

Transfer Efficiency and Triumph in Sports: An Experimental Study of the Italian Serie A

M. Erdem Delice
University of Salerno

Erda Gerçek
Koç University

Abstract

The analysis of the efficiency of professional football clubs in terms of on-field results has been widely debated in the sport economics literature. This paper illustrates a non-parametric analysis evaluating the efficiencies of transfers in Italian Serie A football clubs for the 2008-09 and 2017-18 seasons by constructing inputs of player transfers of football clubs and outputs in the manner of the clubs' game success by using Data Envelopment Analysis ("DEA"), the most popular non-parametric model for estimating productive efficiency, first introduced by Farrell (1957). Our findings show that the Juventus Football Club managed to achieve efficiency on their transfer policies for these football seasons, while on the other hand transfers of Parma Football Club performed rather very inefficiently with regard to their game performance. Additionally, we conclude that teams that won the championship trophy, such as Juventus, Internazionale and AC Milan, had full efficiency in their player transfers at the beginning of the respective season.

Keywords: football, efficiency, transfer, data envelopment analysis, serie A

1. Introduction

In the global economy, many sports activities stand in the system very well as actors that can change the balance of their respective sectors. It is fair to say that the most influential game in all of the sports industry is simply football. Football is well established as the most popular game in the world and could be regarded as a different field altogether. Today football has an audience of almost 6 billion people, and the growth of the economics of this sport has already reached more than \$7 billion globally (Deloitte, 2016). Overall, 80% of this growth rate came from European football. Within the world's economies, the growth rate of football has been continuously increasing over the years. The main reason of this increase is that football tends to combine athletics with commercialized sports and finance by encompassing many sectors and industries (Sultanoğlu, 2008).

Football is a giant market within the global economy. It has developed an increasing economic significance over the past years, demonstrated by an increasing capital markets presence and the rapid growth in the sports industry among its market (Bell et al., 2012). Clubs, employees, referees, coaches and footballers in the football industry also affect many sectors. This is because returns or gains from aspects of football— both fiscal and sportive – have naturally significant impact on the economy as well as other financial activities. The reason for football coming to prominence as a major economic sector is that it is a field where the common demand stems from the society in general (Morrow, 1999). In economics, consumers or households have their consumption of

different goods and services at different times and amounts. Based on these diverse consumptions, they have some utilities that also differ. However, demands coming from consumers of football (such as buying a ticket and going to the stadium to attend a game, purchasing a jersey of a favorite team, purchasing private TV streams and broadcasts to watch favorite teams' games, etc.) are mostly similar (Morrow, 1999). The only difference in the consumption types and levels is that people have different favorite teams that they support, but eventually those consumption attitudes exist regardless of the supported team. In addition, the utility that people get from consuming these are also similar, considering two different persons supporting the same team and the team is winning against rivals, and so on.

Football is a reflection of society itself and affects peoples' psychologies in the society (Kruzhkov, 1987). In football, there is an interesting relationship between supporters and teams. Generally, supporters stick to their favored teams and do not show a tendency to switch to other clubs or giving up support of their teams. This implies that there is a strong nexus between teams and their supporters (Uludağ and Varan, 2013). One of the most important aspects strengthening the link between football clubs and their supporters are the players who gets transferred to that club on the basis of the expectation for bright achievements (Barros and Garcia-del-Barrio, 2011). Hence, transferred players, or transfers of the football clubs, have significant impact on supporters, not only in a sociological way but also for the entertainment and enjoyment of the game itself.

Furthermore, the importance of transfers as well as transfer policies of clubs promote additional economic activities such as season ticket sales and merchandise sales of branded or logo products that portray transferred players (Loewenstein, 2001). Consequently, considering the impact of transfers as a whole, football receives an increased variety of demand from a diverse set of people with different income or purchasing power and from anywhere in the world (Bell et al., 2012).

The main purpose of this study is to measure and analyze the efficiency of football teams with regards to their transfer activities or movements by using the DEA model, under the assumption of inputs of transfers such as the number of players transferred into teams and the transfer expenditure of clubs made in each season; outputs such as overall points that each team gathered during the whole season, goals scored per match, conceded goals for each game – by considering inverse function – and the rankings of football clubs at the end of the season. This paper further illustrates a study of the Italian First Division Football Clubs in order to introduce a novel viewpoint and thus add value to the literature of football economics. In other words, this study represents an attempt to enrich the productivity measurement literature by measuring transfer efficiency of football clubs regarding their transfer policies and decisions.

2. The League that Leads the Change in Football: Italian Serie A

'Italia 90 was a defining moment for global football, and for English football in particular' explained Mark Doidge (2015), highlighting how Italian football affected a remarkable reform in football all around the world.

