Predictors of Crowd Effect in Football: Evidence From Five Major Football Leagues of Europe

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Abstract

This study aims to determine predictors of crowd effect in five major football leagues in Europe. Literature review shows that crowd effect can be determined as size, proximity or density for the analysis. In this study, density was selected among them. Therefore, stadium occupancy rates were used as the crowd effect indicator. As the predictors of crowd effect; total transfer expenditure, total market value, average goals scored per match, UEFA coefficients of each league were utilized as variables of the research. In addition, gross domestic product of each country were included in the analysis as the predictor. Because supporters' economic conditions are also important to afford ticket prices. In this context, data regarding the variables includes from the season of 2005-2006 to 2019-2020 for English Premier League, French Ligue 1, German Bundesliga, Italian Serie A, Spanish La Liga. In this study, panel data analysis was used among quantitative research methods. Stationary of data was determined at the level of I(1). It was indicated through cointegration test that there was a cointegration relationship in the panel. Hence, stadium occupancy rate would move together with other variables in the long term except total market value. According to panel causality analysis results; total transfer expenditure, average goals scored per match, and UEFA coefficients, and gross domestic product are predictors of stadium occupancy rate. Consequently, this study has contributed to the framework of game location theoretically and developed substantial recommendations for professionals.

Keywords: Crowd effect, stadium occupancy rate, crowd density, home advantage, panel causality test

Futbolda Kalabalık Etkisinin Yordayıcıları: Avrupa'nın Beş Majör Futbol Liginden Kanıtlar
Özet

Bu çalışma, Avrupa'daki beş majör futbol liginde kalabalık etkisinin yordayıcılarını belirlemeyi amaçlamaktadır. Literatür taraması kalabalık etkisinin büyüklük, yakınlık veya yoğumluk olarak belirlenebileceğini göstermektedir. Bu sebeple, stadyum doluluk oranları kalabalık etkisi göstergesi olarak kullanılmıştır. Kalabalık etkisinin yordayıcıları olarak liglerin toplam transfer harcaması, toplam pazar değeri, maç başına atılan ortalama gol sayısı, UEFA katsayısı çalışmanın değişkenleri olarak kullanılmıştır. Ayrıca, ülkelerin gayrisafi yurtiçi hasılaları da analize yordayıcı olarak dâhil edilmiştir. Çünkü taraftarların ekonomik durumları da bilet fiyatlarını karşılamaları için önemlidir. Bu bağlamda, değişkenlere ilişkin toplanan veriler 2005-2006 sezonundan 2019-2020 sezonuna kadar İngiltere Premier Lig, Fransa Lig 1, Almanya Bundesliga, İtalya Seria A, İspanya La Liga'yı kapsamaktadır. Çalışmada nicel araştırma yöntemlerinden panel veri analizi kullanılmıştır. Veri durağanlığı I(1) düzeyinde belirlenmiştir. Eşbütünleşme testi aracılığıyla panelde eşbütünleşme ilişkisi olduğu tespit edilmiştir. Dolayısıyla stadyum doluluk oranı değişkeni toplam pazar değeri hariç diğer tüm değişlenlerle uzun dönemde birlikte hareket etmektedir. Panel nedensellik analizi sonuçlarına göre toplam transfer harcaması, maç başına atılan ortalama gol, UEFA katsayısı ve gayrisafi yurtiçi hasıla stadyum doluluk oranının yordayıcılarıdır. Sonuç olarak, bu çalışma teorik açıdan oyun lokasyonu çerçevesine katkıda bulunmuştur ve profesyoneller için önemli tavsiyeler geliştirmiştir.

Anahtar kelimeler: Kalabalık etkisi, stadyum doluluk oranı, kalabalık yoğunluğu, ev sahibi avantajı, panel nedensellik testi.

