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The acquisition of a football player as a non-cooperative game

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Abstract

Football is the best-known sport in Europe and is spread across the world. In recent years, this has been a growing industry in which its entire mode of operation has been changing, involving large amounts of money. One of the factors that most impacts the financial performance of the clubs is the sale of their biggest assets, the players.

The growing effect of the football industry has been felt in every league, with every club investing more and more to strengthen their teams with the best players to become increasingly competitive to achieve their goals. In this sense, it is relevant to treat the value that is invested in a football player as an object of study, considering the impact that this investment has on the financial performance of the club, on the championship itself or even in the economy in general.

Thus, the aim of the dissertation is to study the process of acquisition of a football player, using a non-cooperative game model, where we intend to demonstrate the dynamics of clubs in the acquisition of top football players when there is no intention of the seller club to negotiate.

Key-words: Real options; Football player; Mergers and Acquisitions; Non-cooperative games.

JEL-Codes: C72, G34, L83, Z23.

Resumo

O futebol é o desporto mais conhecido por toda a Europa e está espalhado por todo o mundo. Recentemente, tem sido uma indústria crescente onde todo o seu modo de operação tem mudado, envolvendo grandes quantidades de dinheiro. Um dos fatores que tem maior impacto nos resultados financeiros dos clubes é a venda dos seus maiores ativos, os jogadores.

O efeito crescente da indústria do futebol tem sido sentido em todas as ligas, com todos os clubes investindo cada vez mais para reforçar as suas equipas com os melhores jogadores, de forma a tornarem-se mais competitivas para atingirem os seus objetivos. Deste modo, torna-se relevante tratar o valor que é investido num jogador de futebol como um objeto de estudo, considerando o impacto que este investimento tem no desempenho financeiro do clube, do campeonato em si, ou mesmo na economia em geral.

Assim, é objetivo desta dissertação o estudo do processo de aquisição de um jogador de futebol, usando um modelo de jogos não cooperativos, onde pretendemos demonstrar as dinâmicas dos clubes na aquisição de um jogador de futebol de topo onde não existe intenção de negociar por parte do clube vendedor.

Palavras-chave: Opções reais; Jogador de futebol; Fusões e Aquisições; Jogos não cooperativos.

Classificação JEL: C72, G34, L83, Z23.

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"Se todas as batalhas dos Homens se dessem apenas nos campos de futebol, quão belas seriam as guerras"

- Augusto Branco

Chapter 1: Introduction

Football is the most known sport across the European continent and is spread all over the world. This sport has long ceased to be considered just a sport in which all athletes engage in competition or passion. In recent years, this has been a growing industry in which its entire mode of operation has been changing, involving large amounts of money. The whole environment surrounding football has become an economic sphere capable of generating huge returns, and it is not just the clubs or players who profit from the sports industry. Increasingly, we can see big television contracts being made that cover not only football games, but also the daily lives of clubs and players. More and more media are involved and dedicated exclusively to football. The demand, the number, and the price of tickets to football matches have also grown exponentially in recent years. Sponsorship contracts for football clubs have also been increasing and club merchandising sales have also grown at an unstoppable pace, with an ever-widening target audience spread all over the world.

One of the factors that most impacts the financial performance of the clubs is the sale of their biggest assets, the players. This is also one of the economic and financial factors that most attracts the attention of fans and the general public, mainly due to the values that transfers are practiced. Since 2000, the maximum paid transfer record has been broken six times, with the current one at 222 million euros in the transfer paid by Paris Saint-Germain Football Club to Futbol Club Barcelona to buy Neymar in August 2017. Table 1 shows us the evolution of the maximum transfer record over the years, and the years in which these same records were broken.

Date	Player	From	To	Fee €M
1996	Alan Shearer	Blackburn Rovers	Newcastle United	21.0
1997	Ronaldo	Barcelona	Internazionale Milano	28.0
1998	Denílson	São Paulo	Real Betis	31.5
1999	Vieri	Lazio	Internazionale Milano	46.5
2000	Figo	Barcelona	Real Madrid	60.0
2001	Zidane	Juventus	Real Madrid	77.5
2009	Cristiano Ronaldo	Manchester United	Real Madrid	94.0
2013	Gareth Bale	Tottenham	Real Madrid	101.0
2016	Pogba	Juventus	Manchester United	105.0
2017	Neymar	Barcelona	Paris Saint-Germain	222.0

Table 1 - History of the transfer records. Source: Transfermarkt.

This information differs greatly from what is currently the list of the most expensive transfers ever. From the list of the ten most expensive transfers[1], eight of them have occurred in the last three years, which proves the pace at which the industry of football has grown. Table 2 shows us the list of the ten most expensive transfers. Note that the amounts presented in the table are only the amounts paid, not including clauses that verify the payment of bonuses by the fulfilment of objectives.

Player	From	To	Date	Fee M€
1. Neymar	Barcelona	Paris Saint-Germain	2017	222.00
2. Mbappé	Monaco	Paris Saint-Germain	2018	145.00
3. Coutinho	Liverpool	Barcelona	2017	145.00
4. João Félix	Benfica	Atlético Madrid	2019	126.00
5. Dembélé	Dortmund	Barcelona	2017	125.00
6. Griezmann	Atlético Madrid	Barcelona	2019	120.00
7. Cristiano Ronaldo	Real Madrid	Juventus	2018	117.00
8. Pogba	Juventus	Manchester United	2016	105.00
9. Gareth Bale	Tottenham	Real Madrid	2013	101.00
10. Hazard	Chelsea	Real Madrid	2019	100.00

Table 2 - List of more expensive transfers. Source: Transfermarkt.

[1] Information at the date of this work. There are cases where the value may increase depending on the achievement of objectives.

Globally, the growing effect of the football industry has been felt in every league, with every clubs investing more and more to strengthen their teams with the best players to become increasingly competitive to achieve their goals. This investment is made possible by the ever-increasing budget that teams are entitled to, which comes from rising incomes, for example from television rights and foreign investment.

In the English Premier League, the main football championship of England, which is the most famous and most profitable national football league in the world, there has been a global increase in investment of football players from 640 million euros in 2011 to over 2,000 million euros in 2017, which proves the growing trend of investments in football players. Figure 1 shows us the evolution of investment in football players in the English Premier League between the season 2010/2011 and the season 2019/2020, that is, the money that was spent by the clubs to buy players of another club.

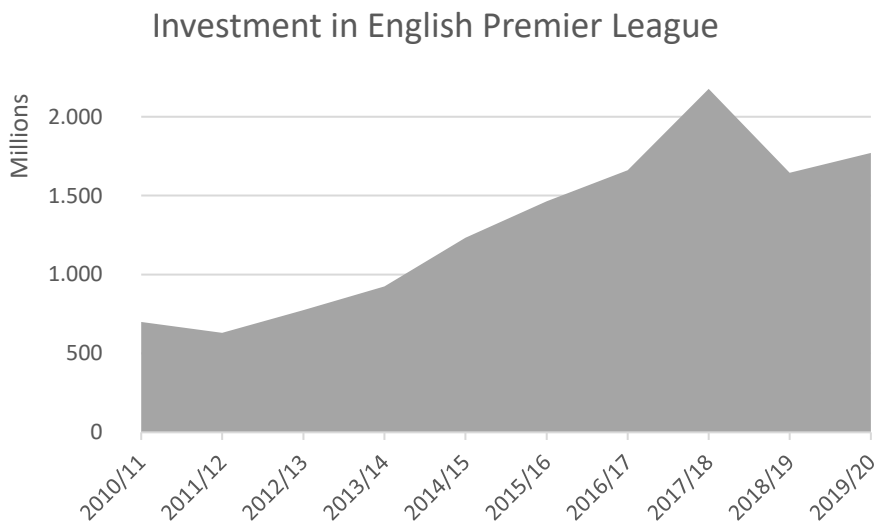

Figure 1- Investment in English Premier League. Source: Transfermarkt.

One of the factors that has increased the investment of clubs in players has been the growing wave of foreign investment in clubs, namely investment coming from the Middle East. An example of this is Manchester City, led by the Emirati Sheik Mansour bin Zayed Al Nahyan or Paris Saint-Germain, led by the Qatari Nasser Al-Khelaifi.

With all the millions being invested every year by clubs in football players, and with all its impact on the global economy, their study is becoming increasingly relevant. At the date, there is no scientific basis for determining the fair value that a club should pay for a player or whether the player is really worth the amount invested in himself. Although there is already some literature that attempts to quantitatively justify the value of a football player through various models, the fact is that the acquisition processes that take place are not based on any existing financial model. In this sense, it is relevant to treat the value that is invested in a football player as an object of study, considering the impact that this investment has on the financial performance of the club, on the championship itself or even in the economy in general.