The Italian Serie A is certainly one of the best football leagues in the world. Historically, Serie A has been identified as the most tactical national league. According to the UEFA list for league coefficient, Serie A places in third, following La Liga (in Spain) and the Premier League (in UK). Also, *Lega Calcio* has managed to be ahead of the Bundesliga (in Germany) and Ligue 1 (in France) concerning club performances in European Tournaments such as the Champions League and Europa League for the last five years (UEFA, 2018).

Furthermore, in 2017, Serie A has globally been declared as one of the most storied football leagues in the world by *Four Four Two Magazine*. A total of 42 Serie A-league-experienced players were selected to the “100 Greatest Footballers in History” list (FourFourTwo, 2017).

There are twenty football clubs competing in the Italian Serie A. According to the regulations of Federazione Italiana Gioco Calcio and Italy's placement in UEFA rankings, clubs that come in the top four qualify for UEFA's Champions League, directly into the group stage. Teams that complete the season in fifth and sixth place in the league qualify for the UEFA Europa League into group stages. In addition to these teams, the winner of *Coppa Italia* (Italian Cup) gets the qualifying ticket into group stages for UEFA's Europa League, unless the winner team has already qualified for one of those UEFA tournaments and assigns their right to the seventh-place team in Series A to qualify for UEFA Europa League. Additionally, teams that rank in the bottom three lowest-places have to be demoted to Serie B. Among the Serie A teams, *Internazionale FC* and *AC Milan* have the largest-capacity football stadiums which they share with different names, that are, *Giuseppe Meazza* and *San Siro*. Lastly, it is important to note that the Serie A trophy has so far been won mostly by *Juventus FC* who received it 34 times, followed by *Internazionale FC* and *AC Milan*, who each managed to earn the trophy 18 times.

3. Studies in the Literature

In the sports economics literature, there are two main approaches to study efficiency of professional football clubs: financial efficiency measurement and sports efficiency measurement (Kulikova and Goshunova, 2014). Financial efficiency refers to the ability of a football club to make a profit. Sports efficiency, on the other hand, addresses success on the field due to certain actions off the field. Although there are many qualified studies in the literature about measuring the efficiency of football clubs by using various indicators, an evaluation of the efficiency of transfer policies of teams has not yet been addressed. This study will present a measurement in the literature by measuring transfer efficiency of football clubs where it has been used as initially productivity analysis of football clubs with regard to their transfer policies and decisions.

In the literature of sports economics, some researchers prefer the Data Envelopment Analysis (DEA), one of the most popular and efficient techniques accepted in the literature for evaluating and measuring the relative performance of similar Decision Making Units (DMUs) (Villa and Lozano, 2016). G.Villa and S. Lozano (2016) expressed in their article about the DEA methodology that was used for analyzing Olympic Games (Li et al., 2008; Lozano et al., 2002; Soares de Mello et al., 2009; Wooldridge, 2002; Wu et al., 2009; Wu et al., 2010) and basketball games (Boscá et al., 2009; Cooper et al., 2011) as well as baseball games (Ruggiero, 2011; Sexton and Lewis, 2003) in several studies.

There are also several other studies in the literature where the DEA methodology is used, for example to assess the performance of football teams for Spanish First Division teams (Barros and Leach, 2006; Espitia-Escuer and García-Cebrián, 2004; Espitia-Escuer and García-Cebrián, 2006; Espitia-Escuer and García-Cebrián, 2008; García-Sánchez, 2007; Picazo-Tadeo and González-Gómez, 2010), for English Premier League teams (Barros and Leach, 2006; Guzmán and Morrow, 2007; Haas, 2003) and for German Bundesliga teams (Haas et al., 2004). Furthermore, some studies include more than two leagues, such as the Italian and Spanish First Division (Boscá et al., 2009) and also for teams playing in the Champions League (Espitia-Escuer and García-Cebrián, 2010).

In the DEA model, some input determinants such as the possession of the ball, number of corner kicks, attempts of shots on goal, and penalty kicks might be used in order to measure the efficiency in football matches (Villa and Lozano, 2016).

4. Data

In this study, we analysed ten seasons of Italian football, from 2008-9 to 2017-18, with 35 football clubs present in Serie A. In order to establish production sets, we used overall transferred players into all teams at the beginning of each year, overall transfer expenditures of all football clubs made during the transfer period as inputs; overall points that teams have at the end of each season, the rankings of football clubs for each season, overall goals scored and conceded by teams at the end of each season as outputs. We aimed to display three different production sets where inputs of entire sets are equal. The reason why it was determined in this manner is that we expected how same inputs might vary for efficiency through different outputs. Hence, it might display different approach for efficiency in transfers and might be able to consider to reach 'Pareto Efficiency' level for each team. In addition, it should be noted that conceded goals of teams were recalculated and we formed it by taking inverse function since conceding a goal is an undesirable case. Table 1 represents all production sets of inputs and outputs for each Serie A league football teams.