INTRODUCTION

Taking advantage of playing the match at home is a deniable fact in today's team sports. Football is one of the most popular team sports today as in the past. It is known that playing the match at home is one of the most important factors that affects the match result in football (22). While home advantage includes positive factors for the home team such as learning/familiarity, travel, rule, and crowd effect, the away team is affected by these factors negatively. Previous studies show that the crowd effect is the most influential home advantage. Home team supporters not only provide motivation and energy to the home team but also discourage the away team on the other hand. Besides, they might affect the decisions of the referee directly or indirectly by making psychological pressure (17). In this context, it can be said that the crowd effect is an important issue

that ought to be investigated deeply as one of the significant advantages of the home team. On the other hand, stadium revenues constitute an important part of football clubs' income as well. Therefore, the crowd effect ought to be considered and tried to be taken advantage of by clubs. However, there is a lack of scientific studies about the predictors of crowd effect in the literature. This constitutes the essential originality and necessity of this study.

Conceptual Framework and Literature Review

Home advantage as one of the most significant determinants of the match results in football (23) mainly involves four factors; familiarity/learning, travel, rule, and crowd. Courneya and Carron (4) developed a framework for game location research as Figure 1 below.
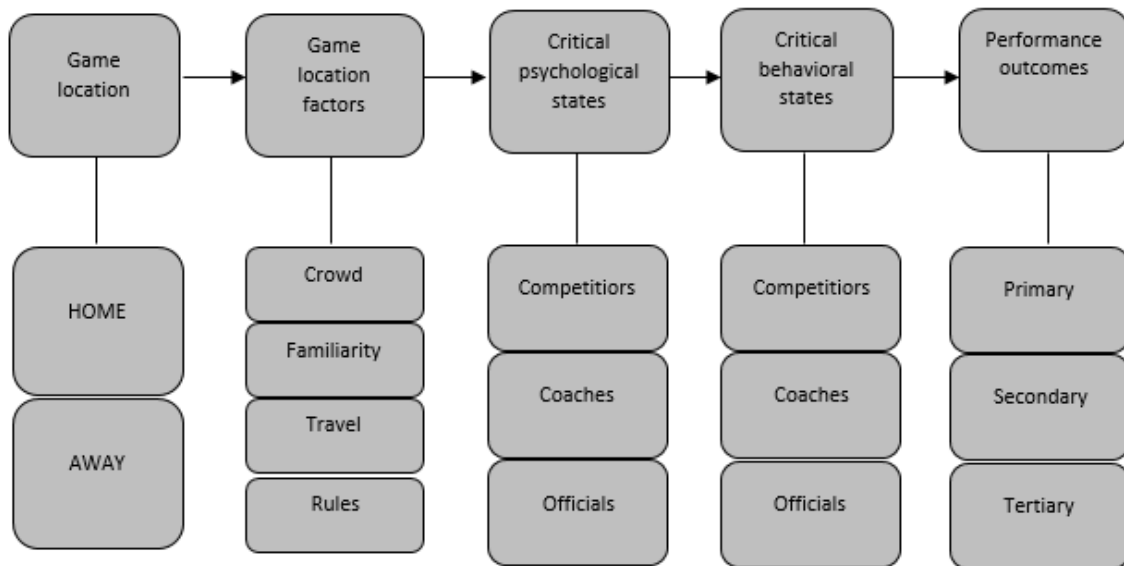

Figure 1: Framework for game location research (Courneya and Carron, 1992: 14)

