes per goal), Zlatan Ibrahimovic (24th, Barcelona, La Liga, 127.3 minutes per goal), and David Villa (25th, Valencia, La Liga, 129.0 minutes per goal), do not score as well on the MGB measure and illustrate that their productivity is more closely tied to creating opportunities by having time on the pitch rather than on efficient productivity.⁷ Keep in mind, however, that if you are on any of these lists, you are still considered a premier performer among the complete set of league players.

Percent of goals to shots. Accuracy—as represented by the proportion of a player’s shots that are on frame—is of little importance if the ball rarely finds the net: it is a highly overrated figure of merit. However, the same cannot be said of a player that converts a sizeable proportion of the shots taken into goals. The top 25 performers for the highest proportion of shots converted to goals is shown in Table 6. The minutes between goals covers how well a player uses what the time available to score goals, however the percent of goals to shots addresses the effectiveness of a player’s limited number of shots—a measure of realized opportunity and, very possibly, the quality of the strike.

⁷ However, persistence is, in itself, an attractive attribute.

- Although Toifilou Maoulida (1st, Lens, Ligue 1, 28.6% goals to shots) surprisingly leads the pack again, and Gonzalo Higuain (6th, Real Madrid, La Liga, 29.3% minutes per goal) who was 5th in the list of minutes between goals, numerous names that have not made earlier lists populate most of the top slots. Pedro (2nd, Barcelona, La Liga, 34.3% goals to shots), Ruiz (3rd, Twente Enschede, Eredivisie, 33.8% goals to shots), Lopez (4th, Catania, La Liga, 31.4% goals to shots). Even though names like Fernando Torres (5th, Liverpool, EPL, 26.1% goals to shots) and Emmanuel Adebayor (7th, Manchester City, EPL, 25.0% goals to shots) appear on this list, the common element shared by almost all of this factor is that they have missed large portions of the season and would not have been uncovered when only the singular performance factor of total goals scored is viewed as the gold standard for goalscoring.

Table 6. Interleague Standardized Goals-to-Shots Ratio.

Rank	Player	Team	League	% goals per shot	PR (% goals per shot)
1	Toifilou Maoulida	Lens	Ligue 1	28.6	99.75%
2	Pedro	Barcelona	La Liga	34.3	99.69%
3	Ruiz	Twente Enschede	Eredivisie	33.8	98.84%
4	López	Catania	La Liga	31.4	98.67%
5	Fernando Torres	Liverpool	EPL	26.1	97.71%
6	Gonzalo Higuain	Real Madrid	La Liga	29.3	96.82%
7	Emmanuel Adebayor	Manchester City	EPL	25.0	96.08%
8	Claudio Pizarro	Werder Bremen	Bundesliga	26.2	95.90%
9	Jon Dahl Tomasson	Feyenoord	Eredivisie	28.9	93.47%
10	Danny Koevermans	PSV Eindhoven	Eredivisie	28.9	93.47%
11	Cacau	VfB Stuttgart	Bundesliga	25.0	92.46%
12	Thomas Müller	Bayern Munich	Bundesliga	25.0	92.46%
13	Frédéric Kanouté	Sevilla	La Liga	26.7	91.55%
14	Sergio Floccari	Lazio	Serie A	26.7	91.52%
15	Gervinho	LOSC Lille	Ligue 1	22.0	90.85%
16	Giampaolo Pazzini	Sampdoria	Serie A	26.4	90.73%
17	Diego Alberto Milioto	Inter Milan	Serie A	26.2	90.14%
18	Marko Pantelic	Ajax	Eredivisie	26.7	87.63%
19	Ciprian Marica	VfB Stuttgart	Bundesliga	23.8	87.36%
20	Mads Junker	Roda JC	Eredivisie	26.4	86.88%
21	Darren Bent	Sunderland	EPL	22.0	86.56%
22	Florent Malouda	Chelsea	EPL	21.8	85.59%
23	Stefan Kiessling	Bayer Leverkusen	Bundesliga	23.1	83.23%
24	Marouane Chamakh	FC Girondins de Bordeaux	Ligue 1	20.0	80.86%
25	Barreto	Bari	Serie A	23.7	80.33%

CONCLUSIONS

Although scoring goals is an inescapable focus of football, considerations that value the more subtle measures of scoring contributions such as a key pass, assists, or the ratio of goals to shots are acknowledged as well. Inflationary measures such as receiving credit for a goal scored via a PK when another player was originally awarded the penalty also needs to be reconsidered. Possibly a shar-

ing of the goal on a 50-50 basis would be a fairer measure with the penalty taker not receiving his share of the goal if it is missed.