Table 1: Production Sets of Inputs and Outputs for DEA Efficiency

PRODUCTION SETS	INPUTS (x)	OUTPUTS (y)
Set 1	Overall Transferred Players	Overall Points
	Total Transfer Expenditure	Ranking
Set 2	Overall Transferred Players	Overall Points
	Total Transfer Expenditure	Total Goals Scored
Set 3	Overall Transferred Players	Overall Points
	Total Transfer Expenditure	Total Goals Conceded

Since input factors for measuring the efficiency of transfers for football clubs are restricted, we regularly took into account the impact of overall transferred players and the total transfer expenditures for each team at the beginning of each Serie A season. Nevertheless, we assumed that these inputs might be considered as they have significant impact on several output sets. Although we have more than one output set, we decided to develop three different output sets to distinguish the efficiency scale of same input factors in order to monitor the variance of optimality for different output sets. We consolidated the data for transfer information for both players and total expenditures from Transfermarkt GmbH & Co. KG (www.transfermarkt.co.uk) and the data for overall points, rankings, total goals scored and conceded from TIM Serie A Official

(www.legaseriea.it) for each of the Serie A football teams for seasons between 2008-09 and 2017-18.

5. Methodology

In general, there are two methods to analyze efficiency, namely parametric and non-parametric models. Initially, non-parametric methods are dealt with overall evaluation of the efficiency instead of focusing on the establishment of a functional link among inputs and outputs by applying weighted indices and putting weights for other variables.

The Data Envelopment Analysis (DEA) is arguably the most popular non-parametric method, initially introduced by Farrell (1957). The purpose of the DEA is to identify the efficiency of any kind of business activity (in our case, these are football clubs) by constructing the efficiency frontier and creating a benchmark for inefficiency of the other business activities, football clubs, that are not included in the frontier of efficiency.

In his study, Farrell aimed to evaluate the effectiveness of one unit of final product based on one input and one output variable. His attempt comprised measurement of agriculture in the USA in comparison with agriculture of other countries. Moreover, Charnes, Cooper and Rhodes developed Farrell's idea by recalculating and designing an algorithm in order to analyse the efficiency of DMU (Decision Making Units) by using a part of inputs and outputs of all various ones (Kulikova, 2013).

The idea for the assessment of efficiency principally relies on optimization. In other words, finding the Pareto optimum (or Pareto efficiency) point is the main purpose to determine DEA efficiency. In economics theory, Pareto efficiency is the fact that all sets of productions reach maximum quantities and it is not possible to produce additional products assuming for given resources and technology. Consequently, DMU reaches its full capacity of efficiency when there is no longer a possibility to raise output levels without a rise in a single or more inputs, and vice versa (Kulikova, 2013).

We may illustrate solving the maximization problem formally as follows (Lissitsa et al., 2003):

$$e_0 = \frac{\sum_{j=1}^s u_j y_{j0}}{\sum_{i=1}^r v_i x_{i0}} \rightarrow \text{maximizing with subject to:}$$

$$\frac{\sum_{j=1}^s u_j y_{jm}}{\sum_{i=1}^r v_i x_{im}} \leq 1; m = 1, 2, \dots, n$$

$$u_j v_i \geq 0; j = 1, 2, \dots, s; i = 1, 2, \dots, r$$

where $x_{im} y_{jm}$ represents the number of inputs and outputs of DMU and $u_j v_i \geq 0$ displays weighted values for inputs and outputs.

The measurement of performance in the CCR model developed by Charnes, Cooper and Rhodes functions with an algorithm that creates correspondence in the optimum among selected inputs and outputs. Decision making units (DMU) which are being observed are levelled on a scale between 0 and 1, representing respectively the lowest efficiency and maximum efficiency for

certain given inputs and outputs. The expected estimation is to obtain a ratio as high as possible in the manner of maximizing e_0 (Charnes, Cooper and Rhodes).

Hence, it might be stated that the DEA is well-suited to help understand how a set is efficient or inefficient with regard to certain inputs and outputs.

6. Measuring Technical Efficiency of Transfers and ‘Plusvalenza’

As the football market grows into a giant sector, in order to succeed in this business, football clubs target not only sports but financial goals as well. In football, it is fair to say that the case of transfers, or transfer policies, is certainly the most crucial and significant subject that concurrently impacts both sports as well as financial aspects. In other words, when teams effectuate transfers for the following season, they not only consider sports achievements such as winning the league, but they also take under consideration the financial contribution on their balance sheet (Carmichael, 1999). Consequently, transfers made by teams carry an expectation of benefits for both aspects. Many teams in the Italian Serie A place an emphasis on transfer policies’ impact on ‘Plusvalenza’. In the Italian football league, the Serie A, the concept of plus-valuation is commonly used by football clubs in order to gain more revenues, or profits, which have an important effect on their balance sheets. Plus-valuation is one of the most important terms in economics. It is simply, by definition, a “gain” - an increase in the value of an asset compared to its previous value, or cost. In other words, a rise in the income of an enterprise merging from the sale of an asset would provide additional revenue by company’s standard commercial activities (Gallo, 2017).