Thus, the aim of the dissertation is to study the process of acquisition of a football player, using a non-cooperative game model, where we intend to demonstrate the dynamics of clubs in the acquisition of top football players when there is no intention of the seller club to negotiate.

In order to answer the problem, the dissertation is organized as follows: in Chapter 2 we address the questions already developed in existing literature as well as studies related to the value of a football player and non-cooperative games. In Chapter 3, we develop our model for acquisition of a football player as a non-cooperative game. In Chapter 4 we apply our model to real cases of recent transfers of world-renowned football players. In Chapter 5 we study how variables react through a sensitivity analysis. Finally, in Chapter 6 we conclude the dissertation.

Chapter 2: Literature Review

The research about the valuation of a football player has begun with Carmichael and Thomas (1993), using the English Football League transfers of the season 1990/1991 to examine the transfer market of football players. The authors described the purposes and procedures that are involved in the transfer market, and then applying the bargaining theory to analyze them. They suggest that the features of the transfer market are captured by the Nash bargaining theory.

Throughout the paper the authors state that the transfer market is used to organize and intermediate the acquisition of football players by clubs in order to reconstruct a new team for the season given that, in normal cases, they want to be more competitive than the last season, and to create channels for the players to exchange the club which they play, in order to search for different opportunities.

In reality, these transfers are subject to rigorous controls. First, the players only can change the club for which he plays if the other two parties agree with the terms of transfer, that is, in order to negotiate with another club, the players must have permission of his current club[2]. Other restriction is about the periods that the transfers can be made. In the main European leagues, the transfers can only occur in the months January, July and August.

Later, Kedar-Levy et al. (2007) developed a model for assessment of the value of athletes that accounts for risk. This model is not focus only in football but in sports athletes in general. They state that an investment made by a given club today, yields an uncertain future income. Since the profitability of a given club is dependent of the performance of the players and their synchronization, and these are factors that are uncertain, we should account for risk in the valuation of athletes.

In the existing literature regarding player valuation, the role of risk has been ignored. However, in any business the factor of risk is inherent, so the business of sports should not be seen as an exception.

The model that was developed was based on the Capital Asset Pricing Model (CAPM), developed by Sharp (1964), Lintner (1965), and Mossin (1966). This model contributes to

[2] There are cases that the permission is not needed, for example when his contract with his current club is expiring in one (or less) year, or when the buyer club is willing to pay the release clause.

the valuation of the individual players and the team coaches, and also to the collective contribution that they can add to the entire team.

According to the authors, the valuation of the team coach is an important factor because he has the key role to explore the potential of the players and his uncertainty regarding to the return of the players that is expected to yield, and also the coach is the one responsible to maximize the synchronization of each player with all his team colleagues.

The model is a result of an equilibrium valuation in a competitive market, that is based on the core theory of portfolio selection in the world of financial economics (CAPM). The key point in this valuation state by the authors of this paper is that the amount of money that the clubs pay for the players[3] and the coaches represent a financial investment made by the team, and so the rate of return of this investment is uncertain.

In the valuation of a football players, one of the crucial points is to identify the variables that has impact on his value. Majewski (2016) present the variables that influence the valuation of a football player and built an econometric model for valuing football players that play on the forward position. The author included on his model fourteen independent variables that describes the performance of a player and are separated in four spheres. The first one is human capital, that represents, for example, the age or performance (number of appearances); Second, the productivity, that represents statistical data such as goals or assists; Third, organizational, that represents the team value or the position in the league; And last, the control of the football player.

One of the tools that is most used in the valuation of this type of asset is the real options approach. Tunaru et al. (2005) developed a framework for valuation of football players that was based on real options theory. The authors developed two models for pricing football players that counts for events, such as the example of injuries, using Poison jump processes. These models are based on the Opta Index, that is an index that tracks the statistical performance of the football players, giving them points according to his performance on the pitch.

[3] In this case is not only taking into consideration the amount paid on the transfers, but also the salaries paid and other kind of bonus.

This study answered the question "how much is the player worth at this moment in time", setting up models based on real options, considering that this is one of the best tools for valuating objects that are not market traded.

The model was applied by Coluccia et al. (2018) for the valuation of a goalkeeper of the Serie A league, the Italian football league. The choice of the use of goalkeepers' position in the paper was due to difficulties in the methodology, considering that using this position of a football player they could focus his attention on a role that is not easily replaceable since that is unique on his role.

The authors state that this model finds consistency among the players however it fails when search for uniformity because each player is an individual that has qualities in different combinations and concentrations. The authors also state that the main problem of this model is that it not provides reliable information about the valuation of a player that plays little time.

Kanyinda et al. (2012) suggested a model that combines methods that were developed in human resources and real options for the valuations of transfer prices of football players. In this article, the authors developed two models: one for a standard player and other for an atypical player.

Options are intrinsic in the relationship between clubs and players. There are three mutually exclusive options that some clubs have when the player is purchased: the club has the option to extend the contract of the player, the option to sell the player and the option to lend the player. There are several factors that influence the amount paid in transfers, the salary of a players or the duration of his contract. The most relevant are age, talent, experience, capacity for improvement, or even the level of media exposure. They state that the most important factor in the valuation of a football player is the age. However, this factor must be linked with other relevant factors, as the case of talent and capacity for improvement. The position of the player can also be a factor that has influence in the valuation. Other factor that can add value for some players is their quality "extra-football", for example their image or their ability to attract crowds.

The environment that characterizes the football is surrounded of uncertainty. This uncertainty involves the competitive interactions, his specific risk and the uncertainty of

future results and future cash flows. According to the authors, in these conditions, methods involving options on real assets are seen as the best methods for valuing a player.

The Real Options approach for valuating athletes is a widely used method, not even in football, but also in another sports. For example, in the case of baseball, Clayton and Yermack (2001) studied the options present in the contracts between professional players and teams, and their impact on player compensation. The options that are studied in the article in particular are the options to extend the contract for one more season at a fixed salary. The team options, that are the more common, is when the team has the right to extend the contact of a player, equivalent to call options, and the player option is when the player has the right to extend its own contract, which is a put option. They proved that the compensation that players receive is higher when the teams have options on their future services, and is lower when are the players that have these options.

Suleman and Saeed (2009) also used real option methodology in another sport, the case of cricket. The purpose of the paper was to test the hypothesis whether the performance of a cricket player can be treated as a real option. As the case of Tunaru et al. (2005), the authors also used a performance index, in this case the SS Index. They calculate the value of the players using binomial option pricing model. They applied this model in five cricket players of Indian Premier League, calculating the points of each player using the SS Index according to their performance, and using these points as probabilities of upward movement and downward movement in the initial value of the cricket players. As shown in the results, the players that have better performance have higher value, and worst results lead to decreases in their value accordingly.

There are other methods and ways of valuing athletes, as academic research is not consensual. The methods may vary in nature and may be based solely on human behavior or purely from accounting methods.

Regarding methods based on human behavior, Swanepoel (2016) argued that the football transfer market behaves irrationally and that the amount paid by players is the "value that fools are willing to pay". By this, the author wishes to mention that there is winner's curse in the football transfer market.

Regarding accounting-based methods, these can be introduced from three principles: cost, income and market. These are methods often used by clubs in accounting ledger and are

addressed by Brummans and Langendijk (1995) and Morrow (1996). Morrow also proposed a model based on accounting methods which was then applied to the Scottish football league. They start from the initial acquisition cost of the football player, and the author proposes "to recoup it over the duration of the contract". Thus, obtains the net value at each end of the accounting period. This amount may be subject to depreciation and will be estimated by the coach in order to recover the purchase value of the football player. The net value must also consider the implied risk associated with the player and is usually lower than the value that is calculated through the income multiplier that is used by UEFA.

Another approach used in football players valuation is a marketing-based approach. Pujol et al. (2008) developed a method for valuating football players in which they were equated with a brand. This is a method that uses variables for indices of popularity and notoriety, and the way players are viewed by the media.

As we can verify, the existing literature regarding the evaluation of football players is not yet very extensive, and there is no consensus regarding the method to be used. Throughout the history of football, there have been several events that have changed the paradigm of player transfers, such as the introduction of financial fair play or the «Bosman Law». The case with the greatest impact was the Bosman case, which in the 1990s allowed the free movement of European community members in football. Until then, football clubs could prevent their players from signing for free for other clubs even after their contracts ended, and there were several rules that prevented or restricted the use of foreign players in the championships. As such, there was no need to place a release clause, which after the «Bosman Law» became the only possibility for clubs to prevent their athletes from signing for other clubs. In August 1990, a process began that completely changed the history of the transfer of players, with Jean-Marc Bosman, who was forbidden from signing a new contract for the French club Dunkerque by his club to which his contract has ended, the Belgian club Standard Liège, taking the case to court. This case lasted for years, and in December 1995 the Court of Justice of the European Union (EU) gave reason to Jean-Marc Bosman. From that moment on, free signing and use of European community members was allowed in the various championships. Currently, players of any nationality are already allowed in the championships, however in some countries there are still some restrictions for extra-community players.