Additionally, cumulative measures are important and give the sports analyst a summative impact of a players performance obviously influenced by their opportunity to perform—game time minutes—while other top flight players may not have those minutes available to them due to a variety of reasons including injury or team rotational policies, or simply because, although talented, they have not broken into the starting eleven. In these cases, the need to include measures that view the efficiency of the player on a per minute basis may often be essential.

This is just a preliminary step in attempting to examine the meaning of “goalscorer” in broader terms that have been accepted traditionally. Further analyses need to examine a fuller collection of measures although there will never be consensus agreement regarding which factors truly comprise a complete set. Without a doubt, the collection will be subjective and represent a reflection of the analyst’s or organization’s value system. However, and with those limitations in mind, here are some judgments regarding the performance factors assessed in this paper:

1. Shooting accuracy, such as the percentage of shots on target, is important, but this measure does not guarantee prodigious goalscoring— the *quality* of a shot is not reflected by accuracy alone, e.g., a “soft shot” on target can be easily defended by a goalkeeper.
2. The most prodigious goalscorers typically create the most prolific number of shots on goal *irrespective of accuracy!* With only a few exceptions, the very best goalscorers are not among the most accurate. Opportunity is more important than accuracy.
3. There is a dramatic difference between leagues in the average minutes a player accumulates over the season. However, it would not be reasonable to assume that the reason for the lower, overall percentage of playing time for Ligue 1 is associated with injuries but, instead, a more active rotation policy in the starting eleven. Although there are exceptions, this difference is statistically significant when a one-way ANOVA is used to access this parameter ($p < 0.05$).
4. The number of goals scored can sometimes be unfairly inflated and may not reflect if the goal opportunity was, in fact,

primarily created by the goalscorer, e.g., if a player's totals are inflated by successful PK conversions, and especially if that player did not suffer the awarded penalty but is, rather, the default PK for his team, his numbers are inflated by an event that has close to an 80 percent success rate (as compared to the approximate 15 percent chance of scoring from an in-play opportunity).

5. Sometimes, considering the accumulated goals scored eliminates players who may have spent a portion of the season either injured or reflect their part-time status as a player not yet breaking into the starting eleven. It may be of great value to closely examine the performance per minute to uncover players that fall in this part-time category. Gonzalo Higuain is an example of a goalscorer who had difficulty getting game time at the beginning of Real Madrid's season but, based on his prolific performance across those precious minutes he did get, he eventually gained a starting status (and outscored his more illustrious counterpart, Cristiano Ronaldo).
6. When a broad range of factors are included that extends beyond the traditional measure of goals scored, many of the most famous names associated with this skill are joined by numerous, less prestigious players who move in to the "top ten" lists of five factors (Table 7). Only two players placed on more than two of the lists selected in this study: Lionel Messi and Gonzalo Higuain. Didier Drogba, Cristiano Ronaldo, Luis Suarez, Di Natale, Dzeko, and Wayne Rooney only registered on two lists.

Table 7. Standardized Comparison Using Collection of Five Diverse Goalscoring Factors.

Player Rank	Goals	Assists	MBG	G/Shots	MinP
Rank 1	Di Natale	Misimovic	Maoulida	Maoulida	Nino
Rank 2	Suarez	Ronaldinho	Suarez	Pedro	Bent
Rank 3	Messi	Suarez	Messi	Ruiz	Maccarone
Rank 4	Dzeko	Dzsudzsak	Di Natale	Lopez	Rodallega
Rank 5	Drogba	Lampard	Higuain	Torres	Hamsik
Rank 6	Niang	Fabregas	Torrez	Higuain	Lampard
Rank 7	Kiessling	Cabaye	Drogba	Adebayor	Pazzini
Rank 8	Gameiro	Messi	Ronaldo	Pizarro	Meier
Rank 9	Higuain	Gameiro	Floccari	Tomasson	Dzeko
Rank 10	Rooney	Ronaldo	Rooney	Koeversmans	Dost

7. No matter what array of measures ultimately used, *it will not provide an objective measure of performance*. It seems that

almost all of the organizations that rank or rate player performance, including Opta, Actim, and Castrol all seem to present their index numbers as objective by virtue of statistical presentation. They are not. The best that can be hoped for is that a rating system is clearly explained and, therefore, rational. However the selection of criteria used by the various prestigious rating systems and the typically unexplained weighting that differentiates more important from less important measures are clearly subjective. Nothing is wrong with that except that often these ratings are accompanied by the assurance that they are, incredulously, objective. It is sufficient that the process is clearly explained and, therefore, provides a frame of reference that can encourage meaningful dialogue that is either supportive or critical. Rationality is about the best we can hope for. Different parties will always bring different values to the table—simple as that. May the best argument win.