Table 2: Overall Transfer Activities of All Teams from 2008-09 to 2017-18

Season	Departures		Arrivals		
	# of Players	Total Revenues (Million €)	# of Players	Total Expenses (Million €)	Total Balance (Million €)
2008-09	213	341,9	212	573,7	- 231,8
2009-10	256	496,9	248	530,5	- 33,6
2010-11	322	357,7	244	420,1	- 62,4
2011-12	354	516,9	263	586,9	- 70,0
2012-13	379	503,4	310	512,1	- 8,7
2013-14	366	539,2	368	545,2	-6,0
2014-15	406	387,7	281	404,0	- 16,3
2015-16	409	606,1	238	646,1	- 40,0
2016-17	342	777,5	216	820,5	- 43,0
2017-18	339	834,6	200	899,1	- 64,5

Source: Transfermarkt

Table 2 illustrates total transfer activities, namely overall players transferred in and out, and total revenues and expenditures of transfers of all teams between the seasons 2008-09 and 2017-18. Interestingly, despite the fact that the number of players departing was always greater than the number of arriving players, the total balance of all football clubs display a deficit on the balance sheet. The highest deficit of football clubs after a transfer period occurred in 2008-09, by € 231.8 m. On the other hand, teams managed to keep deficits to their lowest levels in the 2013-14 season, at just € 6 m. In addition to this, following the 2008-09 football season, transfer deficits diminished sharply across the board for all teams. However, it appears that after the 2013-14 season, football clubs showed a tendency to respond to their balance sheets since total balances of all continued to display an increase in deficit.

Table 2 tells us that the highest amount of transferred players in the Serie A in the 2015-16 season was 409 players, while the lowest one played in the league on 2008-09 football season by 213 players. Furthermore, it appears that overall expenses for all teams are likely on the increase for the last four seasons. It should be noted that we observed the highest amount of transfer payments or expenditures ever in Serie A league's history during the last season (2017-18). Concurrently, it is apparent that a similar pattern of a rise in transfer revenues has been occurring for the last four football seasons in the Serie A. Like transfer expenses, the revenues gained by transfers made have reached their peak in the 2017-18 football season.

7. Results

We apply the DEA model to measure the transfer efficiency of all teams that have been playing between 2008-09 and 2017-18 seasons. Table 3 displays the mean results of the transfer efficiency analysis based on three various production sets.

Table 3: The Results of DEA Model on Transfer Efficiency of Serie A Football Clubs

Football Clubs	Serie A Experience	Production Set-1 Efficiency Scores	Production Set-2 Efficiency Scores	Production Set-3 Efficiency Scores
Atalanta	9	0.444	0.445	0.462
Bari	2	0.447	0.447	0.452
Benevento	1	0.325	0.325	0.325
Bologna	9	0.359	0.359	0.375
Brescia	1	0.454	0.454	0.454
Cagliari	9	0.480	0.483	0.484
Carpi	1	0.367	0.367	0.367
Catania	6	0.370	0.370	0.379
Cesena	3	0.319	0.319	0.319
Chievo Verona	10	0.327	0.327	0.371
Crotone	2	0.409	0.409	0.409

Empoli	3	0.378	0.378	0.378
Fiorentina	10	0.500	0.523	0.529
Frosinone	1	0.208	0.208	0.208
Genoa	10	0.309	0.320	0.320
Hellas Verona	4	0.369	0.393	0.369
Internazionale	10	0.596	0.592	0.588
Juventus	10	0.839	0.744	0.825
Lazio	10	0.548	0.600	0.579
Lecce	3	0.371	0.371	0.371
Livorno	2	0.395	0.395	0.395
Milan AC	10	0.586	0.577	0.592
Napoli	10	0.653	0.717	0.665
Novara	1	0.426	0.426	0.426
Palermo	8	0.390	0.405	0.390
Parma	6	0.248	0.257	0.254
Pescara	2	0.257	0.257	0.257
Reggina	1	0.467	0.467	0.467
Roma FC	10	0.631	0.686	0.668
Sampdoria	9	0.401	0.402	0.412
Sassuolo	5	0.419	0.427	0.443
Siena	4	0.311	0.311	0.341
SPAL	1	0.331	0.331	0.331
Torino	7	0.412	0.449	0.412
Udinese	10	0.382	0.397	0.390
Average	5.71	0.420	0.426	0.428

* Serie A experience represents the length period of seasons for teams between 2008-09 and 2017-18.