The framework indicates four factors of playing at home and their effects on coaches, competitors, and officials. Finally, there are performance outcomes as primary, secondary, and tertiary. Familiarity/learning factor means that the home team is used to physical conditions of the stadium such as pitch, dressing room, and so on. Travel factor can cause some mental and physical problems for away team players such as tiredness and jet lag which might affect their performance during the game. Rules factors involve some privileges for the home team for specific sports such as baseball and hockey. Crowd effect which can be determined as size,

proximity, or density affects motivation and willingness of home team players. On the other hand, it can make pressure on the referee to make some decisions for the advantage of the home team. Moreover, the crowd effect also impress the away team players and coach. This might cause psychological changes in them which can affect their behaviors as well. These game location factors (familiarity, travel, rules, crowd) can make impacts on the critical psychological states of the game parties (competitors, coaches, officials). These critical psychological states involve both cognitive (e.g., cohesion, confidence, anxiety) and affective (e.g.,

pride, stress, excitement) states. Afterward, these critical psychological states might develop some behaviors. For instance, players might start to play more aggressively, coaches might change the formation of their teams or make some substitutions in the right way or wrong way, the referee might also make some mistakes by gibing subjective decisions. At the end of these all procedures, three kinds of outcomes occur. The primary outcome includes basic statistics such as attempts, penalty, corner, ball possession, and so on. The secondary outcome includes the score of the game such as goals scored and conceded. Lastly, the tertiary outcome reflects the result of the competition like winning, losing, or drawing (4).

Within this framework, there are some studies investigate the crowd effect in the literature. Schwartz and Barsky (24) carried out their study with an extensive sample from various sports such as football, basketball, baseball, and hockey. The study includes more than 4.000 games remarked that spectator support and size were important determinants of performance and outcome of the game. Clarke and Norman (3) analyzed 20.306 football matches of 920 clubs from England between the seasons of 1981-1982 and 1990-1991. They stated that home advantage was worth approximately more than 0.5 goal advantage for the home side. Another conclusion was that home advantage was affected by years.

Nevill et al. (17) investigated the match between Liverpool (home) and Leicester City (away) from the season of 1998-1999. They cooperated with forty qualified referees and showed them 47 cases to assess. Consequently, analysis of the study showed that noise of crowd influenced the decision of the referee. Carmichael and Thomas (2) examined 380 matches from 1997-1998 English Premier League season with twenty clubs. Analysis of their study indicated that the effectiveness of home and away teams were influenced by game location factors such as familiarity and crowd effects.

Picazo-Todeo et al. (21) investigated the first division of the Spanish football league between the seasons of 2002-2003 and 2009-2010. 2.561 matches of 3.040 were available for analysis and they found that the referees tended to book away teams more than home. Endrich and Gesche (6) conducted a study to determine whether referees had home team bias or not. For this purpose, they examined the top two divisions of the German football league and

compared the referee decision pre-covid and during covid. Results showed that there were significant differences between pre-covid and during covid in terms of fouls and cards which means home teams were less favored than pre-covid.

Another study belongs to Liu et al. (15) included 720 football matches in the Chinese Super League between 2014-2016. They indicated that home advantage was about 60 percent and home teams had better primary outcomes such as ball possession, penalty, shot on target, corner kick than away teams. Ferraresi and Gucciardi (7) made a comparison for home advantage for the season of 2019-2020 in the first division of the top five leagues (England, France, Germany, Italy, Spain). They stated that playing without audiences because of pandemic, home teams took 0,223 points less and their performance was halved. İnan (2020) collected data from five major European football leagues (England, France, Germany, Italy, Spain) for four seasons from 2015-2016 to 2018-2019. He investigated more than 7000 matches. He found that crowd density and support were very significant determinants of home advantage. On the other hand, Jimenez Sanchez and Lavin (13) carried out a study to compare the crowd effect during Covid-19 and before. They gathered data from eight leagues (Austria, England, Germany 1-2, Italy 1-2, Spain 1-2) and indicated that there was not any significant relationship between playing with a crowd or not except La Liga Santander and Bundesliga 1.

As it is seen from the literature review, home advantage which includes the crowd effect has significant impacts on outcomes of football matches. Crowd effect not only reinforces the home team coach and players but also discourages away team's. In addition, it affects the decisions of the referees as well by making some psychological pressure on them. These facts are supported by the studies above. However, there have been limited studies that investigate determinants of crowd effect for football games.