APPENDIX A: "TOP 20" GOALSCORERS

Table A1. English Premier League Top 20 Goalscorers.

Player	Team	Min played	% min played	Goals	Asst	Shots	Shots on goal	% SOG	% goals per shot	Min per goal	Shots per 90'	Goals per 90'	Shots per goal
Didier Drogba	Chelsea	2774	81.1%	29	10	171	67	39.2	17.0	95.7	5.5	0.94	5.9
Wayne Rooney	Manchester United	2723	79.6%	26	3	172	61	35.5	15.1	104.7	5.7	0.86	6.6
Darren Bent	Sunderland	3387	99.0%	24	1	109	53	48.6	22.0	141.1	2.9	0.64	4.5
Carlos Tevez	Manchester City	2869	83.9%	23	7	119	58	48.7	19.3	124.7	3.7	0.72	5.2
Frank Lampard	Chelsea	3220	94.2%	22	14	129	53	41.1	17.1	146.4	3.6	0.61	5.9
Fernando Torres	Liverpool	1715	50.1%	18	3	69	34	49.3	26.1	95.3	3.6	0.94	3.8
Jermain Defoe	Tottenham Hotspur	2568	75.1%	18	4	102	46	45.1	17.6	142.7	3.6	0.63	5.7
Francesc Fàbregas	Arsenal	2193	64.1%	15	14	81	34	42.0	18.5	146.2	3.3	0.62	5.4
Emmanuel Adebayor	Manchester City	2212	64.7%	14	4	56	29	51.8	25.0	158.0	2.3	0.57	4.0
Louis Saha	Everton	2329	68.1%	13	1	88	29	33.0	14.8	179.2	3.4	0.50	6.8
Gabriel Agbonlahor	Aston Villa	3082	90.1%	13	2	67	41	61.2	19.4	237.1	2.0	0.38	5.2
Dimitar Berbatov	Manchester United	2096	61.3%	12	5	93	39	41.9	12.9	174.7	4.0	0.52	7.8
Florent Malouda	Chelsea	2303	67.3%	12	9	55	25	45.5	21.8	191.9	2.1	0.47	4.6
Cameron Jerome	Birmingham	2684	78.5%	11	3	73	32	43.8	15.1	244.0	2.4	0.37	6.6
Nicolas Anelka	Chelsea	2700	78.9%	11	7	85	44	51.8	12.9	245.5	2.8	0.37	7.7
John Alieu Carew	Aston Villa	2106	61.6%	10	4	61	27	44.3	16.4	210.6	2.6	0.43	6.1
Andrei Arshavin	Arsenal	2263	66.2%	10	2	74	29	39.2	13.5	226.3	2.9	0.40	7.4
Carlton Cole	West Ham	2285	66.8%	10	3	88	36	40.9	11.4	228.5	3.5	0.39	8.8
Craig Bellamy	Manchester City	2379	69.6%	10	8	61	28	45.9	16.4	237.9	2.3	0.38	6.1
Hugo Rodallega	Wigan Athletic	3323	97.2%	10	4	139	55	39.6	7.2	332.3	3.8	0.27	13.9
Average		2560.55	74.9%	15.55	5.40	94.60	41.00	44.41	16.97	183.13	3.31	0.55	6.40
Std Dev		452.15	13.2%	6.10	3.89	35.42	12.86	6.40	4.56	61.67	0.99	0.20	2.19

APPENDIX A: "TOP 20" GOALSCORERS (CONTINUED)