While all these production sets have the same inputs, they have different output indicators, since our purpose is to monitor how transfer factors might differ from various outputs as the focus is on

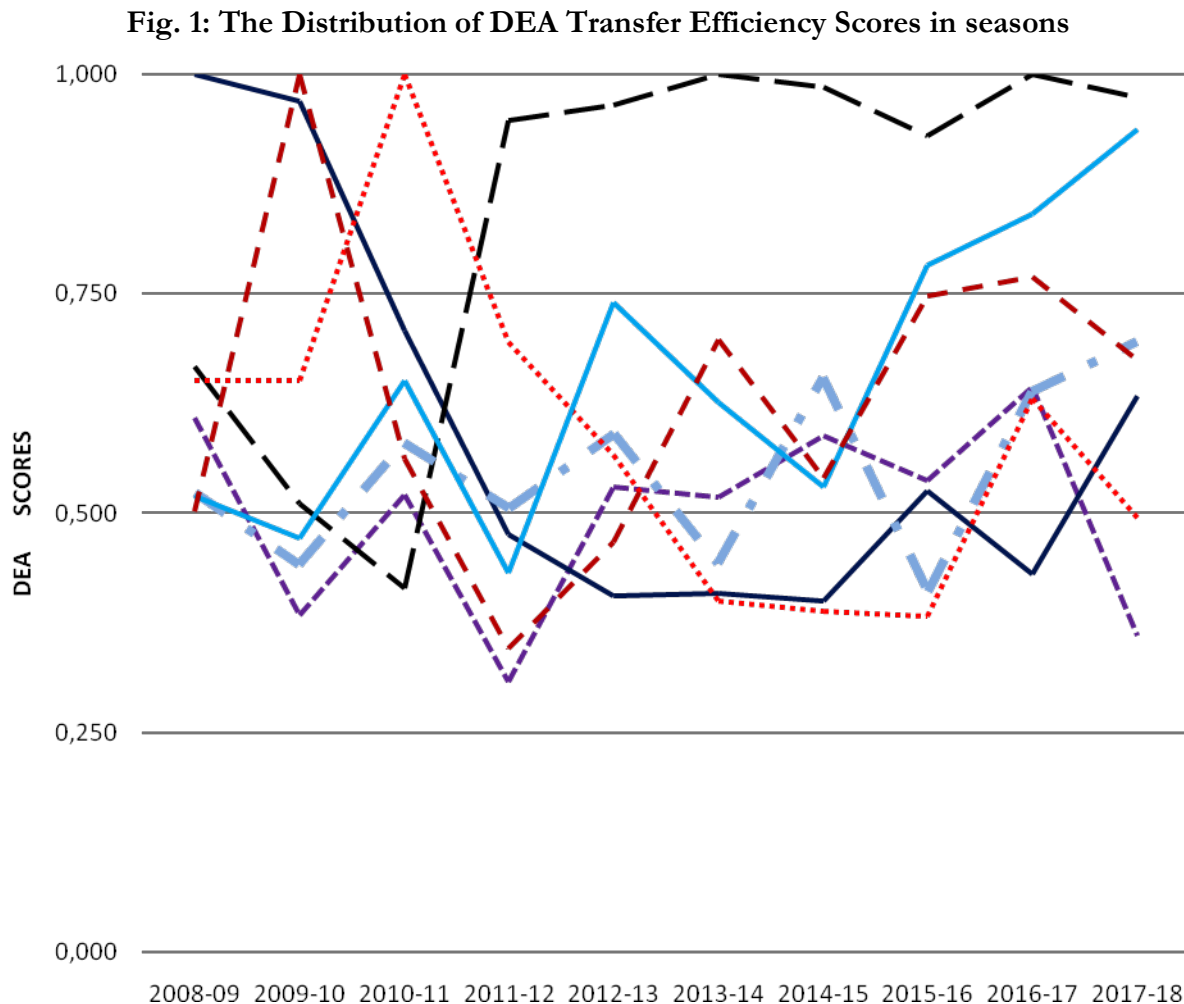
gains in sports achievements owing to transfer policies. The overall number of transferred players into Serie A teams and transfer expenses for those players are defined as inputs in all the production sets. Unlike input factors, production set-1 includes overall points and rankings of each team as output; production set-2 contains overall points and goals scored in each season by teams, and lastly, production set-3 comprises overall points and goals conceded at the end of each seasons. Additionally, we calculated efficiency scores by adding a weighted indicator that counteracts the variances in league experiences for each team in Serie A. In other words, this weighted indicator avoids the bias problem, since each team has different years of Serie A experience.

According to the CCR model, in which we apply DEA for measuring transfer efficiency, the scores place in the interval $[0,1]$ that basically represents whether scores are efficient or inefficient. Due to this fact, it is fair to declare that there are a few football teams in Serie A that attain efficiency on their transfers for each season. Based on Table 3, we found that average efficiency scores for transfers of football teams in the Serie A are 0.420 (Production Set-1), 0.426 (Production Set-2) and 0.428 (Production Set-3) respectively. In other words, the average efficiency scores of transfers measured for all production sets are not quite efficient. Nevertheless, there are a few football teams that reached levels above the medium-efficient value, that is, 0.500 (50.0%), respectively. Studying the last ten seasons, Italian Serie A teams' transfer efficiency scores on average do not reach a medium-efficiency level.