Some studies tried to investigate determinants of stadium attandance for sports games in the literature. Pawlowski and Anders (18) obtained data from German Bundesliga to understand determinants of stadium attendance. They found that stadium attendance was affected by the circumstance of either home or away team had a chance to be the champion statistically. Pawlowski and Nalbantis (19) supported the previous study with data from Austria and

Switzerland. Another study (1) focused on whether the match was broadcasted or not. They obtained data from English Premier League and Spanish Primera Liga. They specified that the matches were broadcasted on TV in England decreased stadium attendance by 3 percent at the weekend, while 8 percent on weekdays. The situation for Spain was 4 percent at the weekend, while 19 percent (free-to-air matches) for the whole week. To sum up, this study tries to bring a new paradigm to explore determinants of stadium occupancy rate and focuses on the clubs' achievements and operations plus national wealth.

MATERIAL & METHOD

Research Desing

In this study, predictors of crowd effect in football has been investigated and tested. On this purpose, expert opinions has been taken. Hence, the predictors have been determined as gross domestic product of each country (GDP), total transfer expenditure of each league (TE), total market value of each league (MV), number of goals per match for each league (GOAL), UEFA country coefficients (UEFA).

Quantitative research design has been implemented in this study due to the investigation of the causal effect. Moreover, the data include various leagues (English Premier League, French Ligue 1, German Bundesliga, Italian Serie A, Spanish La Liga) and years (from 2005-2006 to 2019-2020). Therefore, panel data analysis has been used to test the research model in this study as an appropriate method for the cross-sectional data.

Research Group

Five major football leagues of Europe (English Premier League, French Ligue 1, German Bundesliga, Italian Serie A, Spanish La Liga) constitute the research group of this study. These leagues are taking place in the top 5 standing according to Association Club Coefficients data of UEFA. Because of the lack of information for other leagues based on long-term in terms of some variables, data has been utilized from these major five leagues in the study.

Instruments

Variables of the study are; gross domestic product of each country (GDP), total transfer expenditure of each league (TE), total market value of each league (MV), number of goals per match for each league (GOAL), UEFA country coefficients (UEFA), stadium occupancy rate of each league (SOR).

The data includes the seasons from 2005-2006 to 2019-2020. The reason of selection the season 2005-2006 as the initial point in this study is that there is a lack of information related to some transfer fees before this season for selected leagues. Therefore, this situation could cause missing data for the "transfer expenditure" variable. Gross domestic product (GDP) data has been obtained from the World Bank database (10). The other data (TE, MV, GOAL, UEFA, SOR) have been obtained from the Transfermarkt database (8). Therefore, this study doesn't require ethics committee approval and has not required specific measurement instruments.

Data Analysis

Empirical analysis has been estimated through the following econometric model.

$$SOR_{it}=\alpha_{it}+\beta_1 GDP_{it}+\beta_2 GOAL_{it}+\beta_3 MV_{it}+\beta_4 TE_{it}+\beta_5 UEFA_{it}+u_{it} \quad (1)$$

Napierian logarithm of all variables in Equation 1 were incorporated into the model.

Im, Pesaran, and Shin (11) IPS test; Levin, Lin, and Chu (14) test; Fisher-Augmented Dickey-Fuller panel unit root test which had been modified by Maddala and Wu (16) were performed to test stationary of the variables in the study.

RESULTS

Stationary test results of the variables were presented in Table 1.