Table A2. La Liga Top 20 Goalscorers

Player	Team	Min played	% min played	Goals	Asst	Shots	Shots on goal	% SOG	% goals per shot	Min per goal	Shots per 90'	Goals per 90'	Shots per goal
Lionel Messi	Barcelona	2840	83.0%	34	9	156	95	60.9	21.8	83.5	4.9	1.08	4.6
Gonzalo Higuaín	Real Madrid	2401	70.2%	27	5	92	54	58.7	29.3	88.9	3.4	1.01	3.4
Ronaldo	Real Madrid	2472	72.3%	26	8	197	96	48.7	13.2	95.1	7.2	0.95	7.6
David Villa	Valencia	2710	79.2%	21	3	131	71	54.2	16.0	129.0	4.4	0.70	6.2
Diego Forlán	Atletico Madrid	2573	75.2%	18	7	109	56	51.4	16.5	142.9	3.8	0.63	6.1
Zlatan Ibrahimovic	Barcelona	2036	59.5%	16	8	97	55	56.7	16.5	127.3	4.3	0.71	6.1
Soldado	Getafe	2268	66.3%	16	1	85	45	52.9	18.8	141.8	3.4	0.63	5.3
Luis Fabiano	Sevilla	1645	48.1%	15	3	70	37	52.9	21.4	109.7	3.8	0.82	4.7
Fernando Llorente	Athletic Bilbao	2866	83.8%	14	5	105	49	46.7	13.3	204.7	3.3	0.44	7.5
Nino	Tenerife	3359	98.2%	14	0	110	55	50.0	12.7	239.9	2.9	0.38	7.9
Frédéric Kanouté	Sevilla	1786	52.2%	12	2	45	24	53.3	26.7	148.8	2.3	0.60	3.8
Pedro	Barcelona	2118	61.9%	12	2	35	21	60.0	34.3	176.5	1.5	0.51	2.9
Sergio Agüero	Atletico Madrid	2200	64.3%	12	5	83	51	61.4	14.5	183.3	3.4	0.49	6.9
Aduriz	Mallorca	2794	81.7%	12	4	84	44	52.4	14.3	232.8	2.7	0.39	7.0
Mario Bermejo	Xerez	2889	84.5%	12	1	70	36	51.4	17.1	240.8	2.2	0.37	5.8
Alvaro Negredo	Sevilla	2041	59.7%	11	3	67	38	56.7	16.4	185.5	3.0	0.49	6.1
Mohamed Tchité	Racing Santander	2149	62.8%	11	1	58	33	56.9	19.0	195.4	2.4	0.46	5.3
Pandiani	Osasuna	2422	70.8%	11	1	59	26	44.1	18.6	220.2	2.2	0.41	5.4
Nilmar	Villarreal	2474	72.3%	11	5	58	33	56.9	19.0	224.9	2.1	0.40	5.3
Diego Castro	Real Sporting	2758	80.6%	10	4	50	30	60.0	20.0	275.8	1.6	0.33	5.0
Average		2440.05	71.3%	15.75	3.85	88.05	47.45	54.31	18.98	172.34	3.24	0.59	5.63
Std Dev		420.93	12.3%	6.48	2.64	39.43	20.77	4.82	5.59	56.92	1.31	0.23	1.37

APPENDIX A: "TOP 20" GOALSCORERS (CONTINUED)

Table A3. Serie A Top 20 Goalscorers.

Player	Team	Min played	% min played	Goals	Asst	Shots	Shots on goal	% SOG	% goals per shot	Min per goal	Shots per 90'	Goals per 90'	Shots per goal
Antonio Di Natale	Udinese	3012	88.1%	29	6	149	73	49.0	0.2	103.9	4.5	0.87	5.1
Diego Alberto Milito	Inter Milan	2885	84.4%	22	4	84	44	52.4	0.3	131.1	2.6	0.69	3.8
Fabrizio Miccoli	Palermo	2681	78.4%	19	8	142	61	43.0	0.1	141.1	4.8	0.64	7.5
Giampaolo Pazzini	Sampdoria	3237	94.6%	19	2	72	37	51.4	0.3	170.4	2.0	0.53	3.8
Alberto Gilardino	Florentina	2941	86.0%	15	1	85	48	56.5	0.2	196.1	2.6	0.46	5.7
Francesco Totti	AS Roma	1798	52.6%	14	7	65	29	44.6	0.2	128.4	3.3	0.70	4.6
Marco Borriello	AC Milan	2208	64.6%	14	1	83	33	39.8	0.2	157.7	3.4	0.57	5.9
Barreto	Bari	2429	71.0%	14	5	59	32	54.2	0.2	173.5	2.2	0.52	4.2
Mirko Vucinic	AS Roma	2551	74.6%	14	8	85	36	42.4	0.2	182.2	3.0	0.49	6.1
Allessandro Matri	Cagliari	2592	75.8%	13	5	71	38	53.5	0.2	199.4	2.5	0.45	5.5
Edinson Cavani	Palermo	2613	76.4%	13	0	91	37	40.7	0.1	201.0	3.1	0.45	7.0
Sergio Floccari	Lazio	1402	41.0%	12	1	45	25	55.6	0.3	116.8	2.9	0.77	3.8
Pato	AC Milan	1804	52.7%	12	1	54	31	57.4	0.2	150.3	2.7	0.60	4.5
Marco Di Vaio	Bologna	2332	68.2%	12	3	77	28	36.4	0.2	194.3	3.0	0.46	6.4
Samuel Eto'o	Inter Milan	2498	73.0%	12	6	99	36	36.4	0.1	208.2	3.6	0.43	8.3
Ronaldinho	AC Milan	2901	84.8%	12	14	81	36	44.4	0.1	241.8	2.5	0.37	6.8
Marek Hamsik	Napoli	3247	94.9%	12	6	80	40	50.0	0.2	270.6	2.2	0.33	6.7
Massimo Maccarone	Siena	3253	95.1%	12	4	118	42	35.6	0.1	271.1	3.3	0.33	9.8
López	Catania	1409	41.2%	11	2	35	20	57.1	0.3	128.1	2.2	0.70	3.2
Adailton	Bologna	1987	58.1%	11	3	69	36	52.2	0.2	180.6	3.1	0.50	6.3
Average		2489.00	72.8%	14.60	4.35	82.20	38.10	47.62	0.19	177.33	2.97	0.54	5.74
Std Dev		573.21	16.8%	4.48	3.36	28.45	11.95	7.43	0.06	47.46	0.71	0.15	1.68