As stated in the results in Table 3, however, we measured that *Juventus* (83.9%, 74.4% and 82.5%) has the highest efficiency score in transfers with respect to all production sets, in both the sports and financial, compared to the rest of teams in Serie A, while *Parma* (24.8%, 25.7% and 25.4%) comes out as very inefficient on transfers with respect to sports performance in the last ten football seasons. To put it more clearly, Juventus football club has realized a 83.9% transfer efficiency on overall points and rankings in the league: efficient in transfers by 74.4% on overall points and goals scored; and 82.5% productive on points taken and conceding less goals during the season.

These efficiency scores suggest that for Juventus to be fully efficient, they must increase their output by 16.1%, namely the overall points, rankings, total goals scored and inverse function of conceded goals, without reducing inputs, which include the number of transferred players and transfer expenses for the football club. Moreover, we can state that the Napoli football club (65.3%, 71.7% and 66.5%) have the second best efficiency score in transfers compared to other rivals such as Roma (63.1%, 68.6% and 66.8%), Internazionale (59.6%, 59.2% and 58.8%), AC Milan (58.6%, 57.7% and 59.2%), Lazio (54.8%, 60.0% and 57.9%) and Fiorentina (50.0%, 52.3% and 52.9%).

It is also important to mark that in terms of productivity, transfer efficiencies of teams might have a trend during consecutive seasons. In other words, analyzing teams individually and making comparisons of transfer efficiency in a certain period would also be significant to show the tendency of transfer efficiency for football clubs. Figure 1 shows seven football teams in the Italian Serie A that have efficiency scores in transfers made above the average distributed in seasons between 2008-09 and 2017-18. In addition, Figure 1 represents the productivity of two inputs, namely the amount of transferred players and total transfer expenditures of teams, and a single output, which is the overall points teams gain at the end of each football season.



According to figures, there are many teams that display a volatile trend in transfer efficiency throughout various seasons. Napoli, Roma FC, Fiorentina and Lazio are good examples that show this volatility tendency in transfer efficiency. In other words, these teams have had many ups and downs during ten football seasons considering the productivity of their transfer efforts both from a financial and sports approach over total points at the end of each season. Among those teams, Napoli football club has managed to raise its transfer efficiency for the last four seasons, and they almost caught up with Juventus with a 93.8% efficiency rate, where *Juve* ended the last season with a 97.4% rate of productivity in transfers. Similarly, Internazionale and Lazio football clubs finalized the last season of Serie A with an increase in productivity of transfers with respect to overall points they gained. On the other hand, AC Milan, Fiorentina and Roma football clubs experienced a decrease in their transfer efficiency with respect to their sports performance in the last football season.

It should be noted that while the Juventus football club had a semi-efficient period in transfers between 2008-09 and 2010-11, it has spectacularly increased its productivity of transfers for remainder of the seasons, during which it has also been winning the championship of Serie A at the same time. In addition, Juventus reached full efficiency scores in overall points in the 2013-14 and 2016-17 football seasons. Likewise, AC Milan football club had a remarkable productivity in the transfers it executed for the 2010-11 football season, during which they also become that

season's champion. Another important example of the correlation between transfer efficiency and becoming the winner in the Serie A can be seen during the 2008-09 football season with Internazionale. Internazionale had full efficiency in transfers with regard to overall points and reached the top of the league at the end of that season.

8. Conclusions

Football is well-established as the most popular game in the world. It can be mentioned as an entirely different field in its own right, and it is gaining more significance in the academic scope of sports economics.

In football, supporters and teams have, among themselves, a significant link among themselves. Generally, fans do not give up supporting their teams under any kind of circumstances. One of the most important approaches between football clubs and their supporters strengthening this link are the players who are transferred into the club with the expectation of significant achievements. In order to meet supporters' demand, football clubs aim to make influential transfers at the beginning of each football season.

The main purpose of this study is to measure and analyze the efficiency of football teams with regard to their transfer activities by using the DEA model with the assumptions of inputs of transfers such as the number of players transferred into teams and the transfer expenditure of the club made per each season; outputs such as overall points that each team gathered during the whole season, goal scored per match, conceded goals for each game – by considering inverse function – and the rankings of the football clubs at the end of the season. Moreover, this paper illustrates a study for the Italian First Division Football Clubs in order to innovate and to add value through the literature of football economics. In other words, this study will present a measurement with regard to the literature by measuring the transfer efficiency of football clubs, where it has been used as initially productivity analysis of football clubs regarding to their transfer policies and decisions.

We analyzed 35 Serie A football teams for the last ten football seasons (from 2008-09 to 2017-18). Our production sets include overall transferred players into all teams at the beginning of each year, overall transfer expenditures of all football clubs made during the transfer period as inputs; overall points that teams have at the end of each season, the ranking positions of football clubs for each season, overall goals scored and conceded by teams at the end of each season as outputs. It should be noted that goals conceded of teams were recalculated and we formed it by taking inverse function since conceding goal is an undesirable case.