Throughout the academic investigation and study of valuation of a football player, we found that the model developed by Tunaru et al. (2005) was one of the most requested and used methods. This is a model that supports the research in order to assess the value of a football player.

The model developed is based on a statistical performance index, that tracks the performance of the players on the pitch, giving them points at the end of each game, according to the performance of the player. The model attributes a value to each point, that is dependent on the turnover of the club and the total points of the entire team. The statistical performance index that was used in this paper was the Opta Index.

In order to calculate the value of a football player, the first thing that the Tunaru et al. (2005) methodology does is to calculate the value of one Opta point, that is, how much one Opta point worth in cash. Note that this valuation is made relatively to the club that is valuing the player.

The variable that represent the value in money of a single Opta point, is dependent on two stochastic variables: the turnover of the club and the sum of Opta points of the club.

One of the effects that should be taken into account is the effect of the injuries that affect the players and his long-term value. The authors proposed a model that values the player using a Poisson process. This is a method that is frequently used in rare events.

The valuation of the football player can be made by the perspective of his current club or by the perspective of an outside club (could be, for example, a club that is interested to acquire the player). This distinction is mandatory. In the first case the variables that accounts for the value in money of a single Opta point and the Opta points of an individual player, are correlated. In the second case they are not correlated.

As we can see, there is some literature that attempts to justify the value of a football player. However, when we look at the amount that is actually paid in the transfer of a football player, we have difficulties in justifying his rationality.

A decision of a football club to acquire a football player can be compared to a decision of a company to acquire an asset from another company. When we analyze transfers of players with high importance in their teams, there is usually no intention to negotiate by the seller

club as their desire is to keep the player in question in their team. In the study of Mergers and Acquisitions, this case can be compared to a model of non-cooperative games.

Regarding to the existing literature in the study of non-cooperative games on Mergers and Acquisitions, Selten (1975) showed that there is a first-mover advantage. Rubinstein (1982) developed a model where the seller and the buyer party make offers alternately, until they reach an agreement. The rationality behind this model is how to share a pie of size 1. Admati and Perry (1987) extended the model of Rubinstein where they included the option to postpone the decision. This option can be seen as a Real Option that expresses the managerial flexibility.

Betton and Morán (2003) implemented a Real Options model in order to analyze non-cooperative acquisitions, where the seller party sets the price and the buyer party can accept or can wait in order to clarify the existing uncertainty. Lukas and Welling (2012) extended the model of Betton and Morán, however they included the fact that the total gains are known by both parties, as well as the transaction costs related to the acquisition, and the buyer can also be the offer party. They also find the existence of a first-mover advantage.

In this way we can compare the cases of transfers of football players to cases of Mergers and Acquisitions, where the club that intends to buy a player is the buyer party, and the club that owns the player is the seller party.

Chapter 3: The acquisition of a football player as a non-cooperative game

The decision to acquire a football player is one of the most important decisions in planning a sports season and is central to the sporting success of the football teams. This is a decision that can be equated with a decision of a company to acquire assets from other companies. In fact, when a club transfers one of its players to another club, it is transferring one of its assets.

As a rule, decisions to acquire assets create surplus when assets are transferred from one company to another, that is, from the seller to the buyer. This surplus is usually shared by the seller and the buyer. Translating this into football language, the decision to transfer a player from one team to another creates surplus for both the buying and selling clubs. When a club buys a player, only buys him if the added value that the player brings to the team is higher than the cost that the club incurred to acquire the player, thus creating surplus:

$$Buyer\ club: Value\ of\ the\ player\ for\ the\ team > Money\ spent\ to\ buy\ the\ player$$

On the other hand, when a club sells a player, only sells him if the financial compensation to which it is entitled is greater than the loss that this player brings to the squad, thus creating surplus:

$$Seller\ club: Money\ recieved\ to\ sell\ the\ player > Value\ of\ the\ player\ for\ the\ club$$

In fact, there are also other sources of income that a player brings to his club and that are also essential factors in the decision to buy or sell a player. Firstly, the increase or decrease in the sporting quality of the team, which can translate into better or worse sporting results for the team and which, in turn, generate returns in terms of financial prizes that are awarded according to the sporting achievements achieved by the clubs. There are also other sources of income that a player brings to his team, such as selling merchandising, increasing attraction

to new investors, sponsors or club members, or even increasing ticket revenues. On the other hand, a player also brings increased costs to his team, from costs with his salary and other bonuses, among other operational costs. These variables, in addition to being countless, are not easy to measure and are not always available to the public. For simplicity, these variables will be omitted in our model.

3.1 The Model

The model developed in this dissertation will be based on the model developed by Lukas and Welling (2012). The model shows the influence of managerial flexibility on Mergers and Acquisitions decisions, using a dynamic real options approach, in a non-cooperative game model. While one party defines the premium, the reacting party will define the threshold value for which the proposal will be accepted, conditional on the premium offered.

Let us consider the club S (the seller) that holds a player, considered the target player, that has at the time t the market value of Y_t. On the other hand, consider a club B (the buyer) to which, in his perspective, the same player has a higher market value ($Y_{t_{club\ B}} > Y_{t_{club\ S}}$). It is intention of the club B to acquire a player of Club S. In football language we say that club B wants to buy the target player from club S and, when that purchase occurs, we say that there is a transfer of the player from one club to the other. For this transfer to take place, in return, the buyer club will have to compensate the seller club financially, depending on the value of the player. There will also be other costs, namely sunk transaction costs, which are costs related to the transfer of the player, which could be, for example, the fees of the sports agents involved in the negotiation. These costs will be represented by T, and may be fully supported by one of the clubs, or else they may be shared by both clubs, with $\epsilon \in (0,1)$ being fraction of these costs supported by the buyer club.

We assume that the value of the target player is not constant over time and follows a geometric Brownian motion:

$$dY(t) = \eta Y(t)dt + \sigma Y(t)dW(t), \qquad Y(0) = Y_0, \qquad (1)$$

Where $\sigma^2 \in \mathbb{R}_+$ is the volatility of the value of the target player, $\eta \in \mathbb{R}$ is the growth rate of the value of the target player and $dW(t)$ as an increment of the Wiener process with zero mean and variance equal to dt. We will also assume that all agents are risk neutral and the riskless interest rate *r*, $(r \geq \eta)$ controls the time value of money.

As we can verify in the model developed by Tunaru at al. (2005), the target player may have different values depending on the perspective of the club that is evaluating him. That is, the value of the player for its own club is different from the value of the player for an outside club. Let us consider, in this case, that the seller club is considered the own club of the player and the buyer club is considered the outside club. For simplification of the model, and for a better interpretation of the results, we will consider the value of the player for the seller club as $m_S Y_t$ and the value of the player for the buyer club as $m_B Y_t$, where Y_t is a generalized value of the player for all clubs and $m_{S,B}$ is a constant that attributes the perception of the club for the value of the target player Y_t.

When buys the target player, club B gets the player $m_B Y_t$, however the club will have to pay $km_B Y_t$ to the seller club to release the player, where $k > 0$, and will have to support its corresponding share of sunk transaction costs ϵT:

$$Surplus_{Buyer\ Club} = m_B Y_t - km_B Y_t - \epsilon T \tag{2}$$

In turn, the club S when selling the player is financially compensated in $km_B Y_t$, however will lose the value of player in his perception $m_S Y_t$ and will have to support the corresponding part of sunk transaction costs $(1-\epsilon)T$:

$$Surplus_{Seller\ Club} = km_B Y - m_S Y - (1-\epsilon)T \tag{3}$$

In this way, the buyer club will not incur a loss if $k \leq 1 - \frac{\epsilon T}{m_B Y_t}$, while the seller club will not incur a loss if $k \geq \frac{m_S Y_t + (1-\epsilon)T}{m_B Y_t}$. Thus, transferring the player from club S to club B will only create surplus if $m_B Y_t - m_S Y_t > T$, that is, if the sunk transaction costs resulting from this transfer are less than the difference in perceived value between the two clubs. The surplus resulting from this transfer will be $m_B Y_t - m_S Y_t - T$, and its distribution among the clubs will be dependent on the premium, k, proposed by the seller club.

Let us consider that, at time t_0, one party is proposing to the other a $k > 0$. The other party may accept or reject. However, they can also wait and delay its decision. In this case, we will assume that there will be no next rounds of negotiation, that is, it will be a single negotiation act. If the proposal is accepted, the player will stop playing for club S and will play for club B[4], on the other hand, if not accepted, will continue to play for club S.