APPENDIX A: "TOP 20" GOALSCORERS (CONTINUED)

Table A4. Bundesliga Top 20 Goalscorers. *

Player	Team	Min played	% min played	Goals	Asst	Shots	SOG	%SOG	%(G/ SHTS)	MBG	SHTS/90	G/90
Edin Dzeko	VfL Wolfsburg	3001	98.1%	23	7	135	76	56.3	17.0	130.5	4.0	0.69
Stefan Kiessling	Bayer Leverkusen	2921	95.5%	21	6	91	52	57.1	23.1	139.1	2.8	0.65
Lucas Ramón Barrios	Borussia Dortmund	2623	85.7%	19	4	88	56	63.6	21.6	138.1	3.0	0.65
Kevin Kuranyi	Schalke 04	2800	91.5%	18	7	103	54	52.4	17.5	155.6	3.3	0.58
Arjen Robben	Bayern Munich	1778	58.1%	16	5	76	51	67.1	21.1	111.1	3.8	0.81
Claudio Pizarro	Werder Bremen	2130	69.6%	16	3	61	45	73.8	26.2	133.1	2.6	0.68
Cacau	VfB Stuttgart	1739	56.8%	13	5	52	33	63.5	25.0	133.8	2.7	0.67
Thomas Müller	Bayern Munich	2644	86.4%	13	5	52	35	67.3	25.0	203.4	1.8	0.44
Albert Bunjaku	1. FC Nurnberg	2166	70.8%	12	0	65	33	50.8	18.5	180.5	2.7	0.50
Vedad Ibisevic	1899 Hoffenheim	2582	84.4%	12	4	68	37	54.4	17.6	215.2	2.4	0.42
Ivica Olic	Bayern Munich	1794	58.6%	11	6	53	36	67.9	20.8	163.1	2.7	0.55
Grafite	VfL Wolfsburg	2461	80.4%	11	4	64	36	56.3	17.2	223.7	2.3	0.40
Eren Derdiyok	Bayer Leverkusen	2615	85.5%	11	4	86	48	55.8	12.8	237.7	3.0	0.38
Ciprian Marica	VfB Stuttgart	1520	49.7%	10	2	42	25	59.5	23.8	152.0	2.5	0.59
Mario Gómez	Bayern Munich	1933	63.2%	10	2	56	30	53.6	17.9	193.3	2.6	0.47
Gustavo Adrián Ramos	Hertha Berlin	2231	72.9%	10	3	60	34	56.7	16.7	223.1	2.4	0.40
Aristide Bancé	FSV Mainz 05	2480	81.0%	10	1	84	43	51.2	11.9	248.0	3.0	0.36
Misimovic	VfL Wolfsburg	2764	90.3%	10	13	69	45	65.2	14.5	276.4	2.2	0.33
Alexander Meier	Eintracht Frankfurt	3014	98.5%	10	5	62	30	48.4	16.1	301.4	1.9	0.30
Aaron Hunt	Werder Bremen	2310	75.5%	9	5	47	24	51.1	19.1	256.7	1.8	0.35
Average		2375.30	77.6%	13.25	4.55	70.70	41.15	58.60	19.17	190.78	2.68	0.51
Std Dev		449.36	14.7%	4.14	2.72	22.14	12.55	7.04	4.06	55.20	0.60	0.15

***Note:** Bundesliga and Eredivise play a 34 game season; all other leagues play 38 games per season.

APPENDIX A: "TOP 20" GOALSCORERS (CONTINUED)