According to our findings, on average, teams in the Italian Serie A have a 42% efficiency in their transfers. We calculated that *Juventus* (83.9%, 74.4% and 82.5%) has the highest efficiency score in transfers while *Parma* (24.8%, 25.7% and 25.4%) come out as very inefficient on transfers with respect to sports performance during the last ten football seasons. More specifically, Juventus football club has a 83.9% transfer efficiency on overall points and rankings in the league, efficient in transfers by 74.4 % on overall points and goals scored, and they have 82.5% productive on points taken and conceding less goals during the season. This efficiency scores suggest that in order for Juventus to be fully efficient, they must increase their output by 16.1%, namely the overall points, rankings, total goals scored and inverse function of conceded goals, without reducing the inputs which include the number of transferred players and transfer expenses of the football club.

We also found a strong and significant relationship between winners of the Serie A and transfer efficiency. In other words, teams that won the trophy for championship, such as Juventus, Internazionale and AC Milan, had full efficiency in their transfers at the beginning of each respective season.

Suggestions

This paper aims to measure and analyze the efficiency of football teams with regards to their transfer influences, taking into consideration a certain number of given inputs and outputs. Although the literature contains many studies that evaluate the efficiency in football, there has not yet been any scientific work on transfer efficiency. Our study is an attempt to analyze the Italian First Division Football Clubs in order to explore and thus add value to the literature of football economics. In other words, this study represents an attempt to enrich the productivity measurement literature by measuring transfer efficiency of football clubs regarding their transfer policies and decisions.

Football clubs in the Serie A may use our methodology to help detect inefficient levels of their teams with respect to their sports goals. Therefore, teams might finalize their summer period preparation also by taking under consideration their transfer policies, that is, they might have an advantage before the beginning of each football season and measure efficiencies on their transfers by detecting inefficient parts of their policies and develop more significant ones to achieve an efficient frontier.

Limitations of this study

The main limitation of this study was data availability to increase the scope of our analysis with more indicators. In general, there is data both for sportive and financial indicators to measure the efficiency. However, variables for a specific scope (i.e. transfer data of a club) have been limited. Furthermore, the authors aim to work on a mixed production set with additional variables related to sportive and financial indicators in order to enrich the estimation of transfer efficiency for football clubs. We would like this study to offer a template to analyze other football leagues across Europe.

References

- Barros, C. P., Leach, S. (2006). Performance Evaluation of the English Premier Football League with Data Envelopment Analysis. *Applied Economics*, 38(1), 1449–1458.
- Barros, C. P., Garcia-del-Barrio, P. (2011). Productivity Drivers and Market Dynamics in the Spanish First Division Football League. *Journal of Productivity Analysis*, 35(1), 5-13.
- Bell, A.R., Brooks, C., Matthews, D., Sutcliffe, C. (2012). Over the Moon or Sick as a Parrot? The effects of football results on a club's share price. *Applied Economics*, 44(2), 3435-3452.
- Boscá, J. E., Liern, V., Martínez, A., Sala, R. (2009). Increasing Offensive or Defensive Efficiency? An Analysis of Italian and Spanish football. *Omega*. 37(1), 63–78.
- Carmichael, F., Forrest, D., Simmons, R. (1999). The labourmarket in association football: who gets transferred and for how much?. *Bulletin of Economic Research*, 51(2), 125-150.
- Charnes, A., Cooper, W. W., Rhodes, E. (1978). Measuring the efficiency of decision making units. *European journal of operational research*, 2(6), 429-444.