We will assume that time is continuous, that is, $t \in (t_0, \infty)$. Club S, the club that holds the player, will be the club that will define k $(k > 0)$. The club B, the club that is interested in acquiring the player, will be the reacting party, that is, they will be the party that will decide whether to accept or wait. We will use the Markovian Perfect Nash Equilibrium to determine the equilibrium strategy to be used between both parties. In this case, the own club of the player, club S, will define the optimal premium k, while, depending on this premium, the destination club, reacting party, club B, will define the threshold value $Y^*(k)$ in the second stage for which the proposal must be accepted or rejected. This problem can be interpreted as real options given the managerial flexibility. When exercising the option, the buyer club accepts the proposal and the player is transferred. So we can consider that the option to acquire the player that Club B has is the maximization of the following problem:

$$F(Y) = max\mathbf{E}\left[\left((1-k)m_B Y_t - \epsilon T\right)e^{-rt}\right] \tag{4}$$

Where $\mathbf{E}[.]$ represents the expectations operator. Solving the equation:

$$F(Y) = \left((1-k)m_B Y^* - \epsilon T\right)\left(\frac{1}{Y^*}\right)^{\beta} \tag{5}$$

Where $\beta = \frac{1}{2} - \frac{\eta}{\sigma^2} + \sqrt{\left(\frac{\eta}{\sigma^2} - \frac{1}{2}\right)^2 + \frac{2r}{\sigma^2}} > 1$ represents the positive root of the standard fundamental quadratic equation (Dixit and Pindyck, 1994). The result of the equation is:

$$Y^* = \frac{\epsilon T \beta}{(1-k)m_B(\beta - 1)} \tag{6}$$

[4] Strictly speaking, the player still has to negotiate his contract with club B.

3.2 Optimal Premium

The seller club will choose the k that maximizes the following equation:

$$F(k) = max\mathbf{E}\left[(km_B Y^* - m_S Y^* - (1-\epsilon)T)e^{-rt^*}\right] \quad (7)$$

Solving the equation:

$$k^* = \frac{m_S(\beta-1)\epsilon + m_B(\beta-1+2\epsilon-\beta\epsilon)}{m_B(\beta-1+\epsilon)} \quad (8)$$

Where k^* represents the optimal premium.

3.3 Optimal Timing

Incorporating the optimal premium in Y^*, we arrive at the value of the optimal trigger:

$$Y^*(k^*) = \frac{T\beta(\beta-1+\epsilon)}{(m_B - m_S)\,(1-\beta)^2} \quad (9)$$

Where $Y^*(k^*)$ represents the optimal timing, depending on the premium proposed by the seller club, for which the buyer club must accept the proposal and buy the player.

Chapter 4: Application of the model in real football cases

In this section we will study real cases of transfers that happened recently between football clubs known worldwide in order to apply the methodology that was previously presented.

We will consider a target player, to whom he has a contractual link with the seller club, at time t. To carry out this study, we must take into account several assumptions. We will assume a market value for the target player. In reality, proxies of the market values of football players are available in several market benchmarks, which are widely used by both clubs and general public. One of the most used examples is the *Transfermarkt* (https://www.transfermarkt.com/). The *Transfermarkt* is a website of German origin dedicated to monitoring various sports, and is available in several languages. The target player value will be the last value recorded immediately before the transfer on the *Transfermarkt* website.

We will assume that, in order to strengthen his team and increase sporting competitiveness, the buyer club is interested in acquiring the target player.

As we can see in the model developed by Tunaru et al. (2005), the target player will have a different perception of value for both the seller club and the buyer club. In the model developed by us, we assumed that this difference in the perceived value was demonstrated by a multiplicative factor, to which m_S would represent the multiplicative factor for the seller club in relation to the market benchmark of the target player, while m_B would represent the multiplicative factor for the buyer club in relation to the target player market benchmark. In order to carry out the study, we will take the following assumption: The multiplication factor used by both the seller club and the buyer club will be distributed according to the ranking of clubs assigned by *UEFA* (Union of European Football Associations) of the season before the transfer took place and will have the following distribution:

1st place to 5th place	1,5
6th place to 10th place	1,4
11th place to 15th place	1,3
16th place to 20th place	1,2
21st place to 25th place	1,1
26th place to 30th place	1,0
31st place to 40th place	0,9

Table 3 - Distribution of the multiplication factor

The distribution of the ranking by club can be found in the Table 12 in appendix.

$$Value\ of\ the\ Target\ Player\ for\ the\ seller\ club = m_S \times Y_t$$

$$Value\ of\ the\ Target\ Player\ for\ the\ buyer\ club = m_B \times Y_t$$

The values used as transaction costs, costs that are related to the transfer of the target player, will be values found in reliable national or international press sources. The fraction of transaction costs supported by each club, when the information is not available to the public, will be divided equally by the seller club and the buyer club ($\epsilon = 50\%$).

For growth rate of the player value we will assume values based on the following distribution:

Rising Player	Up to 23 years	1,5%
Mature Player	24 years to 28 years	1%
Declining Players	From 29 years	0,5%

Table 4 - Distribution of the growth rate of the player value

We consider that Rising Players are young players with a huge margin of progression in their career, Mature Players are players who are at the top of their career and Declining Players are players who are approaching the end of their career.

For the remaining parameters, we will use *ad hoc* values. We will assume that the volatility of the value of the player $\sigma = 15\%$ (the same used by Tunaru et al. (2005)) and the riskless interest rate $r = 4\%$.

We therefore propose to evaluate three transfers: Kylian Mbappé, who moved from Monaco to Paris SG in 2018, João Félix, who moved from Benfica to Atlético Madrid in 2019, and Bruno Fernandes, who moved from Sporting CP to Manchester United in 2020.

4.1 Kylian Mbappé

After a year on loan from Monaco to Paris SG, the young French striker Kylian Mbappé moved permanently to the club in the French capital in 2018. Paris SG paid 145 million euros for the player (this transfer was mandatory after a one-year loan to Paris SG. To this amount, 35 million euros in variables can be added for objectives achieved by the player).

At the time of the transfer of the player, his market value according to *Transfermarkt* was 120 million euros[5].

In the season immediately prior to the transfer (2017/2018 season), the seller club Monaco ranked 27th in the *UEFA* club ranking, equivalent to a multiplication factor of 1, while Paris SG ranked 7th in the *UEFA* club ranking, equivalent to a multiplicative factor of 1,4.

According to news from the international version of the Spanish sports newspaper *AS*, the transfer of Kylian Mbappé had transaction costs related to agents of 9 million euros[6]. In the absence of additional information, we will assume that these costs have been equally divided between the seller club and the buyer club.

Taking into consideration that the player was 19 years old at the time of the transfer, we will assume that the growth rate of the player value $\eta = 1{,}5\%$.

[5] Available at *Transfermarkt* through https://www.transfermarkt.com/kylian-mbappe/profil/spieler/342229
[6] Available at *AS* through https://en.as.com/en/2018/11/07/football/1541613930_083920.html

These data are represented in the following table:

Description	**Parameters**	**Value**
Value of Kylian Mbappé (in million euros)	Y_t	120,0
Multiplication factor for Monaco	m_S	1,0
Multiplication factor for Paris SG	m_B	1,4
Transaction costs	T	9,0
Volatility (annual standard deviation)	σ	15%
Risk-Free Rate (annual)	r	4%
Growth rate of the player value	η	1,5%
Fraction of the transaction costs supported by Paris SG	ϵ	50%

Table 5 - Kylian Mbappé: variables value

Based on the model developed, we arrived at the following result:

Results		**Value**
Beta	β	1,7263
Optimal Premium to be Offered to the target	k^*	91,5%
Timing of the Transfer (in million euros)	$Y^*(k^*)$	90,3

Table 6 - Kylian Mbappé: results

As we can verify, according to our model, the optimal premium to be demanded by the seller club would be 91,5%, which translates into an approximate value of 154 million euros. Taking into account the premium, the optimal time for the transfer would be when the player reaches a market value of 90,3 million euros.

Taking into consideration that by the time of the transfer the market value of the player had already exceeded this amount, the buyer club should proceed with the purchase of the player.

As we can see, the amount to be demanded by the seller club (154 million euros) is very close to the real values of this transfer (145 million euros plus 35 million euros for goals achieved by the player). In fact, this transfer may even reach the value resulting from our model, which proves the veracity of our model.

4.2 João Félix

The young Portuguese striker João Félix moved from the Portuguese club Benfica to the Spanish club Atletico Madrid in 2019. Atletico Madrid beat the release clause of the player by paying to the player 126 million euros (in fact, the release clause of the player was 125 million euros, however, due to the financial mechanism used by the buyer club, the transfer cost 126 million euros to Atletico Madrid).

At the time of the transfer of the player, his market value according to *Transfermarkt* was 70 million euros[7].