Table A5. Ligue 1 Top 20 Goalscorers

Player	Team	Min played	% min played	Goals	Asst	Shots	Shots on goal	% SOG	% goals per shot	Min per goal	Shots per 90'	per 90'	Shots per goal
Mamadou Niang	Olympique de Marseille	2478	72.5%	18	6	101	42	41.6	17.8	137.7	3.7	0.65	5.6
Kevin Gameiro	FC Lorient	2991	87.5%	17	7	101	48	47.5	16.8	175.9	3.0	0.51	5.9
Mevlüt Erding	Paris Saint-Germain	2412	70.5%	15	2	89	43	48.3	16.9	160.8	3.3	0.56	5.9
Lisandro López	Olympique Lyonnais	2517	73.6%	15	4	77	28	36.4	19.5	167.8	2.8	0.54	5.1
Ireneusz Jelen	AJ Auxerre	2415	70.6%	14	1	72	36	50.0	19.4	172.5	2.7	0.52	5.1
Loïc Remy	OGC Nice	2873	84.0%	14	3	109	40	36.7	12.8	205.2	3.4	0.44	7.8
Anderson Luiz Nené	AS Monaco FC	2995	87.6%	14	4	136	54	39.7	10.3	213.9	4.1	0.42	9.7
Asamoah Gyan	Stade Rennais FC	2081	60.8%	13	3	93	35	37.6	14.0	160.1	4.0	0.56	7.2
Pierre Alain Frau	LOSC Lille Metropole	2109	61.7%	13	2	71	37	52.1	18.3	162.2	3.0	0.55	5.5
Gervinho	LOSC Lille Metropole	2439	71.3%	13	4	59	31	52.5	22.0	187.6	2.2	0.48	4.5
Yohan Cabaye	LOSC Lille Metropole	2542	74.3%	13	8	103	37	35.9	12.6	195.5	3.6	0.46	7.9
Geraldo Wendel	FC Girondins de Bordeaux	2199	64.3%	12	6	92	28	30.4	13.0	183.3	3.8	0.49	7.7
Youssef Hadji	AS Nancy Lorraine	2233	65.3%	11	3	65	28	43.1	16.9	203.0	2.6	0.44	5.9
Victor Hugo Montano	Montpellier	3035	88.7%	11	3	84	35	41.7	13.1	275.9	2.5	0.33	7.6
Toifilou Maoulida	Lens	1058	30.9%	10	0	35	20	57.1	28.6	105.8	3.0	0.85	3.5
Michel Bastos	Olympique Lyonnais	1953	57.1%	10	1	82	25	30.5	12.2	195.3	3.8	0.46	8.2
Bafetimbi Gomis	Olympique Lyonnais	2073	60.6%	10	5	88	31	35.2	11.4	207.3	3.8	0.43	8.8
Danijel Ljuboja	Grenoble	2624	76.7%	10	2	83	36	43.4	12.0	262.4	2.8	0.34	8.3
Sylvain Marveaux	Stade Rennais FC	2705	79.1%	10	5	67	25	37.3	14.9	270.5	2.2	0.33	6.7
Marouane Chamakh	FC Girondins de Bordeaux	2875	84.1%	10	1	50	24	48.0	20.0	287.5	1.6	0.31	5.0
Average		2430.35	71.1%	12.65	3.50	82.85	34.15	42.26	16.13	196.51	3.10	0.48	6.60
Std Dev		463.68	13.6%	2.43	2.16	22.51	8.55	7.51	4.43	47.29	0.69	0.12	1.62

APPENDIX A: "TOP 20" GOALSCORERS (CONTINUED)