Table 1. Stationarity Test Results

	LLC		IPS		ADF	
	t- statistics	p-value	t- statistics	p-value	t- statistics	p-value
			LEVEL			
SOR	-0.8452	0.1990	-0.4317	0.3330	17.7078	0.0601
GDP	-0.9093	0.1816	-1.1922	0.1166	13.2326	0.2110
GOAL	-1.1067	0.1342	-1.3701	0.0853	16.7753	0.0795
MV	2.6383	0.9958	1.5801	0.9430	7.6425	0.6637
TE	-0.8748	0.1908	-0.8474	0.1984	12.1910	0.2725
UEFA	-1.9408	0.0261	-2.2331	0.0128	20.9681	0.0213
			1ST DIFFERENCES			
SOR	-7.1426*	0.0000	-5.8136*	0.0000	45.1512*	0.0000
GDP	-3.2195*	0.0000	-2.7681*	0.0028	23.8824*	0.0079
GOAL	-6.0031*	0.0000	-5.3889*	0.0000	42.9947*	0.0000
MV	-4.6379*	0.0000	-3.3669*	0.0004	27.9723*	0.0018
TE	-6.6406*	0.0000	-5.6877*	0.0000	42.5158*	0.0000
UEFA	-6.0495*	0.0000	-5.3302*	0.0000	42.7206*	0.0000
*Note: * refer to existence of significance levels of %1*						

As it was shown in Table 1, the H0 hypothesis related to SOR, GDP, GOAL, MV, TE, UEFA could not be rejected at the %1 significance level. Therefore, the variables are unit rooted at zero level I(0). After subtraction of the variables, the alternative hypothesis was supported while the null hypothesis was rejected at the zero level I(0). Thus, it was determined that the variables became stationary.

Pedroni's (20) panel cointegration test which is one of the first generation panel cointegration tests was performed to determine whether the variables move together or not. This test is used in circumstances that do not involve cross-sectional dependence in the panel. In Table 1, it was determined that there was not cross-sectional

dependence. Panel cointegration test was developed from the following equation.

$$y_{i,t} = \gamma_i + \alpha_{1i}x_{1_{i,t}} + \alpha_{2i}x_{2_{i,t}} + \ldots + \alpha_{Mi}x_{M_{i,t}} + \mu_{i,t}$$

$$t = 1,2,\ldots,T; i = 1,2,\ldots,N; m = 1,2,\ldots,M$$

In the equation; T represents the number of observations, N represents the number of countries in the panel, M represents the regression number. In the Pedroni's (20) panel cointegration test; the null hypothesis indicates that there is no cointegration test while the alternative hypothesis indicates that there is a cointegration test. The cointegration test comprises of seven tests. The first four tests show panel statistics while the last three tests show group statistics.

Table 2. Cointegration Test Results

Statistics	t- statistics	p-value
Panel v-statistics	-0.1312	0.5522
Panel rho- statistic	1.4895	0.9318
Panel PP- statistic	-3.9109*	0.0000
Panel ADF- statistic	-4.1689*	0.0000
Group rho- statistic	2.5520	0.9946
Group PP- statistic	-4.8716*	0.0000
Group ADF- statistics	-5.0429*	0.0000
*Note: * refer to the existence of a cointegration relationship at significance levels of 1%.*		

Pedroni's (20) cointegration test results were presented in Table 2. Panel PP- statistic, Panel ADF-

statistic, Group PP- statistic ve Group ADF- statistic were significant at %1 level according to the empirical

findings. Hence, the null hypothesis was rejected and the alternative hypothesis was supported. It was found that there was a cointegration relationship in the panel and the variables would move together in the long term.

Causality between the variables was tested through Emirmahmutoğlu and Köse (5) panel causality test. The variables whether at the level of I(0) or I(1) can be used in the panel causality test. In addition, this test can be used in circumstances that do not include cointegration. panel causality test results were shown in Table 3.