In the season immediately prior to the transfer (2018/2019 season), the seller club Benfica ranked the 21st place in the ranking of *UEFA* clubs, equivalent to a multiplication factor of 1,1, while Atletico Madrid ranked the 4th place in the ranking of *UEFA* clubs, equivalent to a multiplication factor of 1,5.

According to news from the Portuguese newspaper *Jornal de Notícias*, the transfer of João Félix had transaction costs related to agents of 12 million euros[8]. In the absence of accurate information, and taking into account that Atletico Madrid completely beat the release clause of the player, we will assume that these costs were entirely supported by the seller club.

Taking into consideration that the player was 19 years old at the time of the transfer, we will assume that the growth rate of the player value is $\eta = 1{,}5\%$.

[7] Available at *Transfermarkt* through https://www.transfermarkt.com/joao-felix/profil/spieler/462250
[8] Available at *Jonarnal de Notícias* through https://www.jn.pt/desporto/jorge-mendes-cobrou-12-milhoes-na-transferencia-de-joao-felix-11172697.html

These data are represented in the following table:

Description	**Parameters**	**Value**
Value of João Félix (in million euros)	Y_t	70,0
Multiplication factor for Benfica	m_S	1,1
Multiplication factor for Atletico Madrid	m_B	1,5
Transaction costs	T	12,0
Volatility (annual standard deviation)	σ	15%
Risk-Free Rate (annual)	r	4%
Growth rate of the player value	η	1,5%
Fraction of the transaction costs supported by Atletico Madrid	ϵ	0%

Table 7 - João Félix: variables value

Based on the model developed, we arrived at the following result:

Results		**Value**
Beta	β	1,7263
Optimal Premium to be Offered to the target	k^*	100,0%
Timing of the Transfer (in million euros)	$Y^*(k^*)$	71,3

Table 8 - João Félix: results

As we can verify, according to our model, the optimal premium to be demanded by the seller club would be 100%, which translates into a value of 105 million euros. Taking into account the premium, the optimal time for the transfer would be when the player reaches a market value of 71,3 million euros.

Taking into consideration that at the time of the transfer the market value of the player had not yet reached that amount, the buyer club should wait until the player reach that amount to proceed with the transfer. However, we find that the market value of the player is very close to the optimal value to proceed with the transfer. In this case, in real circumstances, Atletico Madrid could still advance with the transfer of the player.

As we can see, the amount to be demanded by the seller club (105 million euros) is below the real values of this transfer (126 million euros). In fact, in this specific case, Atletico Madrid beat the release clause of the player. In these cases, the buyer club will not need any response from the seller club, with the proposal being automatically accepted, and certain transaction costs or other costs related to the transfer of the player can be avoided.

4.3 Bruno Fernandes

The influent midfielder Bruno Fernandes moved from the Portuguese club Sporting CP to the English club Manchester United at the beginning of the year 2020. Manchester United paid for the player € 55 million (to this value can be added 25 million euros in variables for objectives achieved by the player. Sporting CP also holds 10% of the surplus in a future transfer).

At the time of the transfer of the player, his market value according to *Transfermarkt* was 60 million euros[9].

In the season immediately prior to the transfer (2018/2019 season), the seller club Sporting CP ranked 31st in the *UEFA* club ranking, equivalent to a multiplication factor of 0,9, while Manchester United ranked 18th in the *UEFA* club ranking, equivalent to a multiplicative factor of 1,2.

According to news from the Portuguese sports newspaper *ABola*, the transfer of Bruno Fernandes had transaction costs related to agents of 5,5 million euros[10]. In the absence of additional information, we will assume that these costs have been equally divided between the seller club and the buyer club.

[9] Available at *Transfermarkt* through https://www.transfermarkt.com/bruno-fernandes/profil/spieler/240306
[10] Available at *ABola* through https://www.abola.pt/economia/2020-02-21/economia-da-bola-5-5-milhoes-de-euros-gestifute-e-agente-de-bruno-fernandes-divi/550780

These data are represented in the following table:

Description	**Parameters**	**Value**
Value of Bruno Fernandes (in million euros)	Y_t	60,0
Multiplication factor for Sporting CP	m_S	0,9
Multiplication factor for Manchester United	m_B	1,2
Transaction costs	T	5,5
Volatility (annual standard deviation)	σ	15%
Risk-Free Rate (annual)	r	4%
Growth rate of the player value	η	1,0%
Fraction of the transaction costs supported by Manchester United	ϵ	50%

Table 9 - Bruno Fernandes: variables value

Based on the model developed, we arrived at the following result:

Results		**Value**
Beta	β	1,9420
Optimal Premium to be Offered to the target	k^*	91,8%
Timing of the Transfer (in million euros)	$Y^*(k^*)$	57,9

Table 10 - Bruno Fernandes: results

As we can see, according to our model, the optimal premium to be demanded by the seller club would be 91,8%, which translates into an approximate value of 66 million euros. Taking into account the premium, the optimal time for the transfer would be when the player reaches a market value of 57,9 million euros.

Taking into consideration that by the time of the transfer the market value of the player had already exceeded this amount, the buyer club should proceed with the transfer of the player.

We note, in this case, that the amount to be demanded by the seller club (66 million euros) is higher than the real values of this transfer (55 million euros). However, this transfer may even reach, or even exceed, the value resulting from our model if the player reaches the pre-defined objectives.

This demonstrates, once again, that our model reaches values close to those that are exercised in reality.

As we can see, the values practiced in the transfers of football players in reality are very close to the optimal premium given by our model. In the real cases we can verify that currently other variables are included in the payments by the players, as is the case of amounts dependent on objectives achieved by the players. We verify this case in the examples of Kylian Mbappé or Bruno Fernandes. The inclusion of this type of variables in the negotiation is quite recent, and it is more frequent in transfers of young players or transfers of players who come from less competitive championships, where uncertainty is greater. In this way, buyer clubs are more protected if the player does not have the expected performance.

Thus, we concluded that the transfers of Kylian Mbappé and Bruno Fernandes occurred after the market value of the players had exceeded the optimal timing, that is, the clubs should proceed with the transfer of the player. In turn, the transfer of João Félix occurred when the market value of the player had not yet reached the optimal timing, that is, Atletico Madrid should wait. However, we also find that the market value of the player is very close to optimal timing.

Chapter 5: Sensitivity Analysis

In order to realize a better understanding of the model, it is necessary to understand the behavior of the variables and their impact on the final value. In this section we will perform a sensitivity analysis to the variables that are a function of the optimal trigger $Y^*(k^*)$ and the optimal premium k^*. Remember that the variables that are a function of $Y^*(k^*)$ are β, T, ϵ m_1 and m_2, while the variables that are a function of k^* are β, ϵ m_S and m_B. The following figures represent the sensitivity analysis for the values of $Y^*(k^*)$ and k^* as a function of different values for each of its parameters individually, with the remaining parameters remaining equal to the example of Kylian Mbappé.

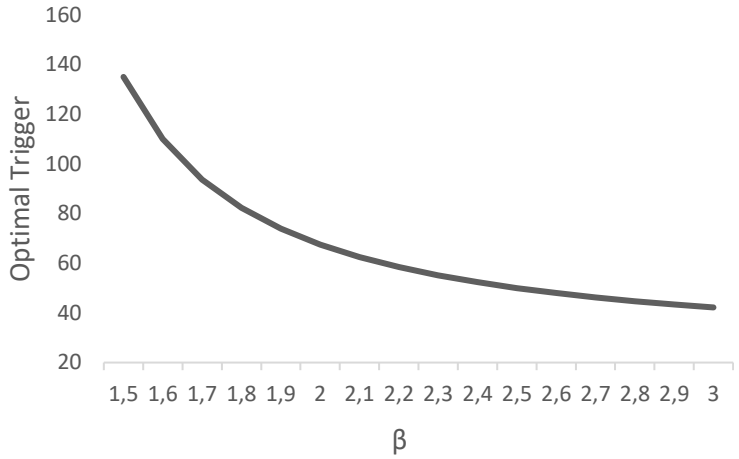

Figure 2 - Value of the optimal trigger for different values of β

Figure 2 represents the sensitivity analysis of the optimal trigger in relation to parameter β, maintaining the remaining parameters according to the example of Kylian Mbappé. As we can verify, the lower the β, the greater the value of the optimal trigger. The β parameter represents uncertainty and the lower the β value, the greater the uncertainty. In this case, we find that the greater the uncertainty, the greater the optimal trigger. That is, for higher levels of uncertainty regarding the value of the player, the buying clubs will take longer to reach the optimum point of purchase.