- Cooper, W. W. , Ramón, N. , Ruiz, J. L., Sirvent, I. (2011). Avoiding large differences in weights in cross-efficiency evaluations: Application to the ranking of basket- ball players. *Journal of Centrum Cathedra*, 4(2), 197–215.
- Deloitte. (2016, January 1). Deloitte Football Money League 2016. Retrieved from <http://www2.deloitte.com/uk/en/pages/sports-business-group/articles/deloitte-football-money-league.html>
- Doidge, M. (2015). *Football Italia: Italian football in an age of globalization*. Bloomsbury Publishing.
- Espitia-Escuer, M., García-Cebrián, L. I. (2004). Measuring the Efficiency of Spanish First Division Soccer Teams. *Journal of Sport Economics*, 5(4), 329–346.
- Espitia-Escuer, M., García-Cebrián, L. I. (2006). Performance in Sports Teams: Results and Potential in the Professional Soccer League in Spain. *Management Decision*, 44(8), 1020–1030.
- Espitia-Escuer, M., García-Cebrián, L. I. (2008). Measuring the Productivity of Spanish First Division Soccer Teams. *European Sport Management Quarterly*, 8(3), 229–246.
- Espitia-Escuer, M., García-Cebrián, L. I. (2010). Measurement of the Efficiency of Football Teams in the Champions League. *Managerial and Decision Economics*, 31(1), 373–386.
- Farrell, M.J. (1957). The Measurement of Productive Efficiency. *Journal of Royal Statistical Society. SeriesA (General)*, 120(3), 253-290.
- FourFourTwo. (2017). 100 Greatest footballers ever. Retrieved from <https://www.fourfourtwo.com/features/fourfourtwos-100-greatest-footballers-ever>
- Gallo, F. (2017). Il business del calcio e la ricerca di un equilibrio: il fair play finanziario.
- García-Sánchez, I. M. (2007). Efficiency and Effectiveness of Spanish Football Teams: A Three-stage DEA Approach. *Central European Journal of Operations Research*, 15(1), 21–45.
- Guzmán, I., Morrow, S. (2007). Measuring Efficiency and Productivity in Professional Football Teams: Evidence from the English Premier League. *Central European Journal of Operations Research*, 15(1), 309–328.
- Haas, D. J. (2003). Productive Efficiency of English Football Teams – A Data Envelopment Analysis approach. *Managerial and Decision Economics*, 24(1), 403–410.
- Haas, D., Kocher, M. G. and Sutter, M. (2004). Measuring Efficiency of German Football Teams by Data Envelopment Analysis. *Central European Journal of Operations Research*, 12(3), 251–268.
- Kruzhkov, S. (1987). Football and society. *Sport in the USSR*, (291), 3-5.
- Kulikova, L. I., Goshunova, A. V. (2013). Measuring Efficiency of Professional Football Club in Contemporary Researches. *World Applied Sciences Journal*, 25(2), 247-257.
- Li, Y. Liang, L. Chen, Y. and Morita, H. (2008). Models for measuring and benchmarking Olympics achievements. *Omega*, 36(1), 933–940.
- Lissitsa, A., Babieceva, T. (2003). Analiz obolochki dannykh (DEA)-sovremennaia metodika opredeleniia effektivnosti proizvodstva. Analysis of the envelope data (DEA)-a modern method of determining the efficiency of production. <http://hdl.handle.net/10419/28581>.
- Loewenstein et. al. (2001). Risk at Feelings. *Psychological Bulletin*, 127(2), 267-286.
- Lozano, S. , Villa, G. , Guerrero, F., Cortés, P. (2002). Measuring the performance of nations at the Summer Olympics using data envelopment analysis. *Journal of the Operational Research Society*. 53(1), 501–511.
- Morrow, S. (1999). *The New Business of Football: Accountability and Finance in Football*, Basingstoke: Palgrave.
- Papke, L.E., Wooldridge, J.M., (1996). Econometric Methods for Fractional Response Variables with an Application to 401(k) Plan Participation Rates. *Journal of Applied Econometrics*, 11(1), 619–632.
- Picazo-Tadeo, A., González-Gómez, F. (2010). Does playing several competitions influence a team's league performance? Evidence from Spanish professional football. *Central European Journal of Operations Research*, 18(1), 413–432.

- Ruggiero, J. (2010). *Frontiers in major league baseball: Nonparametric analysis of performance using data envelopment analysis*, Springer Science & Business Media.
- Soares de Mello, J. C. C. B. , Angulo-Meza, L. and Branco da Silva, B. P. (2009). A ranking for the Olympic Games with unitary input DEA models. *IMA Journal of Management Mathematics*, 20(1), 201–211.
- Sexton, T. R., Lewis, H. F. (2003). Two-stage DEA: An application to major league baseball. *Journal of Productivity Analysis*, 19(2-3), 227–249.
- Sultanoğlu, B. (2008). Hisseleri Halka Arz Edilen Türk Futbol Kulüplerinin Mali Tablolarının Türkiye Muhasebe Standartları Çerçevesinde Değerlendirilmesi, Unpublished Master Thesis, Başkent University.
- UEFA, (2018, May 26) UEFA Country Ranking 2017. Retrieved from <https://kassiesa.home.xs4all.nl/bert/uefa/data/method5/crank2018.html>
- Uludağ, Varan (2013). Futbol Maç Sonuçlarının 4 Büyüklerin Hisse Senedi Getirilerine Etkisi, Conference Paper, 428-435.
- Villa, G., Lozano, S. (2016). Assessing the Scoring Efficiency of a Football Match. *European Journal of Operational Research*, 255(1), 559–569.
- Wooldridge, J. (2002). *Econometric Analysis of Cross Section and Panel Data*. MIT Press, Cambridge, Mass.
- Wu, J., Liang, L., Chen, Y. (2009). DEA game cross-efficiency approach to Olympic rankings. *Omega*, 37(4), 909–918.
- Wu, J., Zhou, Z., Liang, L. (2010). Measuring the performance of nations at Beijing Summer Olympics using integer-valued DEA model. *Journal of Sports Economics*, 11(5), 549–566.