Table A6. Eredivisie Top 20 Goalscorers. *

Player	Team	Min played	% min played	Goals	Asst	Shots	Shots on goal	% SOG	% goals per shot	Min per goal	Shots per 90'	Goals per 90'	Shots per goal
Luis Suárez	Ajax	2970	97.1%	35	17	230	106	46.1	0.2	84.9	7.0	1.06	6.6
Ruiz	Twente Enschede	3009	98.3%	24	8	71	39	54.9	0.3	125.4	2.1	0.72	3.0
Mads Junker	Roda JC	3119	101.9%	23	4	87	42	48.3	0.3	135.6	2.5	0.66	3.8
Mounir El Hamdaoui	AZ Alkmaar	2331	76.2%	20	3	142	63	44.4	0.1	116.6	5.5	0.77	7.1
Marko Pantelic	Ajax	1747	57.1%	16	9	60	33	55.0	0.3	109.2	3.1	0.82	3.8
Bas Dost	Heracles Almelo	3138	102.5%	15	4	88	48	54.5	0.2	209.2	2.5	0.43	5.9
Tim Matavz	Groningen	2311	75.5%	14	3	79	36	45.6	0.2	165.1	3.1	0.55	5.6
Balazs Dzsudzsak	PSV Eindhoven	2733	89.3%	14	15	120	52	43.3	0.1	195.2	4.0	0.46	8.6
Everton	Heracles Almelo	2764	90.3%	14	3	100	35	35.0	0.1	197.4	3.3	0.46	7.1
Ola Toivonen	PSV Eindhoven	2109	68.9%	13	4	63	37	58.7	0.2	162.2	2.7	0.55	4.8
Jeremain Lens	AZ Alkmaar	1966	64.2%	12	7	66	32	48.5	0.2	163.8	3.0	0.55	5.5
Blaise Nkufo	Twente Enschede	2746	89.7%	12	7	66	27	40.9	0.2	228.8	2.2	0.39	5.5
Danny Koevermans	PSV Eindhoven	1241	40.6%	11	2	38	18	47.4	0.3	112.8	2.8	0.80	3.5
Jon Dahl Tomasson	Feyenoord	1843	60.2%	11	3	38	27	71.1	0.3	167.5	1.9	0.54	3.5
Gerald Sibon	Heerenveen	1964	64.2%	11	3	86	28	32.6	0.1	178.5	3.9	0.50	7.8
Otman Bakkal	PSV Eindhoven	2611	85.3%	11	2	62	30	48.4	0.2	237.4	2.1	0.38	5.6
Ricky van Wolfswinkel	Utrecht	2614	85.4%	11	4	63	34	54.0	0.2	237.6	2.2	0.38	5.7
Siem De Jong	Ajax	1499	49.0%	10	3	54	23	42.6	0.2	149.9	3.2	0.60	5.4
Erik Falkenburg	Sparta Rotterdam	2341	76.5%	10	1	60	29	48.3	0.2	234.1	2.3	0.38	6.0
Jacob Mulenga	Utrecht	2898	94.7%	10	5	98	47	48.0	0.1	289.8	3.0	0.31	9.8
Average		2397.70	78.4%	14.85	5.35	83.55	39.30	48.37	0.19	175.05	3.12	0.57	5.73
Std Dev		553.92	18.1%	6.29	4.21	42.89	18.94	8.43	0.06	53.46	1.23	0.19	1.78

APPENDIX B. Friedman and Dunn Tests for Comparing Interleague Goal Scoring Statistics

The six groups of goalscorers from each of the leagues in the study were rank-ordered from top through the 20th player based on total goals scored during league play for the 2009-2010 season (Table B1). The values for the Bundesliga and Eredivisie reflect the normalization needed to “grow” the 34 games played in these two leagues to the 38 that the remaining four leagues play.

The initial intent of using a paired one-way ANOVA test to determine if a statistically significant difference existed between at least one pair of leagues as measured by mean goals scored for the top 20 goalscorers was abandoned because the five of the six league sample distributions failed the normality test (Table B2). The parametric data was downgraded to ordinal and the use of league ranks was compared using the distribution free, non-parametric Friedman test for matched, rank-order-ed samples. The Friedman test examines the six leagues of twenty ranked player and will determine if the rank totals and median rank values differ significantly between at least one pair of leagues.

Table B1. Rank Ordered Top 20 Goals Scored In League Play for 2009-2010 Season (Note: Bundesliga and Eredivisie 34 game season adjusted to 38 game equivalent).

Rank	Goals Scored by Top 20 in Each League					
	EPL	La Liga	Serie A	Bundesliga	Ligue 1	Eredivisie
1	29	34	29	25.7	18	39.1
2	26	27	22	23.5	17	26.8
3	24	26	19	21.2	15	25.7
4	23	21	19	20.1	15	22.4
5	22	18	15	17.9	14	17.9
6	18	16	14	17.9	14	16.8
7	18	16	14	14.5	14	15.6
8	15	15	14	14.5	13	15.6
9	14	14	14	13.4	13	15.6
10	13	14	13	13.4	13	14.5
11	13	12	13	12.3	13	13.4
12	12	12	12	12.3	12	13.4
13	12	12	12	12.3	11	12.3
14	11	12	12	11.2	11	12.3
15	11	12	12	11.2	10	12.3
16	10	11	12	11.2	10	12.3
17	10	11	12	11.2	10	12.3
18	10	11	12	11.2	10	11.2
19	10	11	11	11.2	10	11.2
20	10	10	11	10.1	10	11.2
Mean	15.55	15.75	14.60	14.81	12.65	16.60
Stdev	6.10	6.48	4.48	4.63	2.43	7.02

$$F_R = \frac{12 \sum_{i=1}^k (R_i)^2}{Nk(k+1)} - 3N(k+1)$$

in which

N= number players in each group, 20

k= number of leagues, 6

$\sum R_i$ = the sum of player ranks in the i^{th} league

For sample sizes in excess on N=4, the chi-square distribution for k-1 degrees of freedom is used. If statistically significant findings are discovered using Friedman's test, the Dunn's post test is applied to pinpoint the specific pairs of leagues that exhibit significant differences.