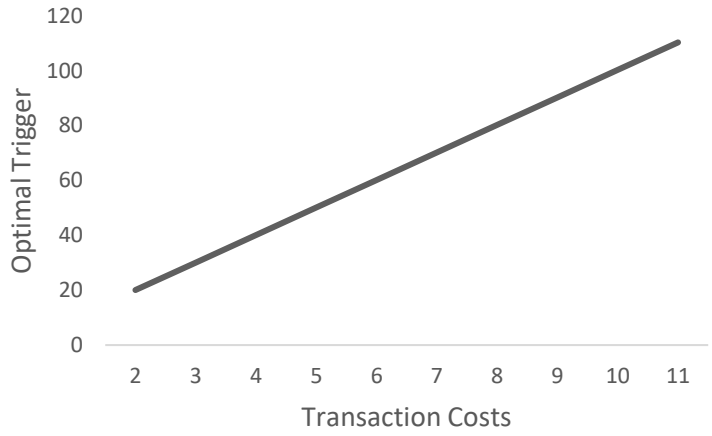

Figure 3 - Value of the optimal trigger for different values of the transaction costs

Figure 3 represents the sensitivity analysis of the otimal trigger in relation to the transaction costs, maintaining the remaining parameters according to the example of Kylian Mbappé. As we can verify, the higher the value of the transaction costs, the greater the value of the optimal trigger. The parameter T represents sunk transaction costs, that is, costs that are related to the transfer of the player other than the amount paid by the player by the buyer club to the seller club. Therefore, the higher the value of these sunk transaction costs, the buyer clubs will take longer to reach the optimum point of purchase.

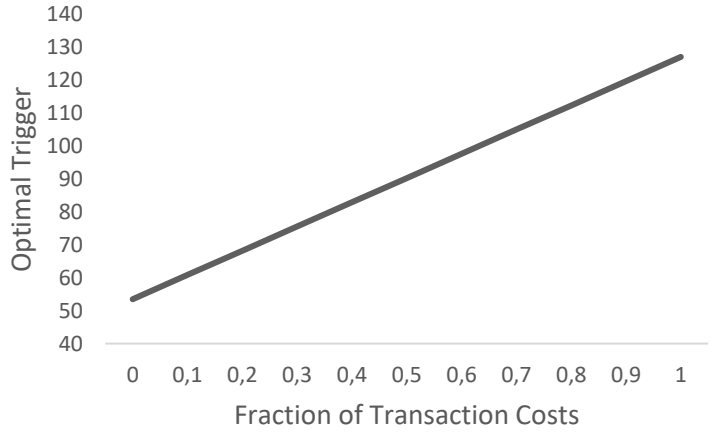

Figure 4 - Value of the optimal trigger for different values of the fraction of transaction costs

Figure 4 represents the sensitivity analysis of the optimal trigger in relation to fraction of transaction costs, maintaining the remaining parameters according to the example of Kylian

Mbappé. As we can verify, the higher the value of fraction of transaction costs, the greater the value of the optimal trigger. The parameter ϵ represents the portion of sunk transactions costs that is supported by the buyer club. Therefore, the higher the value of the portion of sunk transactions costs that is supported by the buyer club, these will take longer to reach the optimum point of purchase.

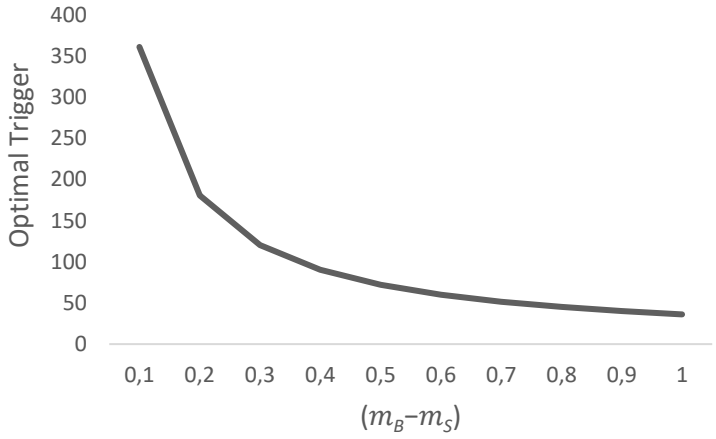

Figure 5 - Value of the optimal trigger for different values of the difference in the perceived value of the player between the buyer club and the seller club

Figure 5 represents the sensitivity analysis of the optimal trigger in relation to the parameter $(m_B - m_S)$, maintaining the remaining parameters according to the example of Kylian Mbappé. This parameter represents the difference in the perceived value of the player between the buyer club and the seller club. As we can verify, the greater the difference in the perceived value of the player between the two clubs, the lower the optimal trigger will be. That is, the buyer club will reach the optimal point of purchase of the player sooner, as the greater the difference.

This fact can also be justified by the negotiation power of the buyer club. The greater this difference, the greater the negotiation power of the buyer club in relation to the seller club. Therefore, the greater the negotiation power of the buyer club, the sooner it reaches the optimal point of purchase of the player.

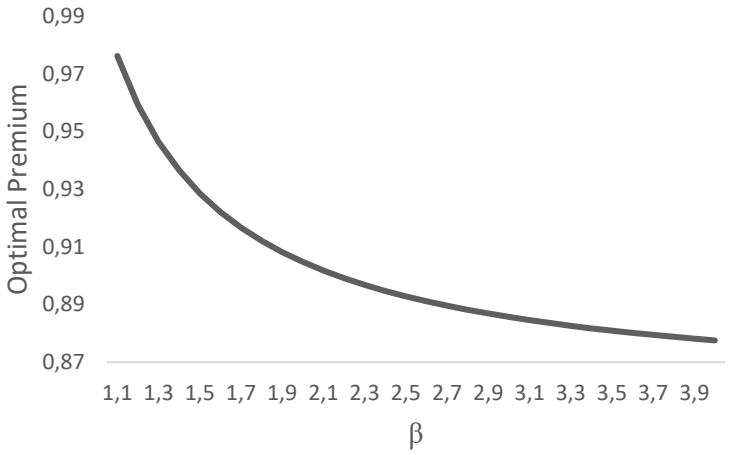

Figure 6 - Value of the optimal premium for different values of β

Figure 6 represents the sensitivity analysis of the optimal premium in relation to parameter β, maintaining the remaining parameters according to the example of Kylian Mbappé. As we can verify, the lower the β, the greater the value of the optimal premium. The β parameter represents uncertainty and the lower the β value, the greater the uncertainty. In this case, we find that the greater the uncertainty, the greater the optimal premium. That is, for higher levels of uncertainty regarding the value of the player, the seller clubs will require a higher premium.

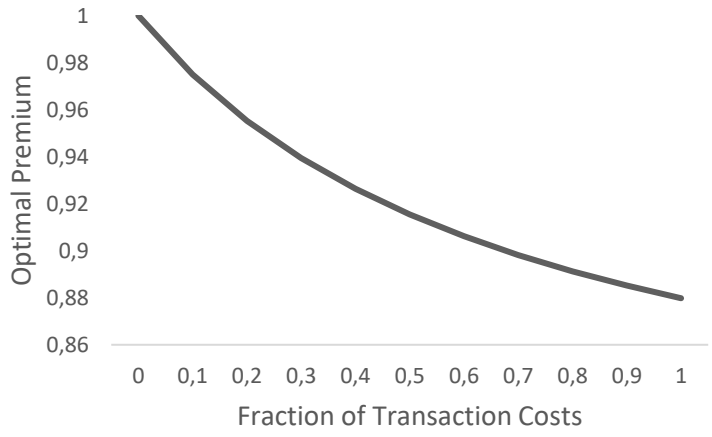

Figure 7 - Value of the optimal premium for different values of the fraction of transaction costs

Figure 7 represents the sensitivity analysis of the optimal premium in relation to the fraction of transaction costs, maintaining the remaining parameters according to the example of

Kylian Mbappé. As we can verify, the higher the value of the fraction of transaction costs, the lower the value of the optimal trigger. The parameter ϵ represents the portion of sunk transactions costs that is supported by the buyer club. That is, in this case, the higher the value of ϵ, the smaller the portion supported by the seller club. Therefore, the lower the value of the portion of sunk transactions costs that is supported by the seller club, the lower the optimal premium demanded.