Table 3: Panel Causality Test Results

	Statistic	p-value
SOR => GDP	38.481	0.000
GDP => SOR	69.374	0.000
SOR => GOAL	14.522	0.150
GOAL => SOR	22.353	0.013
SOR => MV	19.215	0.038
MV => SOR	6.626	0.760
SOR => TE	3.602	0.964
TE => SOR	24.651	0.006
SOR => UEFA	8.562	0.574
UEFA => SOR	20.589	0.024

According to Emirmahmutoğlu and Köse (5) panel causality test results, there was a bidirectional causality between gross domestic product (GDP) and stadium occupancy rate (SOR) at the %1 significance level. Another causality was from GOAL to SOR at the %5 significance level. Unidirectional causality from SOR to MV was determined at the %5 significance level. There was a unidirectional causality from TE to SOR at the %1 significance level. Unidirectional causality was found from UEFA to SOR.

DISCUSSION

Relationship between gross domestic product of countries (GDP), total transfer expenditure of each league (TE), total market value of each league (MV), number of goals per match for each league (GOAL), UEFA country coefficient (UEFA) for each league, stadium occupancy rate for each league (SOR) were investigated in five major football leagues of Europe (English Premier League, French Ligue 1, German Bundesliga, Italian Serie A, Spanish La Liga) in this study. Bidirectional causality relationship has been determined between GDP and SOR in the Emirmahmutoğlu and Köse (5) panel causality analysis. Moreover, there are unidirectional causality relationships from GOAL to SOR, TE to SOR, from UEFA to SOR.

This study has contributed to the framework for game location research of Courneya and Carron (4) considerably. The framework indicates that the crowd effect is a significant determinant of home advantage. This impact has been supported through various studies in the literature (17, 2, 21, 15, 7, 12, 6). However, there is a lack of research in the literature related to determinants of crowd effect. Therefore, an econometric model has been developed in this study and determinants of crowd effect have been tried to estimate.

This study has found that gross domestic product (GDP), number of goals per match (GOAL), transfer expenditure (TE), UEFA country coefficient (UEFA) are predictors of crowd effect. Hence, it can be suggested that teams should try to score more goals and they might play more offensive in this way. Strategies such as parking the bus in front of the goal might decrease their crowd effect. In this way, the secondary outcome of the match (goals scored and conceded) will be more effective which is a component of performance outcomes in the framework of Courneya and Carron (4).

Another predictor of the crowd effect is transfer expenditure according to this study. This means that clubs ought to make investments in their squads. If they do that, their supporters would tend to pact into the stadium to see new faces. However, the important part here is not the number of new faces who join the

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clubs, it is important to sign contracts with talented players who have high market values. But there is an exception here that some of these players are waiting to complete their contract. Later, they make new contracts with new clubs without any transfer fee.

UEFA coefficients for each country league are based on the results of each association's clubs in the five previous UEFA Champions League and UEFA Europa League seasons. The rankings determine the number of places allocated to an association (country) in the forthcoming UEFA club competition (9). UEFA coefficient has been found as a predictor of the crowd effect. Therefore, clubs should try to qualify participation in international tournaments of UEFA. Hence, they will get more spectators in their stadiums. Maybe some fans tend to buy season tickets due to participation of international UEFA tournaments based on clubs.

Lastly, gross domestic product is also a predictor of the crowd effect. GDP is an important indicator of countries' economic growth and attandance at the stadium is also an economical event. For this reason, it was thought that GDP might be a predictor for the model at the macro level. Besides, consumption is one of the essential components of GDP. Football matches are recreational activities that occupy an important place for people's social life. Even if some fans are very loyal and dependent on their team, it is possible that they are not able to afford ticket prices.

These four predictors might be contributed by new studies. Therefore, it is recommended for future studies to estimate other predictors of crowd effect and other leagues might be also useful to test the predictors found in this study. Hence, a framework of crowd effect might be developed in the future which can enlarge the framework of Courneya and Carron (4). Additionally, these predictors can be used as a part of home team advantage studies. The predictors might be tested in other sport activities too.

This study includes some limitations alongside its contributions. For instance, only football matches have been investigated among the sport games. In addition, data has been involved just five major football leagues in the world. Time limitation also should be considered by the readers because the data involve the seasons from 2005-2006 to 2019-2020.

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