The results show that that, based on the comparison of the relative sum of ranks, numerous, statistically significant differences exist between leagues (Table B3). The findings suggest that Ligue 1 and the Eredivisie delivered significantly lower scoring than that of the EPL, La Liga, Serie A, and Bundesliga.⁸

Table B3. Dunn Test of Differences Between Specific League Comparisons.

League	Sum of Ranks	League	Sum of Ranks
EPL	67.00	Bundesliga	72.00
La Liga	77.50	Ligue 1	30.00
Serie A	65.50	Eredivisie	108.00

Rank Sum Comparison			Diff	Signif?	p-Value
EPL	vs.	La Liga	-10.50	ns	P>0.050
EPL	vs.	Serie A	1.50	ns	P>0.050
EPL	vs.	Bundesliga	-5.00	ns	P>0.050
EPL	vs.	Ligue 1	37.00	*	P<0.050
EPL	vs.	Eredivisie	-41.00	**	P<0.010
La Liga	vs.	Serie A	12.00	ns	P>0.050
La Liga	vs.	Bundesliga	5.50	ns	P>0.050
La Liga	vs.	Ligue 1	47.50	***	P<0.001
La Liga	vs.	Eredivisie	-30.50	ns	P>0.050
Serie A	vs.	Bundesliga	-6.50	ns	P>0.050
Serie A	vs.	Ligue 1	35.50	*	P<0.050
Serie A	vs.	Eredivisie	-42.50	**	P<0.010
Bundesliga	vs.	Ligue 1	42.00	**	P<0.010
Bundesliga	vs.	Eredivisie	-36.00	*	P<0.050
Ligue 1	vs.	Eredivisie	-78.00	***	P<0.001

⁸ It is interesting to acknowledge that even though the Eredivisie's Luis Suárez led the overall scoring for the season, the overall distribution of ranks for this league was comparatively weak and many of Holland's top division occupied many of the lower ranks when compared to the other leagues.

Table B2. Descriptive Statistics and ANOVA Tests for Normality for Six Leagues.

Measure	EPL	La Liga	Serie A	Bundesliga	Ligue 1	Eredivisie
Mean	15.55	15.75	14.60	14.82	12.65	16.60
Standard deviation (SD)	6.10	6.48	4.48	4.62	2.43	7.02
Sample size (N)	20	20	20	20	20	20
Std. error of mean (SEM)	1.36	1.45	1.00	1.03	0.54	1.57
Lower 95% conf. limit	12.70	12.72	12.51	12.65	11.51	13.31
Upper 95% conf. limit	18.41	18.78	16.70	16.98	13.79	19.88
Minimum	10	10	11	10.1	10	11.2
Median (50th percentile)	13	13	13	12.85	13	13.95
Maximum	29	34	29	25.7	18	39.1
Normality test KS	0.212	0.2346	0.3033	0.2272	0.1619	0.2564
Normality test P value	0.019	0.0052	<0.0001	0.0081	>0.10	0.0013
Passed normality test?	No	No	No	No	Yes	No

REFERENCES

Torben Tiedemann, Tammo Francksen and Uwe Latacz-Lohmann, "Assessing the performance of German Bundesliga football players: a non-parametric metafrontier approach," *Central European Journal of Operations Research*, Volume 15, Number 4, 309-328, DOI: 10.1007/s10100-007-0034-y (2007).s, May 2010,

Isidoro Guzmán and Stephen Morrow, "Measuring efficiency and productivity in professional football teams: evidence from the English Premier League," *Central European Journal of Operations Research*, Volume 15, Number 1, 21-45, DOI: 10.1007/s10100-006-0017-4, November 2007.

David Biderman, Ranking Europe's Big Soccer Leagues, Wall Street Journal, August 17, 2010.

Nate Silver, A Guide to ESPN's SPI Ratings, http://soccernet.espn.go.com/world-cup/story/_/id/4447078/ce/us/guide-espn-spi-ratings?cc=5901&ver=us, December 7, 2009.

“Metro Fantasy Football: Top 5 strikers,” 3 August 2010,
<http://www.metro.co.uk/sport/836972-metro-fantasy-football-top-5-strikers>

WW Daniel, *Applied Nonparametric Statistics*(2nd ed.), PWS-Kent
1990, pp. 240-241.

Sidney Siegel and N. John Castellan Jr., *Nonparametric Statistics for Behavioral Sciences* by McGraw-Hill 1988, pp. 174-180.