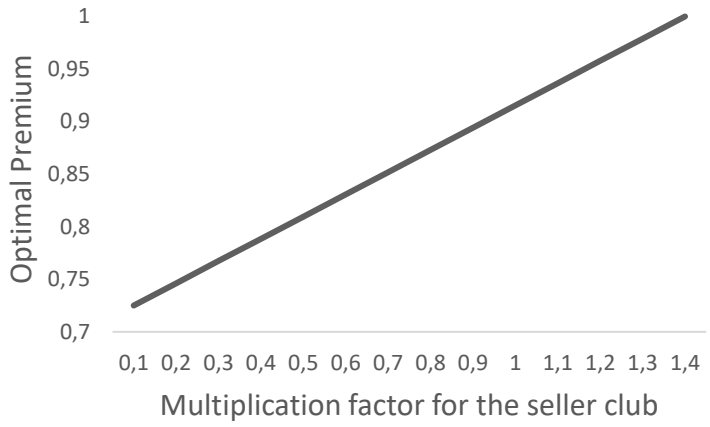

Figure 8 - Value of the optimal premium for different values of the multiplication factor for the seller club

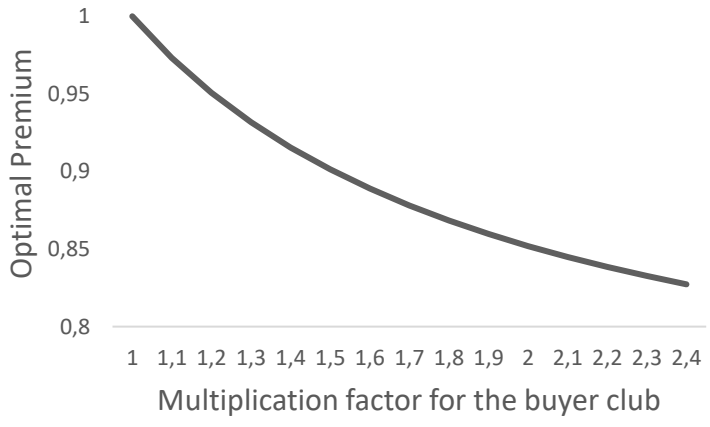

Figure 9 - Value of the optimal premium for different values of the multiplication factor for the buyer club

Figures 8 and figure 9 represent the sensitivity analysis of the optimal premium in relation to the multiplication factor for the seller club and the multiplication factor for the buyer club, maintaining the remaining parameters according to the example of Kylian Mbappé. These parameters represent the perceived value of the player of the buyer club and the seller club. As we can verify, the higher the value of the multiplication factor for the seller club, maintaining the multiplication factor for the buyer club constant (and greater than the multiplication factor for the seller club), the greater the optimal premium required by the seller club. On the other hand, the higher the value of the multiplication factor for the buyer club, keeping the multiplication factor for the seller club constant (and lower than the multiplication factor for the buyer club), the lower the premium required by the buyer club. With this we can conclude that the greater the difference between m_S and m_B, that is, the greater the difference in the perceived value of the player of the buyer club and the seller club, the smaller the optimal premium required by the seller club.

In addition, a greater difference between the two clubs may also positively influence the player's willingness to change the club. This factor can therefore put pressure on the seller club to demand a lower premium.

Chapter 6: Conclusion

The objective of this dissertation was to analyze the process of acquisition of a football player when there is no intention of the seller club to negotiate. In this way, was developed a model of non-cooperative games.

The model developed by us, adapted from Lukas and Welling (2012), intends to assess whether the buyer club should accept the value proposed by the seller club or if they should postpone their decision. Since the objective of each club is to maximize its surplus, the seller club, in a first stage, defines the optimal premium, that is, the optimal price that the buyer club must pay for the player, while the buyer club, in a second stage, sets the optimal timing for the transfer to occur.

Although the model presents values very close to reality when applied in real cases, its application requires that several assumptions are made, namely how the multiplication factor of the teams will be distributed or the transaction costs and their division among the clubs, given that this information is not always available to the public.

The model developed by us also ignores other sources of income or other expenses that a club has with a player, making it very simplistic in relation to the variables it uses. Once again, the majority of the information is difficult to measure or is not available to the general public. In this way, our work is limited to the information available, namely the amount that a club pays for a player, information that is mandatorily available by law, or the information that is speculated by news sources.

For further research, we recommend relaxing some of the assumptions we made, as well as introducing some variables that make the model as close to reality as possible, for example the introduction of variables that account for the wages of the player (a future expense for the buyer club and future savings for the seller club), gains or losses in extra-football income, or even the gain or loss in the sporting performance of the club and synergies with other players.

We also recommend further investigation in cases where the buyer club establishes the premium, being the seller club the reacting party or the introduction of more rounds of negotiation with cooperative game models.

In this way, the model developed by us brings a simplistic view of the problem, easy to measure for application in real cases, looking only at variables included in the negotiation between the seller club and the buyer club, as well as variables involved in the mediation of the negotiation.

The dissertation aimed to fill a gap in the existing literature, taking into account that although it is filled at the level of valuation of the football player, the truth is that it is silent in relation to the process of acquisition of football players and the values that are practiced in transfers of football players in reality.

Although our model suggests justifying the rationality behind the process of acquisition of a football player, we find that in reality there are also transfers with extremely high values, which are not economically explainable. The globalization of football has allowed the entry of many investors, who invest only for pleasure or passion, ignoring the return. This type of investment brings irrationality to the football player transfer market, making the values practiced difficult to explain. Thus, the only justification for this irrationality is that we are present in the "value that fools are willing to pay" (Swanepoel (2016)).

Bibliography

Admati, A. R., & Perry, M. (1987). Strategic delay in bargaining. *Review of Economic Studies 54* , 345-363.

Betton, S., & Morán, P. (2003). A dynamic model of corporate acquisitions. *EFA 2004 Maastricht Meetings Paper No. 4060*.

Brummans, R. J., & Langendijk, H. P. (1995). Human resource accounting in football clubs: A Comparative study of accounting practises in the Netherlands and the United Kingdom. *Working paper, University of Amsterdam*.

Bruno Fernandes. (2020). Retrieved from Transfermarkt: https://www.transfermarkt.com/

Carmichael, F., & Thomas, D. (1993). Bargaining in the transfer market: theory and evidence. *Applied Economics*, 1467-1476.

Clayton, M., & Yermack, D. (2001). Major League Baseball Player Contracts: An Investigation of the Empirical Properties of Real Options.

Club coefficients. (2020). Retrieved from UEFA: https://www.uefa.com/

Coluccia, D., Fontana, S., & Solimene, S. (2018). An application of the option-pricing model to the valuation of a football player in the 'Serie A League'. *Int. J. Sport Management and Marketing*, 155-168.

Dixit, A. K., & Pindyck, R. S. (1994). *Investment under Uncertainty*. Princeton: Princeton University Press.

João Félix. (2020). Retrieved from Transfermarkt: https://www.transfermarkt.com/

Kanyinda, A., Bouteiller, C., & Karyotis, C. (2012). Human capital: assessing the financial value of football players on the basis of real options theory. *Investment Management and Financial Innovations*, 27-37.

Kedar-Levy, H., & Bar-Eli, M. (2007). The Valuation of Athletes as Risky Investments: A Theoretical Model. *Journal of Sport Management*.

Kranz, A. O. (1998). The Bosman Case: The Relationship between European Union Law and the Transfer System in European Football. *Colum. J. Eur. L.*

Kylian Mbappé. (2020). Retrieved from Transfermarkt: https://www.transfermarkt.com/

Lintner, J. (1965). The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets. *The Review of Economics and Statistics*, 13-37.

Lukas, E., & Welling, A. (2012). Negotiating M&As under uncertainty: The influence of managerial flexibility on the first-mover advange. *Finance Reserch Letters 9*, 29-35.

Majewski, S. (2016). Identification of Factors Determining Market Value of the Most Valuable Football Players. *Journal of Management and Business Administration*, 91-104.

Morris, P. E., Morrow, S., & Spink, P. M. (1996). EC Law and Professional Football: Bosman and Its Implications. *Mod. L. Rev.*

Morrow, S. (1996). Football Player as Human Assets Measurement as the Critical Factor in Asset Recognition: A Case Study Investigation. *Journal of Human Resource Costing and Accounting*.

Mossin, J. (1966). Equilibrium in a Capital Asset Market. *Econometrica*, 768-783.

Nash, J. F. (1950). The bargaining problem. *Econometrica 18*, 155-162.

Pujol, F., & Garcia-del-Barro, P. (2008). *Report on Media Value in Football.* ESIrg, Universidad de Navarra.

Rubinstein, A. (1982). Perfect equilibrium in a bargaining model. *Econometrica 50*, 97-109.

Selten, R. (1975). Reexamination of the perfectness concept of equilibrium points in extensive games. *International Journal of Game Theory 4*, 25-55.

Sharpe, W. (1964). Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk. *The Journal of Finance*, 425-442.

Suleman, M. T., & Saeed, M. A. (2009). Option on Human Performance: A Case Study of Indian Premier League.

Transfer Records. (2020). Retrieved from Transfermarkt: https://www.transfermarkt.com/

Tunaru, R., & Viney, H. (2010). Valuations of Soccer Players from Statistical Performance Data. *Journal of Quantitative Analysis in Sports*.

Tunaru, R., Clark, E., & Viney, H. (2005). An option pricing framework for valuation of football players. *Review of Financial Economics*, 281-295.

Appendices

2010/11		2011/12		2012/13		2013/14		2014/15	
Manchester City	183,61	Chelsea	96,45	Chelsea	109,70	Chelsea	130,35	Manchester United	195,35
Chelsea	121,50	Manchester City	91,05	Manchester United	76,45	Tottenham	122,53	Liverpool	151,43
Liverpool	97,53	Liverpool	66,53	Tottenham	73,25	Manchester City	116,00	Chelsea	137,70
Aston Villa	37,40	Arsenal	65,48	Liverpool	70,60	Manchester United	77,13	Arsenal	118,98
Manchester United	29,30	Manchester United	62,30	Manchester City	61,95	Liverpool	58,10	Manchester City	102,80
Sunderland	29,10	Sunderland	28,25	Arsenal	56,00	Arsenal	49,25	Southhampton	96,00
Tottenham	26,60	QPR	26,23	QPR	50,35	Cardiff	45,82	Tottenham	48,47
Birmingham	25,60	Newcastle	26,20	Southhampton	41,50	Southhampton	39,60	Hull	48,22
Arsenal	23,00	Stoke	24,80	Sunderland	38,30	Sunderland	33,91	Newcastle	45,02
Stoke	21,10	Blackburn	20,55	Newcastle	31,97	Crystal Palace	33,00	QPR	43,54
Wolverhampton	20,22	Aston Villa	20,34	Aston Villa	27,83	Everton	31,80	Swansea	41,53
West Ham	15,83	Fulham	18,13	West Ham	23,90	Hull	31,10	Everton	40,16
Newcastle	13,98	Bolton	15,60	Stoke	23,68	Norwich	30,05	West Ham	35,15
West Bromwich	13,83	Norwich	15,25	Everton	21,65	Fulham	29,50	Crystal Palace	31,22
Wigan	11,40	Swansea	12,85	Swansea	20,47	Swansea	26,61	West Bromwich	24,88
Fulham	11,05	Wigan	12,38	Norwich	11,08	West Ham	24,00	Leicester	22,86
Blackpool	5,73	Wolverhampton	12,05	Reading	10,82	Aston Villa	19,84	Sunderland	22,52
Bolton	5,40	West Bromwich	9,14	Wigan	10,54	West Bromwich	15,70	Aston Villa	13,45
Blackburn	5,05	Tottenham	9,00	Fulham	10,00	Stoke	7,00	Burnley	12,62
Everton	1,70	Everton	7,20	West Bromwich	5,00	Newcastle	3,80	Stoke	1,80

2015/16		2016/17		2017/18		2018/19		2019/20	
Manchester City	208,20	Manchester City	215,00	Manchester City	317,50	Chelsea	208,80	Manchester United	214,00
Manchester United	156,00	Manchester United	185,00	Chelsea	260,50	Liverpool	182,20	Manchester City	166,82
Liverpool	126,50	Chelsea	132,80	Everton	203,20	Fulham	116,50	Aston Villa	159,10
Newcastle	107,91	Arsenal	113,04	Manchester United	198,40	Leicester	114,60	Arsenal	157,40
Chelsea	90,50	Crystal Palace	101,30	Liverpool	173,88	Wolverhampton	112,25	Tottenham	148,50
Watford	83,53	Leicester	91,60	Arsenal	152,85	West Ham	99,80	Everton	119,90
Tottenham	71,00	Everton	86,00	Tottenham	121,50	Everton	93,90	Wolverhampton	117,50
Aston Villa	66,55	Tottenham	83,50	Leicester	87,70	Bournemouth	89,10	West Ham	110,20
Sunderland	66,05	West Ham	83,50	Swansea	73,39	Brighton Albion	88,36	Leicester	104,30
Southhampton	60,10	Liverpool	79,90	Watford	71,40	Manchester United	82,70	Brighton Albion	77,05
Bournemouth	55,11	Watford	70,45	Brighton Albion	67,00	Arsenal	80,15	Newcastle	72,90
Stoke	53,65	Southhampton	68,90	Southhampton	61,25	Manchester City	78,59	Sheffield	69,00
West Ham	52,70	Swansea	58,10	Stoke	57,70	Southhampton	62,25	Southhampton	58,60
Leicester	49,90	Middlesbrough	47,95	West Ham	56,80	Newcastle	59,75	Bournemouth	56,45
Everton	48,90	Burnley	45,60	Huddersfield	56,75	Cardiff	51,20	Watford	48,00
Norwich	47,55	Sunderland	41,90	West Bromwich	53,50	Huddersfield	50,70	Chelsea	45,00
West Bromwich	42,90	Bournemouth	40,69	Crystal Palace	48,95	Burnley	33,00	Burnley	19,40
Crystal Palace	28,80	Hull	40,00	Newcastle	44,30	Watford	30,10	Liverpool	10,40
Arsenal	26,50	Stoke	38,78	Burnley	35,74	Crystal Palace	11,85	Norwich	8,82
Swansea	21,81	West Bromwich	37,90	Bournemouth	34,30	Tottenham	-	Crystal Palace	7,90

Table 11 - Investment in English Premier League by club. Source: Transfermarkt.

	2018/2019		2017/2018		2016/2017		
Position	Club	Points	Club	Points	Club	Points	
1	Real Madrid CF	146	Real Madrid CF	162	Real Madrid CF	156	
2	FC Barcelona	138	Club Atlético de Madrid	140	FC Bayern München	139	
3	FC Bayern München	128	FC Bayern München	135	FC Barcelona	131	1,5
4	Club Atlético de Madrid	127	FC Barcelona	132	Club Atlético de Madrid	122	
5	Juventus	124	Juventus	126	Juventus	126	
6	Manchester City FC	106	Sevilla FC	113	Paris Saint-Germain	115	
7	Sevilla FC	104	Paris Saint-Germain	109	Borussia Dortmund	109	
8	Paris Saint-Germain	103	Manchester City FC	100	Sevilla FC	92	1,4
9	Arsenal FC	101	Arsenal FC	93	SL Benfica	102	
10	FC Porto	93	Borussia Dortmund	89	Chelsea FC	91	
11	Liverpool FC	91	FC Porto	86	Arsenal FC	90	
12	Chelsea FC	87	Manchester United FC	82	Manchester City FC	85	
13	Borussia Dortmund	85	Chelsea FC	82	FC Porto	89	1,3
14	AS Roma	81	FC Shakhtar Donetsk	81	FC Schalke 04	81	
15	SSC Napoli	80	SL Benfica	80	Manchester United FC	80	
16	FC Shakhtar Donetsk	80	FC Zenit	78	Bayer 04 Leverkusen	75	
17	Tottenham Hotspur	78	SSC Napoli	78	SSC Napoli	74	
18	Manchester United FC	78	FC Basel 1893	71	FC Shakhtar Donetsk	79	1,2
19	FC Zenit	72	Tottenham Hotspur	67	FC Zenit	77	
20	AFC Ajax	70,5	Bayer 04 Leverkusen	66	Tottenham Hotspur	62	
21	SL Benfica	68	AS Roma	64	Valencia CF	55	
22	Villarreal CF	68	Liverpool FC	62	FC Basel 1893	68	
23	FC Dynamo Kyiv	65	FC Dynamo Kyiv	62	Olympique Lyonnais	57,5	1,1
24	FC Schalke 04	63	FC Schalke 04	62	ACF Fiorentina	54	
25	Beşiktaş JK	62	Olympique Lyonnais	59,5	FC Dynamo Kyiv	59	
26	AS Monaco FC	62	Beşiktaş JK	57	AFC Ajax	61	
27	Olympique Lyonnais	61,5	AS Monaco FC	57	Villarreal CF	44	
28	Bayer 04 Leverkusen	61	FC Salzburg	55,5	Olympiacos FC	59	1
29	FC Salzburg	54,5	Olympiacos FC	54	AS Monaco FC	51	
30	FC Basel 1893	54,5	ACF Fiorentina	54	Athletic Club	40	
31	Sporting Clube de Portugal	50	AFC Ajax	53,5	Galatasaray AŞ	51	
32	PFC CSKA Moskva	48	Villarreal CF	52	RSC Anderlecht	50	
33	RSC Anderlecht	46	RSC Anderlecht	48	SS Lazio	42	
34	Athletic Club	46	Athletic Club	46	Liverpool FC	41	
35	Olympiacos FC	44	PFC CSKA Moskva	45	VfL Wolfsburg	40	
36	VfL Wolfsburg	40	SS Lazio	41	VfL Borussia Mönchengladbach	38	0,9
37	Club Brugge	39,5	Sporting Clube de Portugal	40	AS Roma	39	
38	ACF Fiorentina	39	VfL Wolfsburg	40	FC Dnipro	45	
39	Valencia CF	37	PFC Ludogorets 1945	37	Fenerbahçe SK	44	
40	SS Lazio	37	PSV Eindhoven	36	AC Sparta Praha	41,5	

Table 12 - Ranking of UEFA clubs